Giant Sequoia National Monument (GSNM)

Draft Environmental Impact Statement Summary, Chapters I through VI

Sequoia National Forest
Fresno, Kern, and Tulare Counties, CA
August, 2002

Lead Agency: USDA Forest Service

Responsible Official:

Arthur L. Gaffrey
Forest Supervisor
Sequoia National Forest

For Information Contact:

Jim Whitfield
GSNM Team Leader
Sequoia National Forest
559-784-1500 Extension 1135

Table of Contents

Summary
Chapter I - Purpose and Need
Chapter II - Alternatives
Chapter III - Affected Environment
Chapter IV - Environmental Consequences
Chapter V - List of Preparers and Consultants
Chapter VI - Document Recipients

Appendices

Map Packet

DEIS Cover Letter

Abstract

This draft environmental impact statement describes six alternatives for managing the Giant Sequoia National Monument in California. Each alternative responds differently to the major issues and concerns identified in the planning process. The Record of Decision and final environmental impact statement for the Monument will amend Sequoia National Forest Land and Resource Management Plan.

Alternative 1 is the no action alternative.

Alternative 2 is the Proposed Action as described in the Notice of Intent published in the Federal Register, and the scoping letter, both dated June 8, 2001. It applies all of the direction found in the Sierra Nevada Forest Plan Amendment (Framework) and provides additional management direction for the proper care, management, and enjoyment of the objects of interest in the Monument. It places emphasis on the application of current direction specific to the objects of interest.

Alternative 3 would move resources toward their desired conditions by emphasizing natural processes, primarily fire. It would use prescribed fire and hand treatments to reduce the risk of catastrophic fire and restore a more natural fire regime in the Monument.

Alternative 4 would manage monument lands as a broad, connected ecosystem, without separating or zoning for management emphasis. The exception to this would be areas of high amounts of human use, including all current developed recreation areas and other areas of concentrated human use.

Alternative 5 would prescribe a broad range of management strategies to promote conditions for giant sequoia regeneration in the groves.

Alternative 6 would prescribe a broad range of management strategies to restore and protect all of the ecosystems found in the Monument, as well as promote conditions for giant sequoia regeneration in the groves.

Alternative 6 is the Forest Service preferred alternative.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use that information in the preparation of the final environmental impact statement. Comments on the draft environmental impact statement should be as specific as possible. It is helpful if comments refer to specific pages or chapters of the draft statement. Comments may

also address the adequacy of the statement and the merits of the alternatives discussed. Reviewers may wish to refer to the Council on Environmental Quality Regulations for implementing the procedural provisions of the National Environmental Policy Act at 40 CFR 1503.3 in addressing these points.

Reviewers have an obligation to structure their participation in the environmental review of the proposal so that it is meaningful and alerts an agency to the reviewer's position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could be raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis., 1980).

Send Comments To:

Jim Whitfield
GSNM Team Leader
900 West Grand Avenue
Porterville, CA 93257

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF
· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Summary

Purpose and Need | Proposed Action | Issues | Alternatives | Comparison of Alternatives | Consequences

The Giant Sequoia National Monument (Monument) Draft Environmental Impact Statement (DEIS) presents six alternatives designed to manage the giant sequoia and the other objects of interest. The management plan will establish management direction for the land and resources within the Monument. It will amend the current Sequoia National Forest Land and Resource Management Plan (Forest Plan), as amended by the Sierra Nevada Forest Plan Amendment (Framework).

A Presidential Proclamation created the Giant Sequoia National Monument on April 15, 2000. Then President Bill Clinton designated 327,769 acres of the Sequoia National Forest as National Monument (see Figure I-1, Vicinity Map).

Purpose of and Need for Action

The Presidential Proclamation identified a need to take action regarding two critical problems facing giant sequoias and their ecosystems: 1) the heavy buildup of surface fuels and woody debris, leading to an increased hazard from wildfires, and 2) a lack of regeneration of young giant sequoias to ensure long-term sustainability of the species. The Proclamation also identified the need to provide proper care and management for the following objects of interest:

The naturally occurring groves of giant sequoia;

The ecosystems within the Monument that surround the groves and provide enriching recreational and social experiences, outstanding landscapes, and an array of rare and endemic species, such as the fisher, the great gray owl, the American marten, the northern goshawk, the peregrine falcon, the spotted owl, and the condor;

The historical landscape in and around the Hume Lake Basin associated with the Euro-American use of the giant sequoia since the late 1800s; and

The limestone caverns and prehistoric archeological sites that provide a paleontological record of the ecological changes that giant sequoias have undergone, as well as a prehistoric record of the relationship of the area to the native tribes.

Current direction includes the Forest Plan, as amended by the Framework and the Presidential Proclamation. The Management Plan will provide new direction for the proper care, management and enjoyment of the objects of interest in the Monument.

Return to top of page.

Proposed Action

The Proposed Action, Alternative 2 in this DEIS, appeared in the Federal Register in a Notice of Intent (NOI) on June 8, 2001. This alternative would establish or modify desired conditions and management goals for key resources in the Monument. Included in the Proposed Action and the other action alternatives are new management areas and associated management emphases, standards, and guidelines, to move Monument resources toward desired conditions and meet management goals.

Decision to be Made

The Responsible Official will decide whether to implement the proposed action, one of the other alternatives, or an alternative with a different combination of management goals.

Public Involvement

The public involvement period began with the publication of the Notice of Intent in the Federal Register, June 8, 2001. During the public scoping period, public meetings were held to provide clarification on the proposal.

The Proclamation stated that a Scientific Advisory Board would be appointed to provide scientific guidance during the development of the initial Monument management Plan. Meeting protocol established by the Board allows for 30 minutes of public comment at the beginning of each meeting. Consultation with Native Americans has been ongoing throughout the process. To date, over 2,500 comments have been received and analyzed to help develop management direction for the Monument.

Return to top of page.

Issues

Comments received during the public involvement process revealed important issues or public concerns. The following significant issues were identified from scoping and were used to develop alternatives to the Proposed Action and to focus the analysis.

Air Quality

Prescribed burning may increase short-term smoke emissions and impact public health. The Monument will contribute smoke to the San Joaquin Valley Air Basin. Prescribed burning may decrease long-term emissions by reducing the quantity and intensity of wildfires. Mechanical treatments also contribute minor amounts of emissions through increased dust production.

Fire and Fuels

There is great public interest in ensuring that the fire and fuel reduction strategies in the Framework are effective in their extent and magnitude for treating and protecting the Monument. Fire is a natural disturbance and a key process in a healthy, functioning ecosystem. Fire return intervals in the Monument have been altered through years of fire suppression. Missed fire return intervals have resulted in increased surface, ladder, and crown fuels.

Giant Sequoia

Under certain conditions, the current limitations on crown canopy reductions and tree diameter size removal may not provide adequate opportunities to meet the desired condition for the giant sequoias and their associated mixed conifer ecosystems. Re-establishing natural processes and structural conditions will allow giant sequoia and their mixed conifer ecosystems to be both stable and resilient to environmental change.

Mixed Conifer Restoration

Under certain conditions, the strategies and direction in the Framework may not provide adequate opportunities to meet the desired condition of a more natural fire regime and vegetative stands structure in the mixed conifer ecosystem that surrounds the giant sequoia groves. Re-establishing natural processes and structural conditions will allow giant sequoia and their mixed conifer ecosystems to be both stable and resilient to environmental change. Fuels strategies in the Framework may not restore the ecosystem the desired condition in the Monument.

Recreation

Proposed recreation, interpretation, and education opportunities within the Monument may not meet the demands of visitors, local communities, partners, local governments, tribal governments, or the business community. Changes in the level of development may be needed to meet public demand.

Social Values Regarding Vegetation Treatments

Management activities, including logging, mechanical vegetation treatments, or prescribed fire

may impact the expectations, values, and beliefs that some people have concerning what this national monument should be and by what means it should be managed. Reaching the desired conditions may be a goal widely agreed to, but some of the methods used to reach the goal may be unacceptable to some.

Watershed

The timing, amount, and intensity of management activities necessary to reduce catastrophic fires and achieve the desired conditions may have negative cumulative effects on watersheds, water quality, and beneficial uses. Effects may include accelerated erosion, sedimentation, increased nutrient loading, and decreased stream stability and aquatic habitat.

Wildlife

Proposed fuel reduction and ecological restoration treatments may adversely affect wildlife species that are dependent on late seral/old growth (LSOG) habitat by reducing the amount of that habitat.

Return to top of page.

I. Alternatives Including the Proposed Action

Alternatives to the Proposed Action were developed to address the Purpose and Need and the significant issues. The Monument DEIS analyzes six alternatives: a no action (Alternative 1), the Proposed Action (Alternative 2), and four additional action alternatives. The significant issues developed during public involvement were addressed differently in each of the action alternatives. All alternatives, except the no action alternative, propose the delineation of new management areas, with associated management emphasis and standards and guidelines.

Management Direction Common to All Action Alternatives

The description of each action alternative begins with a theme and an introduction. Four major strategies are developed and summarized for each alternative. These are addressed in more detail in Chapter II of the Monument DEIS.

Restoration. This strategy addresses the need to restore key terrestrial and hydrologic processes and structures, especially the regeneration of giant sequoia and the re-introduction of fire to fire-dependent ecosystems.

Protection. This strategy reduces the risk of catastrophic fire to communities and the objects of interest.

Recreation/Human Use. This strategy addresses the need for people to interact with and enjoy the objects of interest.

For illustrative purposes, potential recreation opportunity areas have been identified. These are sites that have a high potential for development of future recreation facilities or opportunities. They are considered in each of the action alternatives.

Transportation. This strategy manages the road system for the proper care and management of the objects of interest.

All of the alternatives incorporate strategies described in the Framework for protection of California spotted owls, northern goshawk, American marten, and Pacific fisher.

Alternative 1 (No Action): Theme - Continue current management direction.

Alternative 1 is the no action alternative required by the National Environmental Policy Act. Management within the Monument would continue under the existing Forest Plan, as amended by the Framework, and direction derived from the Proclamation itself. Approximately 3,200 acres per year would be treated under this alternative.

No new management areas are proposed; land allocations from the Framework would apply. Management direction would restore fire to the ecosystems and help maintain or develop old forest characteristics.

Direction for managing fuels would provide protection to communities and high value areas. The Wildland Urban Intermix strategy prescribes the use of ¼ mile defense zones, where fuels are intensively treated immediately adjacent to communities. Threat Zones are 1¼ mile wide areas adjacent to defense zones, where fuels are treated less intensively than in the defense zones. Strategically placed area treatments (SPLATs) would also be used to reduce fuels and reduce the risk of catastrophic wildfire.

Direction for recreation from the Forest Plan would still apply in the Monument where it is not superceded by the Framework.

Off-highway vehicle use in the Monument would be limited to designated roads only.

Alternative 2 (Proposed Action): Theme - Protect and restore giant sequoia ecosystems within their zones of ecological influence.

Alternative 2 is the Proposed Action. It does not address the significant issues because they were developed based on public comments received on this Proposed Action. Goals are proposed to meet the desired conditions, which are common to all action alternatives. This alternative would primarily treat areas with high fire susceptibility to reduce the risk of catastrophic fire.

Restoration Strategy. Framework land allocations and associated standards and guidelines would apply. These strategies would focus on protecting communities from catastrophic fire and maintaining old forest characteristics. No Monument-wide strategy for restoration of natural processes, fire return intervals, or desired vegetative stand structure is presented. This alternative would treat approximately 6,000 acres per year.

Protection Strategy. Alternative 2 would apply Framework wildland urban intermix strategies to protect communities, other sites occupied by people, and the objects of interest. The strategy includes implementation of wildland urban intermix defense zones, threat zones, and strategically placed area treatments to reduce the risk of catastrophic fires.

Human Use/Recreation Strategy. Alternative 2 would assess the increased demand for recreation and help meet that demand for a wide variety of recreational, interpretation, and education uses.

Transportation Strategy. This alternative would emphasize retaining existing road access for public use and for management activities.

Alternative 2 would establish additional desired conditions and management goals for key resources in the Monument. It proposes the designation of three management areas (see Figure II-2 in the Map Packet). Desired Conditions, Management Goals, Management Areas, Management Emphases, and Standards and Guidelines are detailed in Chapter 2 of the Monument DEIS.

Alternative 3: Theme - Emphasize natural processes.

Alternative 3 addresses the significant issues of Watershed, Wildlife, Social Values Regarding Vegetative Treatments, and Recreation. This alternative proposes a management area for high profile giant sequoia groves. High profile groves are those that have good road access and have current or potential recreation opportunities. This alternative would apply prescribed fire, hand treatments, road closures, and road decommissioning. Mechanical treatments would be avoided. Approximately 6,000 acres per year would be treated to begin restoring fire to the Monument ecosystems. Restoration treatments would be the priority after initial protection treatments are completed.

Framework management strategies for California spotted owl, northern goshawk, and great gray owl protected activity centers (PACs), forest carnivore den sites, California spotted owl home range core areas, aquatic management strategy, and willow flycatcher habitat are incorporated in this alternative. Standards and guidelines from the Framework that would be retained include those for lower Westside hardwoods, large tree retention, snags and down woody debris, incidental removal of vegetation and down woody material, noxious weeds, and grazing (outside of high profile grove areas). The following allocations and associated management strategies from the Framework would not apply in Alternative 3: the urban wildland intermix defense and threat zones, old forest emphasis areas, and southern Sierra fisher conservation area.

Restoration Strategy. Alternative 3 would emphasize the use of prescribed fire and associated hand equipment (chainsaws) and would limit the use of heavy equipment. Approximately one

percent of the acres in the high profile groves would be treated each year, using prescribed fire and hand treatments. Restoration outside of the high profile groves would be accomplished using prescribed fire and hand treatments in restoration treatment areas. Treatments would be based on the fire return intervals for different vegetation types, fire susceptibility, and local conditions.

Protection Strategy. A defense zone approximately 200 feet wide would be used to protect communities, encompassing an estimated 3,600 acres Monument-wide. The defense zone width would be determined locally, based on local fire behavior and terrain. Prescribed fire would be the primary tool to reduce the risk of catastrophic fire in the rest of the Monument.

Human Use/Recreation Strategy. Alternative 3 proposes to eliminate OHV use in the Monument, which would increase the feeling of isolation from motorized use. Primitive and semi-primitive recreation opportunities and trails would be increased. This alternative would concentrate day use recreation in the high profile groves. It would increase day use opportunities and expand or implement new interpretation and education programs and facilities. The existing capacity of developed overnight facilities would be maintained, while dispersed overnight recreation use would be reduced.

Transportation Strategy. Alternative 3 would focus on reducing environmental impacts from the road system. Roads needed for restoration work or public access to high profile groves, recreation sites, private land, or special use sites, would be maintained and remain open. Others would be decommissioned or closed to public use.

Alternative 3 would establish additional desired conditions and management goals for key resources in the Monument. It proposes the designation of three management areas (see Figure II-5 in the Map Packet). Desired Conditions, Management Goals, Management Areas, Management Emphases, and Standards and Guidelines are detailed in Chapter 2 of the Monument DEIS.

Alternative 4: Theme - Manage ecosystems conservatively and encourage recreation.

Alternative 4 addresses the significant issues of Social Values Regarding Vegetative Treatments, Recreation, and Wildlife. This alternative would establish two management areas, the Human Influence Zone (HIZ) and the General Forest Zone (GFZ). Management strategies in the HIZ would focus on protection from catastrophic fire and meeting the desired conditions for recreation and other human uses. The GFZ would include all areas outside the HIZ. Overall management would focus on ecosystem restoration, especially on lands disrupted by past logging, on lands where the natural fire regime has been disrupted by fire suppression, and on riparian areas that do not meet desired conditions. Resources and natural processes would move toward the desired condition, primarily through the use of prescribed fire, hand treatments, and mechanical thinning. An estimated 6,000 acres per year would be treated to begin restoring fire to Monument ecosystems.

Framework land allocations and management strategies that would be retained include California spotted owl, Northern goshawk and great gray owl PACs, forest carnivore den sites, California spotted owl home range core areas, aquatic management strategy, and willow flycatcher habitat. Standards and guidelines from the Framework would be retained for lower Westside hardwoods, large tree retention, snags and down woody debris, incidental removal of vegetation and down woody material, noxious weeds, and grazing. The following allocations and management strategies from the Framework would not apply in Alternative 4: the urban wildland intermix defense and threat zones, old forest emphasis areas, and southern Sierra fisher conservation area.

Restoration Strategy. Alternative 4 would focus on restoring desired fire return intervals and desired forest characteristics (such as a mosaic of tree species and age classes), restoring plantations and roads to natural conditions, and restoring or stabilizing riparian habitat that does not meet desired conditions. Vegetation restoration methods would generally be limited to prescribed fire and hand treatments and would be focused within the GFZ. Generally, no trees larger than 12 inches in diameter would be removed for ecological restoration. Plantations would be managed to restore forest structure to desired condition and to minimize the risk of catastrophic fire.

Protection Strategy. This alternative proposes to provide protection for communities and other occupied sites by reducing the fire hazard around existing structures, developed campgrounds, other developed public use areas, and along major roads within the HIZ. Prescribed fire, hand thinning, and mechanical treatments would be the preferred treatment methods. Generally, no trees larger than 12 inches in diameter would be removed unless necessary for emergencies, for public safety, or for the development and maintenance of recreation and administrative sites.

***Human Use/Recreation Strategy*.** Developed and dispersed recreation opportunities, winter use facilities, trails, and interpretive facilities and opportunities would be increased in Alternative 4.

***Transportation Strategy*.** Alternative 4 would emphasize reducing environmental impacts from roads, while providing for public access. Roads with high risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned.

Alternative 4 would establish additional desired conditions and management goals for key resources in the Monument. It proposes the designation of two management areas (see Figure II-6 in the Map Package). Desired Conditions, Management Goals, Management Areas, Management Emphases, and Standards and Guidelines are detailed in Chapter 2 of the Monument DEIS.

Alternative 5: Theme - Manage groves with a wide range of management strategies to promote characteristics for giant sequoia regeneration.

Alternative 5 addresses the significant issues of Fire and Fuels, Giant Sequoia, Mixed Conifer Restoration, Recreation, and Social Values Regarding Vegetative Treatments. A broad range of management strategies to promote conditions for giant sequoia regeneration in groves would be prescribed. Management strategies would be grove-specific and include prescribed fire and mechanical treatments (including heavy machinery). Up to approximately 8,000 acres per year would be treated to begin restoring fire to Monument ecosystems.

Within the groves, the following allocations and associated management strategies from the Framework would be retained: California spotted owl, northern goshawk, and great gray owl PACs, forest carnivore den sites, California spotted owl home range core areas, aquatic management strategy, and willow flycatcher habitat. Lands within the groves that are not in any of the above allocations would become a new land allocation, with the primary purposes of protection and restoration of the groves. Framework standards and guidelines to be retained would include lower Westside hardwoods, large tree retention, snags and down woody debris, incidental removal of vegetation and down woody material, noxious weeds, and grazing. Outside of the groves, Framework allocations and management strategies, including the use of prescribed fire and mechanical treatments, would apply. The first priority for treatment would be areas identified to reduce the risk of catastrophic fire.

***Restoration Strategy*.** Alternative 5 would provide for the systematic reintroduction of fire to the ecosystem by following new management strategies for the groves and by following Framework strategies outside of the groves. Lands outside of groves would be treated to reduce the risk of catastrophic fire sufficiently over the long term to allow prescribed fire and wildland fire use to act as the primary tools to move resources toward desired conditions.

***Protection Strategy*.** Alternative 5 would provide protection to communities, other occupied sites, and the objects of interest, using the full range of Framework strategies including urban wildland intermix threat and defense zones, strategically placed area treatments, and wildland fire use.

***Human Use/Recreation Strategy*.** Alternative 5 would assess the increased demand for recreation and help meet that demand for a wide range of recreation uses. The alternative would encourage the expansion of overnight camping opportunities near and in the groves. The focus of interpretation would be on historical areas on the Hume Lake District and on natural settings on the Tule River and Hot Springs Districts.

***Transportation Strategy*.** Alternative 5 would emphasize retaining existing road access for public use and for management activities.

Alternative 5 would establish additional desired conditions and management goals for key resources in the Monument. It proposes the designation of five management areas (see Figure II-7 in the Map Packet). Desired Conditions, Management Goals, Management Areas, Management Emphases, and Standards and Guidelines are detailed in Chapter 2 of the Monument DEIS.

Alternative 6: Theme - Manage entire Monument with the widest range of management strategies.

Alternative 6 addresses the significant issues of Fire and Fuels, Giant Sequoia, Mixed Conifer Restoration, Recreation, and Social Values Regarding Vegetative Treatments. This alternative would allow the broadest range of management strategies to restore and protect all of the

ecosystems found in the Monument, as well as promote conditions for giant sequoia regeneration in the groves. Outside of the groves, areas would be designated for ecological restoration treatments based on monument-wide strategies and site-specific analysis. Treatments to reduce the risk of catastrophic fire would be the first priority. Other areas would be treated to meet the desired condition for vegetation and to return fire-dependent ecosystems to a desired fire return interval. Management strategies would include prescribed fire and mechanical treatments (including heavy machinery). Up to approximately 8,000 acres per year would be treated to begin restoring fire to Monument ecosystems.

Alternative 6 would retain the following allocations and associated management strategies from the Framework: California spotted owl, northern goshawk, and great gray owl PACs, forest carnivore den sites, California spotted owl home range core areas, aquatic management strategy, and willow flycatcher habitat. Areas outside these allocations would become new land allocations with a new set of standards and guidelines. Standards and guidelines from the Framework that would be retained include those for lower Westside hardwoods, large tree retention, snags and down woody debris, incidental removal of vegetation and down woody material, noxious weeds, and grazing.

Restoration Strategy. Alternative 6 calls for the systematic reintroduction of fire throughout the Monument to re-establish a desired fire return interval for all fire-dependent ecosystems. Existing plantations would be managed to restore forest structure, hydrologic conditions, and minimize risks from catastrophic fire.

Protection Strategy. Alternative 6 would protect communities, other sites occupied by people, and the objects of interest, using a full range of Framework strategies including urban wildland intermix threat and defense zones, strategically placed area treatments, and wildland fire use.

Human Use/Recreation Strategy. Alternative 6 would assess the increased demand for recreation in the Monument and help meet that demand for a wide range of recreation uses. The expansion of overnight camping opportunities in and near groves would be encouraged. This alternative would emphasize interpretation and education on management activities, focusing on the historical areas on the Hume Lake District and on natural settings on the Tule River and Hot Springs Districts.

Transportation Strategy. Alternative 6 would emphasize retaining road access for public use and for management activities similar to current access levels.

Alternative 6 would establish additional desired conditions and management goals for key resources in the Monument. It proposes the same management areas as Alternative 5 (see Figure II-7 in the Map Packet). Desired Conditions, Management Goals, Management Areas, Management Emphases, and Standards and Guidelines are detailed in Chapter 2 of the Monument DEIS.

Return to top of page.

Comparison of Alternatives

Table II-1: Comparison of Alternatives by Issues and Indicators

The following acreages were developed for use in the analysis of effects of implementing the alternatives. They were developed using the Spectrum's computer modeling system and applying the management direction and standards and guidelines for each alternative. These figures are estimates of treatments for the first decade of implementation and are not intended to be site-specific. The actual amount of area treated would vary as landscape analyses are conducted.

Table II-2: Comparison of Alternatives by Treatment Methods for the First Decade

Table II-3: Comparison of Alternatives by Strategy

Return to top of page.

III. Affected Environment

Chapter III of the Monument DEIS describes the affected environment by resource in detail.

IV. Environmental Consequences

This section compares the alternatives by summarizing their environmental consequences, which are discussed in Chapter IV of the Monument DEIS in more detail.

Air Quality

Smoke from prescribed burning could affect air quality and is a concern because of its potential effects on human health and visibility. Fires emit large amounts of particulate matter (PM10 and PM2.5) and carbon monoxide, as well as nitrous oxide (NOx) and volatile organic compounds (VOCs), which are precursors to ozone. Emissions are based on the number of acres burned within an airshed. Reducing the total acreage burned, regardless of the type of fire, is the most effective way to reduce the total emissions within an airshed. Because prescribed fire generally produces fewer per-acre emissions than wildland fire, it is possible to burn more acres by prescribed fire than would normally occur with wildland fire and still maintain the same total emissions within an airshed.

Wildfires result in greater emissions per acre than prescribed burns. Wildfires often occur under conditions of high temperature and low humidity, with high concentrations of ozone. Prescribed burning reduces existing fuels, thus reducing the fire hazard and the risk of high intensity wildfire.

Alternatives 1, 2, 3, 5, and 6 would all have some amount of volume of wood products removed that would represent a savings in emission outputs. Alternative 4 proposes to burn any material that is removed. All alternatives would have some pile burning in the first decade, which spreads emissions over a longer time.

Alternative 2 offers the least PM10 emissions in the first decade, followed by Alternatives 1, 3, 4, and 6, in that order. Alternative 5 puts the largest amount of PM10 emissions into the airshed.

Caves

Under all alternatives, caves and their associated resources would be inventoried, protected, studied, and preserved. All of the alternatives include some form of vegetation management, prescribed burning, road maintenance, recreation use and management, and other management activities. The management strategies and goals for all the alternatives would limit the possible effects on cave resources from these activities to minimal or no effects.

Fire and Fuels

All of the alternatives propose to treat chaparral. Alternatives 1, 2, 5, and 6 propose to treat chaparral using methods of mechanical treatment or prescribed fire. Alternatives 3 and 4 would only apply prescribed fire methods.

All alternatives would result in an overall reduction of fuel loading and fire susceptibility.

No alternative is expected to result in an increase in prescribed fire escapes.

All alternatives would move stand structure characteristics to conditions that support low intensity surface fires characterized by the historic fire regime. As thinning by prescribed fire or mechanical treatments begin to reduce stand densities and open forest canopies, trees over 30 inches in diameter would become more abundant.

Alternatives 1, 2, 5, and 6 would apply wildland urban intermix defense and threat zones to provide community protection following widths prescribed in the Framework. Alternatives 1, 2, and 5 would use standards and guidelines for defense zone prescription as directed in the Framework. Alternative 6 could result in vegetation removal beyond that prescribed in the framework following site-specific analysis. Alternatives 3 and 4 would use smaller defense zones to provide community protection. Alternative 4 would restrict the width of the defense zone to 200 feet, while Alternative 3 would allow for adjustments for local fuels and conditions up to 1,300 feet in width.

Alternative 6 treats the most acres to reduce fire susceptibility. Alternatives 1, 2, 5, and 6 propose to reduce fire susceptibility, using both prescribed fire and mechanical treatment methods. Alternatives 3 and 4 would use only prescribed fire methods.

Alternative 1 would move the least amount of acres toward a more historic fire return interval in the first decade. Alternative 6 would move the most acres toward a more historic fire return interval, while the other alternatives would range between 1 and 6, in ascending order.

Giant Sequoia and Mixed Conifer

All alternatives would reduce fuel loading, vegetation density, and overstory tree canopy. There would also be a reduced risk of catastrophic wildfire, new patches of vegetation, and improved health and vigor in residual trees. Young seral stages of vegetation would be created in chaparral and brush stands, increasing heterogeneity of the stands. Initial prescribed burn treatments would likely lead to a modest increase in giant sequoias in the first decade.

Under Alternative 1, there would be no emphasis to restore ecological processes and conditions for the protection and long-term sustainability of giant sequoia or the other vegetation in the Monument.

Alternative 2 would treat approximately 6% of the giant sequoia acreage as wildland urban intermix defense zones. This would create openings in the forest canopy that would allow for the establishment of young vegetation. It is not likely that the gaps created would be greater than ¼-acre in size, given the desired outcomes. Approximately 28% of the grove acreage falls within the wildland urban intermix threat zones. The use of prescribed fire in threat zones is likely to create gaps in the canopy, given the high fuel loading. Mechanical treatment in strategically placed fuel treatment areas would allow for the removal of trees up to 20 inches in diameter to meet fuels objectives. The initial treatments of mechanical thinning and/or prescribed burning would be most likely to create gaps, given the high tree densities.

Alternatives 3 and 4 are more likely to create gaps and patches that are outside the range of recommended management variability. Gap and patch frequency would be more likely to be met by Alternatives 5 and 6, due to the use of mechanical methods in pre-treatment prior to burning. Alternatives 1 and 2 would create gaps, although less than Alternatives 5 and 6.

Alternative 3 would have the greatest short and long-term effects on stand density, as compared to Alternatives 1, 2, 5, or 6. Over time, Alternatives 1, 2, 5, or 6 would result in more large trees because of the greater and more sustained thinning effects from the prescribed fire.

The effects of Alternative 4 are similar to Alternative 3, except that the road system for Alternative 4 would remain largely intact, with relatively few road miles being proposed for decommissioning or closure. Prescribed burning would be emphasized as the primary management tool. The almost exclusive use of prescribed fire in Alternatives 3 and 4 would be expected to create gaps and patches that are more than 10% of the area within groves and other mixed conifer forest.

The effects of Alternative 5 are similar to those of Alternative 2, because the same management direction would apply to all acres, excluding the giant sequoia groves. Effects in groves would be similar to those of Alternative 6. Restoration of stand structure, particularly creation of gaps and patches of new vegetation in giant sequoia groves, would be emphasized in Management Area GSG1. Activities in groves within GSG2 and GSG3 would focus on reducing the risk of catastrophic fire in the short term. As groves meet desired conditions for reduced susceptibly from catastrophic fire, emphasis would shift to create new gaps in their stands, as well. Over the long term, groves in all management areas would move toward the desired condition, as gaps are created by mechanical methods or prescribed fire. New patches of vegetation would be established, and groves would be at a reduced risk of catastrophic fire from the present condition.

In the first two or three decades following implementation of Alternative 6, the short-term effects would include the creation of gaps and patches of new vegetation where gaps exist. Gaps would also be created in Management Areas GSG2 and GSG3, as a result of activities primarily for protection purposes.

Treating most of the groves within 20 to 30 years would lead to a reduction in fire susceptibly for all of the groves. Thinning areas between the created gaps, improving stands, would reduce stand density and improve tree health, due to improved growing conditions. Most of the vegetation outside of the groves would be treated for either protection or restoration objectives within 20 to 30 years. The effects on gap creation, patches of new vegetation, re-introduction of fire into the ecosystem, and reduction of fire susceptibility would be similar to those described within giant sequoia groves. Over the long term, there would be an increase in shade-intolerant species over existing levels.

Range

All alternatives, except Alternative 3, would implement Framework guidelines. Changes from the Framework would result in a reduction in grazing of 20% to 30%. Alternative 3 proposes to eliminate grazing in high profile giant sequoia groves (Management Area HPG). This would directly affect three grazing permits, either eliminating them all together or making them not economically viable. Two other permits would be affected to a lesser extent. Overall, grazing would be reduced by approximately 1,135 animals and 5,300 animal units per month, or approximately 10% of the current grazing program within the Sequoia National Forest.

Rare Plants

The Forest Service is mandated to maintain the viability of species at risk. The Fish and Wildlife Service regulate effects on species listed under the protection of the Endangered Species Act; therefore, effects on these species would range from minimal to no effect. Species that benefit from general openings would likely benefit under implementation of Alternatives 1, 2, or 5. The benefits, however, would be offset by the strong preference for creating openings adjacent to communities, where increased disturbance may offset gains in potential habitat. Alternatives 3 and 4 would have the greatest effect on canopy reduction in the short term. The expected increase in more intense prescribed burns would benefit gap species, such as *Clarkia springvillensis, Calochotrus westonii, Monardella linoidse,* and possibly *Oreonana prupurascens, hulsea bevifolia,* and*Railardiopsis muirii*.

The establishment of gaps in canopy closure and general openings would be more conservative in Alternatives 5 and 6 than in 3 and 4. Created openings and thinning would benefit gap phase species, such as *Calochortus westonii*, and *Clarkia springvillensis*, but not as much as the more aggressive burning program.

Watershed

All alternatives would embrace the aquatic management strategy and the ecosystem management strategy presented in the Framework.

Applying the principle that the more acres are treated by mechanical methods, the higher the risk of cumulative watershed effects, Alternatives 3 and 4 would have the least effect on the aquatic and riparian community, and Alternatives 1, 2, 5, and 6 would have the greatest effect. Alternatives 3 and 4 would have similar consequences. They both would have higher consequences since they would exert less control over the size and amount of material removed and the intensity of the fires during initial treatments.

Alternatives 1, 2, 5, and 6 propose no changes to the road system. Alternatives 3 and 4 would include some road closures and decommissioning. A reduction in the road system reduces the potential for cumulative watershed effects. A cumulative watershed effects analysis, along with road treatments, would be conducted at the landscape level and provide a more site-specific analysis for project-level management.

Management actions that have the potential to affect soil and water resources are considered to be the highest in Alternatives 1, 2, 5, and 6, which have more potential for ground-disturbing activity. Alternatives 1, 2, 5, and 6 would provide more protection to soil and water resources due to the likelihood of reduced wildfire severity. Alternatives 1, 2, 5, and 6 would also produce the greatest amount of short-term effects to soil and water quality, while providing the greatest long-term benefits in terms of prevention of and protection from wildfire.

Alternatives 3 and 4 have the least likelihood to affect soil and water resources on slopes due to less ground-disturbing activity. They have the highest potential to affect soil and water quality, due to the reduced control of broadcast burning in stream buffers. Alternatives 3 and 4 would provide a reduced level of soil and water quality protection, primarily due to the likelihood of high severity wildfires.

Wildlife

The wildlife analysis addresses aquatic and riparian species, early seral stage species, late seral stage species, lower Westside hardwoods, and wildlife species at risk.

Alternatives 1, 2, and 5. Alternatives 1, 2, and 5 would improve aquatic and riparian habitat by decommissioning roads, particularly those identified with impacts to riparian habitats. Early seral stage habitat would be created in Alternatives 1, 2, 5, and 6 but the habitat would be mostly focused in the urban interface areas. Thinning prescriptions used in Alternative 5 might

create mosaics with some additional early seral habitat, but the thinning prescriptions are unlikely to open canopies to the extent necessary for development of shrub and herbaceous undergrowth. A gradual increase in late seral stage habitat would result from implementing Alternatives 1, 2, or 5. The alternatives would result in a modest decline of approximately 100 acres per decade lost to stand-replacing fire. Modeling predicts that area meeting late seral old growth (LSOG) characteristic would increase from nearly 70,000 acres to approximately 140,000 acres. Alternatives 1, 2, and 5 would follow Framework direction to specifically favor hardwoods where they naturally exist.

Alternatives 3 and 4. Alternatives 3 and 4 would depend heavily on the use of fire without mechanical treatments. The modeled result would be a reduction in canopy, loss of large conifers, and a greater potential for escaped fires. Alternative 3 would result in the greatest reduction in miles of road and would eliminate grazing from high profile groves. This might lead to improved habitat that would be beneficial to riparian dependent species. The higher use of fire without mechanical pre-treatment of fuels under Alternatives 3 and 4 would create larger gaps or openings within the forest. The larger opens, reduced canopy, and the germination of more fire-dependent shrubs would result in the most early seral stage habitat under any of the alternatives. Alternatives 3 and 4 would also be more aggressive in thinning stands of smaller suppressed trees due to fire intensity without mechanical pretreatment. The modeled result is a steady increase over time in spotted owl habitat, larges trees per acres, and snags. In the short-term spotted owl nesting habitat would suffer from increased openings and a loss of large trees, but improve over the long term. The use of fire alone in these alternatives would limit the ability to selectively treat stands to improve hardwood retention. Openings in the canopy might increase hardwood recruitment and would be likely to increase the numbers and size of oaks over time, but to a lesser extent than under Alternative 6.

Alternative 6. Alternative 6 would treat the most acres using mechanical methods. This translates into greater certainty that treatments would occur. It also produces greater potential for compaction and inadvertent harm to small, relatively immobile species. There would also be the potential for loss of riparian deciduous hardwoods such as alders and aspen. The mix of mechanical and fire treatments would likely leave more down woody debris, pockets of slash, and ground over that would limit growth of herbaceous and shrub species. Habitat effectiveness might be higher due to having greater control of and ability of leave hiding cover with mechanical treatments. Alternative 6 would improve LSOG habitat at a faster rate than Alternatives 1, 2, and 5, but not as rapidly as Alternatives 3 and 4. Fewer acres would be lost to stand-replacing wildfire so the long-term loss of LSOG habitat would decrease. Mechanical pretreatment increases the opportunity to protect elements that appear to be important to some species. This alternative would allow more flexibility to selectively thin to favor oak retention and protect existing large oaks.

Wildlife Species at Risk.

The valley elderberry long-horned beetle would likely benefit from activities that restore the role of fire to chaparral ecosystems. All alternatives would have a beneficial effect on this beetle. Limitation on the use of mechanical pretreatments in chaparral in Alternative 3 might limit options for the protection of elderberries, which would require other mitigation to offset or minimize potential shrub loss.

Chaparral burning and treatment of fuels in the oak belt would be likely to increase deer and result in better availability of food supplies for the California condor. There would also be an increase in openings and large snags necessary for foraging and roost sites for the condor. The small opening and thinning proposed in groves in Alternatives 5 and 6 would be unlikely to adversely affect quality of nesting habitat for condors and might improve foraging in the area surrounding potential nest trees.

California spotted owl, Pacific fisher, and American marten have slightly different habitat requirements, but also have several elements in common. Outcomes for Alternatives 1, 2, and 5 would not vary significantly from the Framework. Alternatives 3 and 4 would likely increase effects of canopy and large trees reduction over a larger area in the short term. Overall nesting habitat and large trees would increase under all alternatives, more under Alternatives 3 and 4 than Alternatives 1, 2, 5, or 6. Large snags and down wood would also increase the most under Alternatives 3 and 4.

Alternative 6 would give more protection to existing snags, large trees, down logs, and oak than Alternatives 3 and 4. Thinning, from below, under all alternatives would be likely to improve flight paths and increase the resilience of stands to disease, pests, and fire.

Heritage Resources

All alternatives would have some irreversible commitments of heritage resources. Examples are inadvertently damaged or destroyed sites, vandalized or looted sites, and sites that have not been inventoried and recorded and are undergoing loss from natural processes. Every alternative seeks to minimize this loss through inventory and evaluation, monitoring, and improved project implementation. Prescribed burning and wildfires would have the potential to directly affect heritage sites by burning historic structures and damaging or destroying artifacts and features of archaeological sites. Effects would be greater from a wildfire because of high temperatures and the inability to control the effects.

Recreation

In Alternative 1, the Recreation Opportunity Spectrum (ROS) classifications would not change from those developed for the Forest Plan and the 1990 Mediated Settlement Agreement. The Recreation Opportunity Spectrum classes would be the same for all action alternatives. The overall effect would be to add area to the lesser-developed classes and provide greater opportunities for non-motorized activities.

Alternative 1 continues with current direction and would not meet the demands of the recreating public. New facilities may be constructed to help meet the demand for developed sites. Overcrowding would likely occur more frequently. This alternative would not be expected to significantly change PAOT capacity in the next decade. The current road and trail system would be maintained and would continue to provide access for recreation, interpretation, and education needs.

Alternative 2 responds to the projected increased in demand for more and varied recreational, interpretation, and educational opportunities. However, this alternative would still not meet the projected demands of the recreating public, although it has the potential to accommodate demand better than Alternative 1. Additional developed recreation sites would increase PAOT capacity and would meet a portion of the expected increase in public demand for recreation opportunities. There would be no expected loss of dispersed recreation opportunities. The current road and trail system would be maintained and would continue to provide access to developed and dispersed recreation sites.

Alternative 3 is generally responsive to the expected increases in demand for more primitive experiences and isolation from motorized use within the Monument. The range of recreation opportunities in this alternative would be narrower than in the other alternatives. Alternative 3 would not be expected to meet the demands of the recreating public, but it may better meet the demand for some primitive kinds of recreation experiences than the other alternatives. PAOT capacity would be lower in this alternative than in any of the other action alternatives. Alternative 3 would expand day us opportunities, maintain the status quo of developed overnight facilities, and reduce dispersed overnight use. Approximately 400 miles of roads would be open to the public, the greatest reduction in road miles of all the alternatives. Additional trails might be developed.

Alternative 4 generally responds to the expected increases in demand for more recreation opportunities. However, this alternative will not meet the demands of the recreating public, although it has the potential to accommodate demand better than Alternative 1 and 3, but less than Alternatives 2, 5, and 6. Additional developed recreation sites would increase PAOT capacity and would meet a portion of the expected increase in demand for recreation opportunities. Dispersed recreation activities would be accommodated in a number of places. An increase would be expected in dispersed recreation use. The existing road system would be reduced slightly and would continue to access existing developed and dispersed recreation sites. Additional trails might be developed.

Alternatives 5 and 6 are generally responsive to the expected increases in demand for a wide range of recreation opportunities. However, Alternatives 5 and 6 will still not meet the demands of the recreating public, although these alternatives are more likely to accommodate more of the projected demand than any of the other alternatives. Additional developed recreation sites would increase PAOT capacity and would meet a portion of the expected increase in demand for recreation opportunities. Dispersed recreation activities would be accommodated in a number of places. An increase would be expected in dispersed recreation use. The existing road system would remain unchanged and would continue to access existing developed and dispersed recreation sites. Additional trails might be developed.

Scenic Environment

Alternative 1 would retain the visual quality objectives assigned by the Forest Plan, although they would be converted to scenic integrity objectives, terminology as used by in the Scenic Management System.

The Scenic Integrity Objectives (SIOs) for all action alternatives are approximately 18% (60,200 acres) of very high, 28% (91,200 acres) of high, 53.5% (174,200 acres) of moderate, and 0.5% (800 acres) of low.

The selective removal of trees and prescribed burning (of vegetative residues and related flammable materials) can have a positive effect upon the scenic values of the national forest. Planting more fire-resistant species, such as ponderosa and Jeffrey pines, giant sequoia, and incense cedar, in fire-prone areas can have a similarly positive effect.

Public information that addresses the temporary nature of adverse effects to scenery associated with prescribed burning can help reduce the potential for negative public reaction after a fuels treatment project.

Socio-Economics

Over the next ten years, Monument visitation is expected to increase by approximately 1 million visits under all but Alternative 3. Alternative 3 would produce more visits than currently, but not as much as is expected under the other alternatives.

Acres of mechanical treatment vary from approximately 330 acres per year in Alternative 4 to about 3,810 acres per year in Alternative 5. All alternatives except Alternative 4 would be expected to produce some amount of wood products following treatments. Treatment acres and expected wood products available after treatment would have a negligible effect on future employment in the agriculture sector. All but Alternative 4 would support existing jobs in logging and milling in the manufacturing sector of the community. Those that prefer fire alone with no production of timber would rank Alternative 4 as the most favorable, with Alternative 3 ranking 2nd, Alternatives 1 and 2 ranging 3rd, and Alternatives 5 and 6 ranked 4th and 5th, respectively. Those who prefer mechanical treatment and production of timber volume would rank the alternatives in order of most to least preferred as Alternatives 6, 5, 1 and 2, 3, and 4.

Roads

The road system under Alternatives 1, 2, 5, and 6 would contain approximately 900 miles of roads within the Monument. The demands on the road system could create management conflicts in terms of which roads are the highest priority to maintain. Under Alternatives 1, 2, 5, and 6, public access would be as important as vegetation management and other administrative access. The road system overall may deteriorate faster because the funding would be spread over a larger road network than in Alternatives 3 or 4. The road system under Alternative 3 would be comprised of approximately 760 miles of road; approximately one-third of that mileage would not be open to the public. Under Alternative 4 an estimated 875 miles of roads would remain in the Monument.

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF
· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Chapter I Purpose of and Need for Action

Purpose of and Need for Action. I-2 | Background. I-2 | Purpose and Need. I-2 | Proposed Action. I-6 | Decision to be Made. I-6 | Scientific Advisory Board. I-6 | Public Involvement I-7 | Issues. I-8 | Air Quality. I-9 | Fire and Fuels. I-9 | Giant Sequoia. I-10 | Mixed Conifer Restoration. I-11 | Recreation. I-12 | Social Values Regarding Vegetation Treatments. I-13 | Watershed. I-14 | Wildlife. I-15

Purpose of and Need for Action

Background

The Giant Sequoia National Monument (Monument) was created on April 15, 2000 by Presidential Proclamation (see Appendix G). The Proclamation designated 327,769 acres within the boundary of the Sequoia National Forest (Forest) in south-central California as a national monument (see Figure I-1, Location Map of the Giant Sequoia National Monument). The Monument remains under the jurisdiction of the Forest Service and the President directed the Secretary of Agriculture to prepare a management plan within three years. A scientific advisory board was appointed, in consultation with the National Academy of Sciences, to provide scientific guidance during the development of this management plan.

Purpose and Need

The purpose of this management plan is to establish management direction for the land and resources within the Monument. It will amend the current Sequoia National Forest Land and Resource Management Plan (Forest Plan), as amended by the Sierra Nevada Forest Plan Amendment (Framework).

The Proclamation identifies the need to take action regarding two critical problems facing the giant sequoias and their ecosystems: 1) the heavy buildup of surface fuels and woody debris, leading to an increased hazard from wildfires, and 2) a lack of regeneration of young giant sequoias to ensure long-term sustainability of the species. The Proclamation also clearly identifies opportunities for scientific research, interpretation, and recreation, and the need for a transportation plan. The management plan will provide proper care for the objects of interest as identified in the Proclamation. A summary of the objects of interest include (for a complete description see the Proclamation in Appendix G):

The naturally occurring groves of giant sequoia (see Figure I-2, Giant Sequoia Groves)

The ecosystems within the Monument that surround the groves and provide enriching recreational and social experiences, outstanding landscapes, and an array of rare and endemic species, such as the fisher, the great gray owl, the American marten, the northern goshawk, the peregrine falcon, the spotted owl, and the condor.

The historical landscape in and around the Hume Lake Basin associated with the Euro-American use of the giant sequoias since the late 1800s.

The limestone caverns and prehistoric archeological sites that provide a paleontological record of the ecological changes that giant sequoias have undergone, as well as a prehistoric record of the relationship of the area to the native tribes

Current management direction for the Sequoia National Forest and the Monument includes the Presidential Proclamation and the Forest Land and Resource Management Plan (Forest Plan) as amended by the Sierra Nevada Forest Plan Amendment (Framework). The Framework provides management direction for many important concerns such as aquatic, riparian, and meadow management; fire and fuel management; and old forest ecosystem management. It provides strategies, as well as standards and guidelines, to address the risk of catastrophic fire, although

it is not focused on the objects of interest within the Monument. It also provides some management direction to begin to address the restoration of giant sequoia ecosystems (see Appendix C for a summary of Framework direction).

Current management direction does address some key concerns raised by the public during and immediately after the establishment of the Monument. The Proclamation provides specific direction for dealing with some activities, such as accessing private lands and special use facilities, issuing special use permits (permits for three organizational camps have recently been renewed), hunting and fishing, and limiting off-highway vehicle use. The direction in the Proclamation applies to lands owned or controlled by the United States, not private land. The Proclamation withdraws lands in the Monument from new mining claims, eliminates the use of Monument lands to provide a sustained yield of timber, permits the use of motorized vehicles only on designated roads, maintains the jurisdiction of the State of California with respect to fish and wildlife management (including hunting and fishing), maintains the laws and regulations that apply to special use authorizations, and maintains existing rights.

Proposed Action

The proposed action was published in a Notice of Intent in the Federal Register and in the scoping letter, both dated June 8, 2001. Publication of the proposed action initiated the 45-day public scoping period and provided the public with an opportunity to comment on the initial thoughts regarding actions that might be taken.

The proposed action recommends the establishment of new or modified desired conditions and management goals for key resources in the Monument. To realize those desired conditions and meet those management goals, it also proposes the designation of new management areas (MAs) within the Monument, and their associated management emphases, standards, and guidelines.

The term proposed action" is not synonymous with another term used in environmental impact statements, preferred alternative." Please see Chapter II, Alternatives Including the Proposed Action, for a full description of the proposed action (Alternative 2).

Decision to be Made

Given the purpose and need, the Responsible Official will review the proposed action, the other alternatives, and the environmental consequences in order to make the following decision:

Whether to implement the proposed action, an alternative to the proposed action, or take no action at this time.

Scientific Advisory Board

A Scientific Advisory Board (Board) was created with the purpose of providing scientific guidance during the development of this initial Monument management plan. The Board operates under a Department of Agriculture charter, which was signed August 31, 2000 and expires upon completion of the management plan. It consists of eight members, representing a range of scientific disciplines including the physical, biological, and social sciences. Its members are:

- Chairperson, Dr. Paul Waggoner, Department of Forestry and Horticulture, Connecticut Agricultural Experiment Station
- Vice Chairperson, Professor Jeanne Clarke, University of Arizona
- Dr. Douglas Piirto, Professor, California Polytechnic University
- Dr. David M. Graber, Senior Science Advisor, National Park Service
- Dr. Karen Nissen, Anthropologist/Archaeologist
- Dr. Daniel Tormey, Principal, Environmental Consultant, Entrix, Inc.
- Dr. Nate Stephenson, Research Ecologist, U.S. Geological Society
- Dr. George Woodwell, Woods Hole Research Center

The Board provides advice to the Forest Service in the form of advisories. The advisories are reached by a consensus of the board members present who have participated in the discussion regarding the advisory. The Board has met four times and provided 18 advisories to the Forest Service (see Appendix F for the complete text of these advisories). Board meetings are open to public attendance and also open to public comment during the first 30 minutes of each meeting.

Return to top of page.

Public Involvement

The Notice of Intent was published in the Federal Register on June 8, 2001. A scoping letter was mailed to interested publics on the same date. Both the Notice of Intent and the scoping letter asked for public comment on the proposal from June 8, 2001 to July 24, 2001.

Public meetings on the proposal were held in Sacramento, Los Angeles, Clovis, Bakersfield, and Porterville, California from July 10 to July 16, 2001. At these meetings, the Monument planning team provided overviews of the proposed action, answered questions, discussed the timeline, and encouraged public comment.

Three issues of the publication Giant Sequoia National Monument Issues and Updates" were mailed to other agencies and interested publics to provide information on the development of the Monument management plan. They were mailed in December 2000, July 2001, and April 2002.

A web site for public access is available with information on the Monument management plan, the Board, and links to other sites regarding giant sequoias. The address is: Giant Sequoia National Monument Plan Amendment.

Public meetings were held in Porterville on March 11, 2002, and in Bakersfield on March 12, 2002. At these meetings, the Monument planning team provided information on the development of alternatives for managing the Monument, answered questions, and encouraged public involvement.

In January 2002, a letter was mailed to the public requesting participation and information for the Roads Analysis Process as a part of the Monument planning process (see Appendix D). Opportunities to meet with the team leader were offered as part of the input process and were scheduled with two groups in February 2002.

Using comments from the public, tribal consultations, the scientific advisory board, and other agencies and organizations, the interdisciplinary team developed a list of potential issues to address.

Issues

Following the end of the public scoping period, comments and concerns were separated into two groups: non-significant and significant issues. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, or other higher-level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. Significant issues were defined as such because of their relevance to the decision to be made, the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. They were established by the Forest Supervisor. Significant issues are used to develop alternatives, determine what mitigation or constraints are needed, and help focus the analysis. The Council of Environmental Quality National Environmental Policy Act (NEPA) regulations explain this delineation in Sec. 1501.7: …identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-significant issues and reasons regarding their categorization as non-significant may be found in the project file on record at the Sequoia National Forest Supervisors Office in Porterville, CA.

The following are the significant issues identified after scoping that were used to develop alternatives and focus the analysis, and that will be analyzed throughout this document. Indicators are presented with each issue; they will be used in the analysis to measure change relating to that issue in each alternative.

Air Quality

Issue: Prescribed burning may increase short-term smoke emissions and impact public health.

Background Information: The San Joaquin Valley Air Basin is classified as a serious non-attainment area for the health-based National Ambient Air Quality Standards for particulate matter with an aerodynamic diameter of 10 microns or less (PM-10). Smoke from wildfires and prescribed burns contributes PM-10 to the air.

The Giant Sequoia National Monument will inevitably contribute smoke to the Basin, regardless of management approach. At one extreme, if no forest restoration efforts are undertaken and all fires are fought aggressively, the Basin will still experience episodes of moderate to extreme smoke from wildfires that inevitably escape control and burn through dense, unrestored, fire-prone forest. On the other hand, management actions that restore forests to a condition that is less prone to uncontrollable wildfires, whether those actions emphasize prescribed fire or mechanical means, will also produce smoke. Prescribed fire inevitably produces smoke, though the timing and quantity are much more controllable than that produced by wildfires. Prescribed burning may decrease long-term smoke emissions by reducing the quantity and intensity of wildfires. Additionally, mechanical approaches to forest restoration can contribute to PM-10 through increased dust production, though this contribution is probably minor relative to that of smoke.

Indicators:

1. PM-10 emissions (tons) generated by underburning and pile burning in the first decade.

Fire and Fuels

Issue: There is great public interest in ensuring that the fire and fuel reduction strategies in the Framework are effective in their extent and magnitude for treating and protecting the Monument.

Background Information: Fire is a natural disturbance and a key process in a healthy, functioning ecosystem. It has been an important ecological force in the Sierra Nevada for thousands of years. Changes to the historic fire regime can have significant effects on landscape patterns of vegetation and fuels and, as a result, fire behavior. As throughout the Sierra Nevada, fire return intervals in the Giant Sequoia National Monument have been altered through years of fire suppression. Over the last century, fire return intervals have been missed, leading to significant increases in surface, ladder, and crown fuels. The result is an increased potential for uncharacteristically severe wildfires. These large, severe fires affect the vegetation differently than the frequent, less severe fires, changing the pattern over the landscape and, in turn, affect the cycles of fuel accumulation and fire. The Framework's approach to fuel reduction locates fuel treatments across broad landscapes that are linked to support one another so that the spread of wildland fire is interrupted and its intensity reduced. These strategies are intended to protect the resources found in the Monument, including life, property, and sensitive resources such as the giant sequoias, wildlife, and riparian areas.

Indicators:

1. Acres treated to move the fire susceptibility rating from moderate or high toward low.
2. Acres treated to move toward historic fire return intervals.

Giant Sequoia

Issue: Under certain conditions, the current limitations on crown canopy reductions and tree diameter size removal may not provide adequate opportunities to meet the desired condition for the giant sequoias and their associated mixed conifer ecosystems.

Background Information: The desired condition is to re-establish natural processes and structural conditions that allow the giant sequoia and their mixed conifer ecosystems to be both stable and resilient to environmental change. The conditions that existed prior to 1875 are used as a reference. This period exhibited a fire regime of frequent and generally low-intensity fires. This fire regime helped promote a high degree of vegetative diversity and a low risk of catastrophic fire. The fires created openings in the forest canopy and a mosaic of vegetative age and size classes that led to the successful establishment and recruitment of young giant sequoias.

For giant sequoia seedlings to become established and grow successfully, openings need to be created with no significant competition for light and soil nutrients from other vegetation. These conditions may be achieved by using prescribed fire methods only. However, under certain conditions, mechanical methods may be more desirable. These conditions include: 1) in the Southern Sierra Fisher Conservation Area allocation, where mechanical treatment is emphasized over prescribed fire; 2) in the Old Forest Emphasis allocation, where prescribed fire use in proximity to special resource values and private property, or extreme fuel conditions, may represent an unacceptable risk by using prescribed fire alone; and 3) where the existing

fuel loads in giant sequoia groves are so heavy that mechanical or hand treatments are desirable prior to re-introducing fire. When using mechanical methods, the standards and guidelines prescribed by the Framework constrain reductions in the canopy cover to establish desired fire behavior outcomes (flame lengths and live crown base heights) and constrain the size of trees that can be purposefully removed by mechanical methods.

Indicators:

1. The amount of predicted change in conditions and trends to the following key ecological indicators (Piirto and Rogers, 1999) as compared to the desired condition: gap and patch size, gap and patch frequency, plant community, risk from severe fires, and fire return interval. The last two indicators are also discussed under Fire and Fuels.

Mixed Conifer Restoration

Issue: Under certain conditions, the strategies and direction in the Framework may not provide adequate opportunities to meet the desired condition of a more natural, historic fire regime and vegetative stand structure in the mixed conifer ecosystem that surrounds the giant sequoia groves.

Background Information: Fire is a natural disturbance and a key process in sustaining a healthy, functioning ecosystem. It has been an important ecological force in the Sierra Nevada for thousands of years. Changes to the historic fire regime have had significant effects on landscape patterns of vegetation and fuels and, as a result, fire behavior. The result is an increased potential for uncharacteristically severe wildfires. These large, severe fires affect the vegetation differently than the frequent, less severe fires, changing the pattern over the landscape and, in turn, affect the cycles of fuel accumulation and fire.

The desired condition is to re-establish natural processes and structural conditions that allow the mixed conifer ecosystem to be both stable and resilient to environmental change. The conditions that existed prior to 1875 are used as a reference. This period exhibited a fire regime of frequent and generally low-intensity fires. This fire regime helped promote a high degree of vegetation diversity and a low risk of catastrophic fire.

While using prescribed fire methods are preferred, under certain conditions, mechanical methods may be more desirable. According to the Framework, these conditions include: 1) in the Southern Sierra Fisher Conservation Area allocation, where mechanical treatment is emphasized over prescribed fire; 2) in the Old Forest Emphasis allocation, where prescribed fire use in proximity to special resource values and private property may represent an unacceptable risk by using prescribed fire alone; and 3) where the existing fuel loads in are so heavy that mechanical or hand treatments are desirable prior to re-introducing fire. When using mechanical methods, the standards and guidelines prescribed by the Framework constrain reductions in the canopy cover to establish desired fire behavior outcomes (flame lengths and live crown base heights) and constrain the size of trees that can be purposefully removed by mechanical methods.

The Framework's strategies to reduce fuels, reduce the risk of catastrophic fire, and protect late seral old growth habitat may not restore the ecosystem to the desired condition in the Giant Sequoia National Monument. The effectiveness of the Framework strategies to restore the desired condition of a more natural fire regime and vegetative stand structure are uncertain.

Indicators:

1. The amount of predicted change in conditions and trends to the following key ecological indicators (Piirto and Rogers, 1999) as compared to the desired condition: gap and patch size, gap and patch frequency, plant community, risk from severe fires, and fire return interval. The last two indicators are also discussed under Fire and Fuels.

Return to top of page.

Recreation

Issue: Proposed recreation, interpretation, and education opportunities within the Monument may not meet the demands of visitors, local communities, partners, local governments, tribal governments, or the business community.

Background Information: Changes in the level of development may be needed to meet public demand for a wide range of high quality opportunities for recreation, interpretation, and education within the Monument. Many people believe the Monument should provide more developed recreation, interpretation, and educational experiences. Other people think the Monument should provide dispersed and, some would say, more natural opportunities for recreation, interpretation, and education, with fewer developed facilities.

Indicators:

1. Change in People at One Time (PAOTs) that can be served by recreational, interpretive, and educational facilities.
2. Estimated capacity of dispersed recreation areas or concentrated use areas (CUAs).
3. Predicted mileage of roads and trails available for public use.

Return to top of page.

Social Values Regarding Vegetation Treatments

Issue: Management activities including logging, mechanical vegetation treatments, or prescribed fire may impact the expectations, values, and beliefs that some people have concerning what this national monument should be and by what means it should be managed.

Background Information: There is debate over what management activities are appropriate in the Monument and in the giant sequoia groves, such as the use of mechanical equipment (ground-based heavy equipment), prescribed fire, or handwork. The connection between the spiritual need to preserve a part of the natural ecosystem and maintain historic uses and lifestyles, and the need to sustain forest health through active management may, therefore, appear to be weak or contradictory. Reaching the desired conditions of historic stand structures, historic fire regimes, and protecting the objects of interest, especially giant sequoias, may be a positive goal widely agreed to, but some of the different methods to reach the desired outcomes may be unacceptable to some.

Expectations, values, and beliefs vary by individual and are difficult to measure. Some people want more active management, including mechanical treatments, to restore the Monument and reduce catastrophic fire risk, while others want only fire to be used to reach these goals. Some people believe the cost of restoration and fuel treatments should be partially offset by the sale of wood products that result from those treatments, while others feel that the use of mechanical methods and the sale of wood products are contrary to appropriate management of the Monument. Therefore, indicators to measure the difference between alternatives for this issue are the volume of wood products resulting from restoration and protection treatments (that could be available for sale) and the acres of mechanical treatments per year.

Indicators:

1. Wood products available from protection and restoration treatments.
2. Acres of mechanical treatments per year.

Return to top of page.

Watershed

Issue: The timing, amount, and intensity of management activities necessary to reduce catastrophic fires and achieve the desired conditions may have negative cumulative effects on watersheds, riparian health, soil and water resources, and beneficial uses. These effects may include accelerated erosion, sedimentation, increased nutrient loading, and decreased stream stability and aquatic habitat.

Background Information: The Monument contains multiple watersheds, the waters of which support numerous beneficial uses, both inside and outside of Monument boundaries. The combined effects of past management activities, urbanization, fuels reduction direction in the Framework, and restoration activities for protection of the giant sequoia groves and their ecosystems have the potential to adversely impact Monument watersheds. Campgrounds, roads, and other facilities in subwatersheds or landscapes with a high density of past, present, and proposed management activities add to the potential for cumulative effects.

Large, severe wildfires can have negative effects on watersheds, riparian health, soil and water resources, and beneficial uses. The effects of these catastrophic fires can add to the potential for cumulative effects, even in the absence of management activities.

Indicators:

1. Acres in the Monument with a prescription that would move the fire susceptibility rating toward low and reduce potential cumulative effects from catastrophic wildfire.
2. Potential risk of cumulative effects within the total acres of watersheds that contain Monument lands:
    3. a. Percent of ground-based treatment
       b. Percent of non-ground-based treatment (burning)
       c. Total system road miles open for public use

Return to top of page.

Wildlife

Issue: Proposed fuel reduction and ecological restoration treatments may adversely affect wildlife species that are dependent on late seral/old growth (LSOG) habitat by reducing the amount of that habitat.

Background Information: The Framework described effects to LSOG-dependent species based on certain fuel treatment priorities and delineations associated with urban intermix zones. The proposed action for the Monument management plan proposes vegetation treatments to protect and restore the giant sequoia groves. The treatments proposed may include fuels treatments and silvicultural treatments in LSOG areas. The Monument provides habitat for a wide range of important wildlife species that are dependent on LSOG habitat. Sensitive species of concern include the California spotted owl, the American marten, and the Pacific fisher.

Indicators:

1. Predicted change in acres of late seral/old growth habitat (as defined in the Sierra Nevada Ecosystem Report).

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF

· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Chapter II Alternatives Including the Proposed Action

Alternatives Including the Proposed Action. II-2 | Alternatives Considered but Eliminated from Detailed Study. II-2 | Alternatives Considered in Detail. II-3 | Management Direction Common to All Alternatives. II-5 | Alternative 1 (No Action). II-8 | Management Direction Common to All Action Alternatives. II-9 | Alternative 2 (Proposed Action). II-15 | Alternative 3. II-23 | Alternative 4. II-33 | Alternative 5. II-44 | Alternative 6. II-57 | Comparison of Alternatives. II-68 | Preferred Alternative. II-81

Alternatives Including the Proposed Action

This chapter describes and compares the alternatives considered for management of the Giant Sequoia National Monument. These alternatives were developed to meet the purpose and need and to address the issues developed during the scoping process (see Chapter I). Issues may be addressed in more than one alternative and they may be addressed in significantly different ways. An issue may be based on differences of opinion regarding what types of activities are appropriate in the Monument. For example, some people may want more of something while others may feel that would detract from the Monument. In such cases, that issue may be addressed by taking different approaches in different alternatives, such as proposing more of something in one alternative but less in another.

This chapter will provide the decision maker with a range of alternatives to consider for the Monument. It will set the stage for an analysis of each alternative and its anticipated effects (described in Chapter IV).

This chapter contains four parts: (1) a description of the alternatives that were considered but eliminated from detailed study; (2) a description of each alternative considered in detail, including the proposed action; (3) a comparison of the alternatives; and, (4) identification of the alternative currently preferred for implementation.

Return to top of page.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to explore and objectively evaluate a range of reasonable alternatives and to briefly discuss the reasons for eliminating alternatives that were not considered in detail (40 CFR 1502.14). The alternatives not considered in detail may be illegal, may not meet the purpose and need as established by the Proclamation, may be technologically infeasible, may be clearly infeasible, may be a duplication of an alternative considered in detail, may be one on which a decision has already been made, may be determined to cause unreasonable environmental harm, may be impossible to implement, or may be remote or speculative. Therefore, some alternatives were considered but dismissed from detailed consideration for reasons summarized below.

The Forest Service considered, but did not develop in detail, an alternative that would have included a mass transit system for the Monument. To help determine the need and feasibility for mass transit, it was discussed with managers of the adjacent Kings Canyon and Sequoia National Parks, along with members of the National Park Service Alternative Transportation Program (ATP). The discussion revealed the complexity and difficulty of planning, developing, and managing mass transit systems in remote, forested settings. The advice from the ATP members during the discussion was that it is not a good idea to build a mass transit system based on speculation that they system may be needed or useful in the future. Mass transit

systems should be developed based on known data on visitor use, including volume, location, and use patterns. At this time there are no data to suggest current visitor use would support a mass transit system. None of the alternatives preclude development of mass transit systems if they become necessary and feasible, but including an alternative with a mass transit system would be speculative at this time.

The Forest Service considered, but did not develop in detail, an alternative that would have managed the giant sequoia groves using prescribed fire and hand treatments. Mechanical equipment would not have been used in the groves and no trees greater than 10 inches in diameter would have been cut inside the groves. Outside of the groves, the direction for vegetative treatments would have been the same as Alternatives 2 and 5. Management areas in this alternative would have been the same as the management areas in Alternative 5. Recreation opportunities would have been limited to maintaining current overnight capacity and increasing the day use opportunities within the Monument. This alternative was eliminated from detailed study because it was very similar to other alternatives and therefore did not add to the range of alternatives that were considered in detail.

Return to top of page.

Alternatives Considered in Detail

Six alternatives were developed and considered in detail, including the No Action and Proposed Action alternatives. The description of these alternatives includes several sections: Management Direction Common to All Alternatives, Alternative 1, Management Direction Common to All Action Alternatives, Alternative 2, Alternative 3, Alternative 4, Alternative 5, Alternative 6.

Management Direction Common to All Action Alternatives describes the rules and guidelines that are the same in all the alternatives, including the No Action Alternative (Alternative 1) and five action alternatives (Alternatives 2 through 6). This section is followed by a description of Alternative 1. The National Environmental Policy Act requires consideration of a no action alternative. It consists of current management rules and guidelines if no action is taken to change them. It does not mean that no management activities could occur; it means there would be no change to the rules and guidelines that currently apply to the Monument. The rules and guidelines that apply to the No Action Alternative include those described in both of these first two sections: Management Direction Common to All Alternatives and Alternative 1.

Management Direction Common to All Action Alternatives describes the proposed rules and guidelines for managing the Monument that are the same in each of the action alternatives (Alternatives 2 through 6). Following this, each of the action alternatives is discussed individually. These discussions include how each of the issues is addressed by that alternative and a description of what actions are proposed to meet the purpose and need. The rules and guidelines that apply to any of the action alternatives include those described in all of these three sections: Management Direction Common to All Alternatives, Management Direction Common to All Action Alternatives, and the individual section for each action alternative (Alternative 2, Alternative 3, etc.).

The description of alternatives does not describe the effects that might occur if the alternative is implemented. The resources that could be affected and the expected effects to that resource from the actions proposed in each alternative are discussed later in Chapters III and IV.

Within each alternative, there are rules and guidelines that are referred to as direction.'s There is a hierarchy to the direction described for each alternative, from the broadest goals to the most specific direction. They are:

Desired Conditions. These describe the condition of resources that is desired and that the alternatives are designed to meet, by various methods. The Desired Conditions are the same for all of the action alternatives.

Management Goals. These are goals that each alternative is designed to meet. They are broad descriptions of outcomes that are desirable or acceptable for the resources being managed in each alternative. Some goals are common between alternatives, but some are different. **Management Emphases.** These are goals that apply to specific areas within the Monument called Management Areas. They provide additional guidance that applies to a specific management area but not to the entire Monument. These emphases vary between alternatives. **Standards and Guidelines.** These are specific standards that must be met for the area where they apply. They may apply to the entire Monument or they may apply to only specific Management Areas. **Management Areas.** These are parts of the Monument that are differentiated, mapped, and named for each alternative. They represent areas with different

management direction, where certain management emphases and standards and guidelines apply. They vary by alternative and are named for ease of identification.

Return to top of page.

Management Direction Common to All Alternatives

The alternatives considered in detail all have certain things in common. Alternatives 1 through 6 all include some of the direction found in the Forest Plan, some of the direction found in the Framework, and all of the direction provided in the Proclamation. Applicable direction from the Forest Plan, Framework, and Proclamation are briefly summarized here. See Appendix C for a more thorough summary of Framework direction and Appendix G for a copy of the Proclamation. For a copy of the Forest Plan, contact the Sequoia National Forest Supervisor's Office.

Forest Plan Direction

Direction from the Forest Plan that is not superceded by the Framework or the Proclamation applies to all alternatives. That direction is briefly summarized in the following goals from the Forest Plan (USDA Forest Service, Sequoia National Forest, 1988, pages 4-2 to 4-4).

Recreation

Increase the quality and variety of recreation opportunities and emphasize natural settings.

Reduce conflict among users and establish fees that are compatible with the private sector.

Enhance and interpret the more significant cultural resources, consistent with forest use and resource management.

Provide and protect areas of important natural associations for non-manipulative research, observation, and study.

Encourage location of facilities or uses not consistent with national forest purposes and goals on private land.

Wilderness

Provide for wilderness use, protection of the wilderness resource, and reduction of conflict between the uses of wilderness and the wilderness values of solitude and naturalness, and the ecological, geological, and similar features of scientific, educational, or historical value.

Wildlife, Fish, and Plants

Maintain and improve habitat for endangered and threatened plant and animal species.

Provide well-distributed habitat diversity for indigenous wildlife species.

Maintain or increase habitat capabilities to support viable populations of wildlife and fish species.

Provide increased quality and quantity of opportunities for enjoyment of consumptive and non-consumptive uses of the wildlife, fish, and plant resources.

Increase the diversity of plant and animal communities.

Range

Maintain or enhance the productivity of all forest ranges through adequate protection of the soil, water, and vegetation resources.

Foster, then follow with action, the idea that joint stewardship is in everyone's best interest.

Contribute to the stability of the ranching community by recognizing its value as part of our

heritage, its contribution of food and fiber, and its maintenance of open space.

Utilize improved management systems that ensure cost-effective management of suitable ranges.

Timber

Maintain and enhance the giant sequoia species and individual old growth specimen's trees to increase recreation use and interpretive opportunities.

Water, Soil, and Air

Provide the technical services needed to comply with water quality goals as specified in the Clean Water Act.

Maintain or improve long-term soil productivity.

Emphasize the protection, management, and improvement of riparian areas during the planning and implementation of land and resource management activities along stream courses on the forest.

Facilities

Develop and maintain the forest transportation system to appropriate standards for management purposes, while providing efficient routes for forest users and protecting resources.

Provide support facilities to meet forest management requirements.

Rural Community and Human Resources

Continue to support and participate in employment and training programs for youths, older Americans, and the disadvantaged in response to national employment and training needs and opportunities existing in forest surroundings.

Increase opportunities for the use of volunteers in accomplishing forest goals.

Framework Direction

The following allocations and associated management strategies from the Framework apply to all alternatives: the California spotted owl protected activity centers (PACs), northern goshawk PACs, great gray owl PACs, forest carnivore den sites, California spotted owl home range core areas, aquatic management strategy, and willow flycatcher habitat (see Appendix C). Standards and guidelines from the Framework that would be retained in all alternatives include those for lower Westside hardwoods, large tree retention, snags and down woody debris, incidental removal of vegetation and down woody material, noxious weeds, and grazing.

Proclamation Direction

The Proclamation provides guidance for the proper care and management of the objects of interest in the Monument. It emphasizes protection and restoration of the natural resources in the Monument, including giant sequoia groves, plants and animals, geologic features, and prehistoric and historic artifacts. The Proclamation provides specific direction for dealing with some activities, such as accessing private lands and special use facilities, issuing special use permits (permits for three organizational camps have recently been renewed), hunting and fishing, and limiting off-highway vehicle use. The direction in the Proclamation applies to lands owned or controlled by the United States, not private land. It withdraws lands in the Monument from new mining claims, eliminates using Monument lands to provide a sustained yield of timber; permits use of motorized vehicles only on designated roads, maintains the jurisdiction of the State of California with respect to fish and wildlife management (including hunting and fishing), maintains the laws and regulations that apply to special use authorizations, and maintains valid existing rights.

Return to top of page.

Alternative 1 (No Action)

Theme: Continue current management direction.

Alternative 1 is the no action alternative. It provides the baseline for the effects analysis in Chapter IV. Under this alternative, current management direction, the Forest Plan as amended by the Framework and the Presidential Proclamation, would continue to guide management of the Monument (see Figure II-1 in the Map Packet). No amendment to current direction would be made. In addition to the previous section, Management Direction Common to All Alternatives, the following additional direction applies to Alternative 1.

Alternative 1 includes all of the Framework management direction for concerns such as aquatic, riparian, and meadow management; fire and fuels management; and old forest ecosystem management. It provides strategies and standards and guidelines to address the risk of catastrophic fire, although it is not focused on the objects of interest within the Monument. The Monument contains the following land allocations as set by the Framework: southern sierra fisher conservation areas, old forest emphasis areas, general forest, urban wildland intermix defense zones, urban wildland intermix threat zones, spotted owl protected activity centers and home ranges core areas, northern goshawk protected activity centers, great gray owl protected activity centers, willow flycatcher habitat, forest carnivore den sites, riparian conservation areas, and critical aquatic refuges (see Appendix C). It also contains the previously determined allocations of wilderness and wild and scenic rivers. Appendix H summarizes and displays common prescriptions that could be applied in applying the standards and guidelines from the Framework.

Management Direction Common to All Action Alternatives

Desired Conditions

The Desired Conditions described below are broad, overarching goals that describe the conditions of resources that are desirable within the Monument. The Desired Conditions are the same for all action alternatives.

Giant Sequoia and the Surrounding Ecosystems. Natural processes and vegetative structural conditions are re-established at levels that allow the vegetative ecosystems within the Monument to be both stable and resilient to environmental change. These natural processes are functioning within the range of variation that allows the potential natural vegetation to develop. Fire is the primary disturbance factor in the mixed brush/chaparral, lower Westside hardwood, and conifer (which includes the giant sequoia groves) ecosystems. Other disturbance processes in these ecosystems, as well as the red fir ecosystem, include insect and disease activity, drought-related effects, and weather events. In particular, the overall stand conditions of the giant sequoia groves and their surrounding ecosystems exhibit characteristics that are within natural ranges of variability, including species composition, forest structure, and age-class distribution. The landscape provides a wide variety of habitat for wildlife and aquatic species.

The structural conditions, and timing, intensity, and frequency of processes that existed prior to 1875 are used as reference conditions. This period exhibited a fire regime of frequent fire return intervals, which helped promote a highly diverse vegetation mosaic of age classes, tree sizes, and species composition, along with a low risk of large catastrophic fires.

Dispersed and Developed Recreation. Visitors to the Monument find a rich and varied range of recreational, educational, and social opportunities enhanced by giant sequoias and the natural resources of the surrounding ecosystems. Visitors to the Monument have the opportunity to recreate in a variety of settings, from primitive to highly developed areas.

Scenic opportunities range from pristine landscapes to locations where management activities are apparent, helping visitors appreciate how healthy ecosystems function and how humans fit into them.

Historic and Prehistoric Resources. The historic and prehistoric resources of the Monument are protected, studied, interpreted, and managed to maintain their cultural and scientific integrity and provide educational, cultural, and recreational opportunities to visitors. The cultural and spiritual values of the Monument are protected, managed, and utilized for the benefit of local tribes, communities, and visitors. ***Transportation System***. The road and trail network is commensurate with the level of management activities occurring in the Monument and supplies the transportation system needed for public use related to recreation, special uses, private land access, fire protection, as well as the enjoyment, proper care, and management of the objects of interest. Roads and trails needed to meet management goals are maintained to provide safe use and limited impacts to aquatic and terrestrial habitats.

Roads not needed to meet management goals are decommissioned and stabilized. ***Caves***. The natural condition of caves within the Monument is preserved, to the extent possible, to maintain natural function and protect the unique resources that depend on a cave environment for existence.

The study of caves provides scientific knowledge, especially regarding the paleontological and archaeological artifacts that may shed light on thousands of years of change within the giant sequoia groves, their surrounding ecosystems, and the prehistoric people who helped shape the ecosystem.

Some caves provide educational and recreational opportunities for visitors.

Scientific Study. Management of the resources in the Giant Sequoia National Monument reflect an active on-site research program in close cooperation with the public, other agencies, and entities that share management responsibilities for giant sequoias. Management decisions consider the best available science.

Management Goals

Management Goals are broad descriptions of desirable outcomes for resources within the Monument. Those listed below are found in all action alternatives. Each action alternative has its own additional goals, but they do not apply to the other action alternatives. These additional goals are included in the descriptions of the individual action alternatives later in this chapter.

Historic and Prehistoric Resources.

Protect historic and prehistoric values from impacts that could destroy them or accelerate their natural rate of deterioration.

Manage and interpret a variety of historic and pre-historic sites for the education and enjoyment of visitors.

Consult with local tribal governments and Native Americans in the planning of projects in the Monument. Ensure access to culturally important sites and resources for use by Native Americans.

Caves.

Locate and inventory caves, and classify them according to their most notable values.

Protect caves and their associated resources from impacts that could damage or destroy them, including surface activities, activities within caves, and activities altering their sustaining groundwater conditions.

Provide for public use where appropriate, including interpretation, education, and recreation.

Work with scientific groups, volunteer organizations, and recreational clubs to help protect, preserve, and study caves and their associated resources.

Evaluate caves for their potential to be designated as Significant, as described in the Federal Cave Resource Protection Act of 1988.

Develop a cave management plan and prescriptions for Significant caves.

Scientific Study.

Ensure that the best available science is considered in the planning and design of management actions.

Encourage and guide scientific research in the Monument that will explore a wide range of hypotheses designed to improve the care and management of the objects of interest, including the giant sequoia groves, the ecosystems that surround them, the historical landscape, the caves, and prehistoric archaeological sites. Cooperating partners may include Forest Service research stations, universities, and other interested scientific organizations or agencies, as well as tribal governments and interested members of the public.

Management Emphases Common to All Management Areas.

Emphasize the following types of areas for the development of new recreation facilities or opportunities: existing travel corridors, existing sites that can tolerate additional use or development, dispersed sites that are already impacted and can tolerate additional or different types of use, and areas of special interest.

Based on the criteria above, potential recreational opportunity areas have been identified and are mapped in Figures II-3 and II-4. The potential recreational opportunity areas are common to all alternatives. The potential recreational opportunity areas are not the only areas where recreational opportunities could be developed. They are areas identified, for illustrative purposes, as sites that have high potential for development of future recreational facilities or opportunities. Decisions on the location and type of recreational development would be made at the landscape level, in site-specific analyses.

The description of each action alternative begins with a theme and an introduction. The introduction includes a summary of the four major strategies developed for each alternative to respond to the significant issues, as follows:

Restoration Strategy. The strategy that addresses the need to restore key terrestrial and hydrologic processes and structures, especially the regeneration of giant sequoias and the re-introduction of fire to fire-dependent ecosystems. **Protection Strategy.** The strategy to reduce the risk of catastrophic fire to communities and the objects of interest. **Recreation/Human Use Strategy.** The strategy to address the need for people to interact with and enjoy the objects of interest. **Transportation Strategy.** The strategy to manage the road system for the proper care and management of the objects of interest.

Return to top of page.

Alternative 2 (Proposed Action)

Theme: Protect and restore giant sequoia ecosystems within their zones of ecological influence.

Alternative 2 is the Proposed Action as described in the Notice of Intent published in the Federal Register, and the scoping letter, both dated June 8, 2001. It does not specifically address the significant issues found in Chapter I because the issues were developed largely based on public comments to this Proposed Action.

Alternative 2 applies all the direction found in the Framework (see Appendix C) and provides additional management direction for the proper care, management, and enjoyment of the objects of interest in the Monument. It places emphasis on the application of current direction specific to the objects of interest.

Alternative 2 proposes goals to meet the desired conditions: to protect giant sequoias, their ecosystems, and the natural processes that sustain them; to improve developed and dispersed recreation opportunities; to protect and interpret historic and prehistoric resources; to provide a useful, safe, and environmentally acceptable transportation system; and to provide for scientific study of the Monument's resources.

Alternative 2 would primarily treat areas of the Monument that have high fire susceptibility to reduce the risk of catastrophic fire. The highest priority would be to protect communities and sensitive resources in the Monument.

The following strategies, desired conditions, goals, management areas, management emphases, and standards and guidelines are intended to provide the direction necessary to meet the intent of Alternative 2.

Restoration Strategy. Alternative 2 would apply Framework standards and guidelines and use the Framework land allocations. For most of the Monument, these strategies would restore fire to the ecosystem to maintain or develop old forest characteristics. It would manage watersheds around groves (the zones of ecological influence) and the surrounding ecosystems by protecting them from catastrophic fire, restoring riparian areas, and protecting old forest habitat. Like the Framework, this alternative does not offer a long-term, monument-wide strategy for restoration of natural processes, fire return interval, or desired vegetative stand structure. **Protection Strategy.** Alternative 2 would use all of the Framework strategies to protect communities, other sites occupied by people, and the objects of interest. Key strategies include the urban wildland intermix defense zones (1/4 mile), threat zones (1¼ mile), wildland fire use, and strategically placed area treatments (SPLATs) in order to reduce the risk of catastrophic fire. **Recreation/Human Use Strategy.** Alternative 2 would assess the increased demand for recreation in the Monument and help meet that demand for a wide

variety of recreation, interpretation, and education uses. Recreation and human use would be widespread in the Monument, not concentrated or focused in specific areas.

Transportation Strategy. Alternative 2 would emphasize retaining road access for public use and for management activities similar to current access levels. For public access, emphasis would be on maintaining roads to recreation sites, dispersed areas, special use sites, and private land. An extensive road system would be available for recreation driving and off-highway vehicle use. For management access, emphasis would be on ecosystem restoration and fire protection. Roads with high risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on unclassified roads and those classified roads producing unacceptable impacts where repair or relocation is unreasonable. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to administrative sites, to replace roads producing unacceptable resource impacts, or to provide access for research. The maintenance strategy would be to continue to request funds to reduce the maintenance backlog and keep the road system in acceptable condition.

Each action alternative proposes management areas. Management areas are mapped portions of the Monument where additional direction is added in the form of management emphases and/or standards and guidelines. Management areas are named and displayed on the alternative maps (see Figures II-2, II-5, II-6, and II-7 in the Map Packet). Alternative 2 proposes the designation of three management areas (see Figure II-2 in the Map Packet), as follows:

Management Area ZOI-WG, Zones of Influence Including the Groves: This management area (MA) includes the ecological zones of influence for the giant sequoia groves and their surrounding ecosystems, including the groves. Generally these areas are defined by the boundaries of the watersheds where the giant sequoia groves are found. These boundaries are described in the Forest Service draft report entitled Defining Ecological Zones of Influence for Giant Sequoia Groves on the Sequoia National Forest.'s The zones of influence are the areas within which management activities could both directly and indirectly affect grove ecology.

Management Area HLHA, the Hume Lake Historic Area: This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. **Management Area GML, General Monument Lands:** This MA includes lands not included in Management Areas ZOI-WG or HLHA. It includes a wide variety of vegetation types and ecological zones. Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems.

Desired Conditions

For Alternative 2, the desired conditions for key resources are the same as for all of the action alternatives being considered (see the Desired Condition section of Management Direction Common to All Action Alternatives's earlier in this chapter).

Management Goals

This section lists goals for Giant Sequoias and the Surrounding Ecosystems, Dispersed and Developed Recreation, and the Transportation System. These goals are in addition to the goals for Historic and Prehistoric Resources, Caves, and Scientific Study, listed previously in this chapter under Management Direction Common to All Action Alternatives.

Each goal statement indicates to which alternatives it applies. For example, some goals are found in all the alternatives, some goals are in more than one alternative, and some goals are unique to one alternative. This is intended to give the reader a better understanding of how the alternatives are different. A goal may not be listed with a particular alternative for different reasons. There may be a similar but different goal associated with other alternatives or the goal may not be applicable to other alternatives.

Giant Sequoias and the Surrounding Ecosystems.

Protect giant sequoia groves and the surrounding ecosystems by ensuring that they are resilient to natural events (e.g. wildfires, floods, epidemic outbreaks of insects and diseases) and other events that are contrary to, or disruptive of, ecological processes necessary for a healthy and sustainable ecosystem (common to all action alternatives).

Protect and restore the hydrologic functions and soil resources upon which the groves and surrounding ecosystems depend (common to Alternatives 2 and 3).

Protect blue oak in the lower Westside hardwood ecosystem and improve the viability of black oak in the mixed conifer forest (common to Alternatives 2, 3, 5, and 6).

Protect communities by completing fuel treatments for community protection within the first three decades of plan implementation (common to Alternatives 2, 5, and 6).

Restore groves and their surrounding ecosystems to reflect historic conditions, which include a fire return interval of frequent and generally low-intensity fires; a mosaic of different age and size classes of vegetation; and regeneration and recruitment of shade-intolerant species such as pines, giant sequoias, and hardwoods (common to all action alternatives).

In conifer plantations, apply the necessary vegetation management and fuels treatments to promote the re-establishment of natural processes and vegetation conditions consistent with the potential natural vegetation of the site (common to all action alternatives).

Reduce the risk of catastrophic fire in the conifer, chaparral, and lower Westside hardwoods ecosystems. Restore a more frequent fire return interval and create a diverse mix of age classes and structural diversity, using the historic conditions prior to 1875 as a reference (common to all action alternatives).

Adapt management strategies over time to reflect current monitoring and the best available scientific information (common to all action alternatives).

Coordinate planning and implementation of protection and restoration projects with private landowners and adjoining agencies, which include the Sequoia and Kings Canyon National Parks, Mountain Home State Forest, the Universities of California (Whitaker's Forest), and the Tule River Indian Tribe (common to all action alternatives).

Dispersed and Developed Recreation.

Manage scenic resources to maintain or enhance high scenic value. Develop scenic vistas to view icons and special features of the Monument (common to all action alternatives).

Increase recreation facility capacity for overnight camping, day use, and other appropriate recreation activities.

Use a science-based method to collect visitor information, such as the National Visitor Use Monitoring System. Use these data, as well as other information, to help determine the demand and need for additional visitor facilities and services (common to all action alternatives).

Improve visitor facilities, information, and services to help meet projected demand for recreation and visitation in cooperation with permittees; cooperators; county, state, and federal agencies; tribal governments; recreation user groups; and the business community (common to Alternatives 2, 5, and 6).

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, for hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Improve recreation, interpretation, and education opportunities by connecting, linking, and coordinating facilities, services, and themes whenever feasible (common to all action alternatives).

Transportation System.

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all action alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Provide enjoyable and safe opportunities for riding off-highway vehicles, including snowmobiles, on designated roads within the Monument (common to Alternatives 2, 4, 5, and 6).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Management Areas, Management Emphases, and Standards and Guidelines

Direction Common to All Management Areas

Management Emphases:

Maintain current levels of access for public and administrative use consistent with protection of the objects of interest.

Prior to decommissioning roads, consider opportunities for their use as recreation trails.

Standards and Guidelines: No standards and guidelines are proposed common to all management areas in this alternative. ***Management Area ZOI-WG, Zones of Influence Including the Groves***. This management area consists of the ecological zones of influence for the giant sequoia groves and their surrounding ecosystems. These boundaries are described in the Forest Service draft report entitled Defining Ecological Zones of Influence for Giant Sequoia Groves on the Sequoia National Forest.'s The zones of influence are the areas within which management activities could both directly and indirectly affect grove ecology. It contains approximately 91,040 acres.

Management Emphases:

Emphasize the recruitment, retention, and long-term protection of young giant sequoias, pines, and black oaks.

Encourage scientific research. Focus research on potential impacts of management and human use on giant sequoia ecology, restoration and protection.

Standards and Guidelines: None proposed. *Management Area HLHA, Hume Lake Historic Area*. This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. It contains approximately 15,680 acres.

Management Emphases:

Preserve and interpret this historical landscape and its associated ecosystems.

Provide a wide range of recreational and interpretive opportunities.

Provide interpretive and educational materials emphasizing the relevance, fragility, and values of the area's heritage resources and ecology.

Emphasize the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Standards and Guidelines: None proposed. ***Management Area GML, General Monument Lands***. This management area consists of the part of the Monument not included in Management Area ZOI-WG or Management Area HLHA. It includes a wide variety of vegetation types and ecological zones. Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems. It contains approximately 219,500 acres.

Management Emphases:

Encourage scientific research. Focus research on potential impacts of management and human use on giant sequoia ecology, restoration and protection.

Reduce fuel loads, especially down slope of the groves, and return to a more natural fire interval.

Standards and Guidelines: None proposed.

Return to top of page.

Alternative 3

Theme: Emphasize natural processes.

Alternative 3 addresses the significant issues of Fire and Fuels, Giant Sequoia, Mixed Conifer Restoration, Recreation, Social Values Regarding Vegetation Treatments, and Watershed. It would move resources toward their desired conditions by emphasizing natural processes, primarily fire. It would use prescribed fire and hand treatments to reduce the risk of catastrophic fire and restore a more natural fire regime in the Monument. Determining what vegetation could be removed would be based on the predicted fire behavior of prescribed fires, rather than using the diameter limits and crown canopy limits in the Framework (Appendix C). These proposals are in response to the Fire and Fuels, Giant Sequoia, Mixed Conifer Restoration, and Social Values Regarding Vegetation Treatments issues.

Approximately half of the giant sequoia groves would be identified as high profile groves and managed for restoration, concentrated recreational use, and protection. Restoration of the high profile groves would be done at a conservative pace, approximately one percent per year. The other giant sequoia groves would be managed as part of the surrounding mixed-conifer ecosystem. These proposals are in response to the Giant Sequoia and Mixed Conifer Restoration issues.

Road closures, road decommissioning, and elimination of some dispersed recreation sites would occur to reduce the environmental impacts from compacted surfaces and to provide more areas isolated from the effects of motorized traffic. Use of unlicensed off-highway vehicles would not be allowed on roads or trails. Recreational opportunities would increase for day use activities, education, and interpretation, but overnight and dispersed opportunities would be reduced or stay the same. These proposals are in response to the Recreation and Watershed issues.

This alternative would avoid using mechanical treatments except for community protection. A defense zone of approximately 200 feet wide would be used to protect communities and occupied areas. There would be approximately 3,600 acres in this defense zone. This approach would replace the Framework urban wildland intermix defense and threat zone prescriptions. These proposals are in response to the Fire and Fuels, Social Values Regarding Vegetation Treatments, and Watershed issues.

An estimated 6,000 acres per year would be treated to begin restoring fire to Monument ecosystems. Restoration treatments would be the priority after initial protection treatments are completed.

The following strategies, desired conditions, goals, management areas, management emphases, and standards and guidelines are intended to provide the direction necessary to meet the intent of Alternative 3.

Restoration Strategy. Alternative 3 would reduce the number of roads and extent of the road system, as well as reduce the impacts from compacted areas in the Monument. Management would emphasize the use of prescribed fire and associated hand equipment (chainsaws) and limit the use of heavy equipment to protection activities around communities and on roads. New standards and guidelines would be proposed for vegetation management based on fire behavior predictions. High profile groves would be managed by treating only about one percent of their acreage per year, using prescribed fire and hand treatments to meet restoration goals. Restoration in the rest of the Monument would be accomplished using prescribed fire and hand treatments in restoration treatment areas. Treatments in these areas would be based on the fire return intervals for different vegetation types, fire susceptibility, and local conditions. Treatments outside of the high profile groves would be designed to re-introduce fire to the ecosystem and to reduce the risk of catastrophic fire. **Protection Strategy.** Alternative 3 would protect communities and other sites occupied by people with a defense zone that would typically be 200 feet but could range up to ¼-mile, based on local fire behavior and terrain. Use of mechanical treatments would be allowed for protection.

Prescribed fire would be the primary tool to reduce the risk of catastrophic fire in the rest of the Monument. This approach would replace the community protection strategy prescribed in the Framework. **Recreation/Human Use Strategy.** Alternative 3 would increase the feeling of isolation from motorized use by eliminating OHV use in the Monument. Primitive and semi-primitive recreation opportunities and trails would be increased. This alternative would concentrate human use and recreation in existing developed recreation sites, along major travel routes, and in high profile giant sequoia groves. It would increase opportunities for day use and expand or implement new interpretation and education programs and facilities. The existing capacity of developed overnight facilities for visitors would be maintained, while dispersed overnight recreation use would be reduced. Dispersed recreation sites that do not meet the aquatic management strategy in the Framework would be eliminated. **Transportation Strategy.** Alternative 3 would emphasize reducing environmental impacts from roads. For public access, emphasis would be on maintaining road access to recreation sites, high profile giant sequoia groves, special use sites, and private land. Roads not needed for these purposes would be closed to public access. No off-highway vehicle use would be allowed on the road system. For management access, emphasis would be on ecosystem restoration and fire protection. Roads for restoration or fire protection would be decommissioned in areas where natural conditions are re-established. Roads with risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on reducing road mileage and would include reductions of classified and unclassified roads with moderate to high risk for producing unacceptable resource impacts. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to new administrative sites, to relocate roads that produce unacceptable impacts, or to provide access for scientific research. The maintenance strategy would be to reduce maintenance costs by closing and decommissioning roads.

The following allocations and associated management strategies from the Framework would not apply in Alternative 3: the urban wildland intermix defense and threat zones, old forest emphasis areas, and southern Sierra fisher conservation areas.

Management areas are proposed to identify key areas where additional emphases can help meet the theme and goals of the alternative. Alternative 3 proposes three management areas (see II-5 in the Map Packet), as follows:

Management Area HPG, the High Profile Groves: High profile giant sequoia groves that currently have or have the potential for high public use, or have special features. **Management Area HLHA, the Hume Lake Historic Area:** This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. This MA remains the same for all alternatives. **Management Area GMA, General Monument Area:** The rest of the Monument not included in Management Areas HPG and HLHA, including non-high profile giant sequoia groves. It includes a wide variety of vegetation types and ecological zones. Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems.

Desired Conditions

For Alternative 3, the desired conditions are the same as for all of the action alternatives being considered (see the Desired Condition section of Management Direction Common to All Action Alternatives's).

Management Goals

Giant Sequoias and the Surrounding Ecosystems.

Protect giant sequoia groves and the surrounding ecosystems by ensuring that they are resilient to natural events (e.g. wildfires, floods, epidemic outbreaks of insects and diseases) and other events that are contrary to, or disruptive of, ecological processes that are necessary for a healthy and sustainable ecosystem (common to all action alternatives).

Protect and restore the hydrologic functions and soil resources upon which the groves and surrounding ecosystems depend (common to Alternatives 2 and 3).

Protect blue oak in the lower Westside hardwood ecosystem, and improve the viability of black oak in the mixed conifer forest (common to Alternatives 2, 3, 5, and 6).

Protect communities by completing fuel treatments for community protection within the first

decade of plan implementation.

Restore groves and their surrounding ecosystems to reflect historic conditions, which include a fire return interval of frequent and generally low-intensity fires; a mosaic of different age and size classes of vegetation; and regeneration and recruitment of shade-intolerant species such as pines, giant sequoias, and hardwoods (common to all action alternatives).

In conifer plantations, apply the necessary vegetation management and fuels treatments to promote the re-establishment of natural processes and vegetation conditions consistent with the potential natural vegetation of the site (common to all action alternatives).

Reduce the risk of catastrophic fire in the conifer, chaparral, and lower Westside hardwood ecosystems. Restore a more frequent fire return interval and create a diverse mix of age classes and structural diversity, using the historic conditions prior to 1875 as a reference (common to all action alternatives).

Adapt management strategies over time to reflect current monitoring and the best available scientific information (common to all action alternatives).

Coordinate planning and implementation of protection and restoration projects with private landowners and adjoining agencies, which include the Sequoia and Kings Canyon National Parks, Mountain Home State Forest, the Universities of California (Whitaker's Forest), and the Tule River Indian Tribe (common to all action alternatives).

Treat up to approximately 10% of the grove acreage per decade.

Dispersed and Developed Recreation

Manage scenic resources to maintain or enhance high scenic value. Develop scenic vistas to view icons and special features of the Monument (common to all action alternatives).

Increase recreation facility capacity for day use, education and interpretation, and other appropriate recreation activities.

Use a science-based method to collect visitor information, such as the National Visitor Use Monitoring System. Use these data, as well as other information, to help determine the demand and need for additional visitor facilities and services (common to all action alternatives).

Improve visitor facilities, information, and services for recreation and visitation in cooperation with permittees; cooperators; county, state and federal agencies; tribal governments; recreation user groups; and the business community (common to Alternatives 3 and 4).

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Improve recreation, interpretation, and education opportunities by connecting, linking, and coordinating facilities, services, and themes whenever feasible (common to all action alternatives).

Reduce the impacts of recreation on giant sequoia groves, the surrounding ecosystems, and other objects of interest in order to protect and restore the giant sequoia groves and the natural processes on which they depend.

Maintain the existing capacity of overnight facilities for visitors by relocating facilities that are removed from sequoia groves, riparian areas, or other areas due to conflicts with the aquatic management strategy in the Framework.

Expand the trail system to connect recreation facilities and interpretive sites and increase opportunities for primitive and semi-primitive recreation experiences and isolation from the sounds and sites of motorized vehicles.

Transportation System.

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Reduce impacts from roads.

Management Areas, Management Emphases, and Standards and Guidelines

Direction Common to All Management Areas

Management Emphases:

Emphasize natural regeneration for restoration of giant sequoia and associated species, including pines and oaks.

Emphasize prescribed fire and associated hand treatments to meet restoration and protection goals.

Seek to reduce areas of heavily impacted surfaces or large areas of hardened surfaces including, but not limited to, areas of overnight use, recreation residence tracts, and roadways.

Prior to decommissioning roads, consider opportunities for their use as recreation trails.

Emphasize decommissioning or closing to public use those roads that do not provide access to high profile giant sequoia groves, restoration activities, recreation sites, private land, or sites under special use permit.

Standards and Guidelines:

Eliminate dispersed recreation sites that are inconsistent with the aquatic management strategy in the Framework.

Use heavy equipment off of roads only in the following circumstances:

-To construct, reconstruct, or decommission roads. -When necessary to protect or restore aquatic habitats. -When constructing and/or maintaining defense zones around community/facilities and areas of high value. -During fire suppression and other emergency ecological activities. -In plantations where using prescribed fire would not meet protection and restoration goals. -To construct, maintain, or enhance recreational or administrative facilities, including trails.

Issue personal use firewood permits only for the purposes of restoration and community protection.

Do not permit OHVs except for administrative or emergency use.

Establish and maintain defense zones around communities to protect them from the spread of wildfire. The width of these defense zones will vary based on predicted fire behavior from approximately 200 feet to 1,300 feet. Wherever necessary and possible, incorporate existing man-made or natural fire-resistant features into these defense zones.

To meet vegetation restoration and community protection goals, select vegetation for removal based on predicted fire behavior.

Encourage establishment of new vegetation in existing openings or areas of very low stocking in coniferous forests.

Remove necessary vegetation for the development, maintenance, or improvement of recreation

and administrative sites and projects.

Management Area HPG, High Profile Groves. This management area consists of specific giant sequoia groves or portions of them within their established administrative boundaries. These are groves that currently have or have the potential for high public use. They are generally easily accessible by car, have special features, and existing or potential value for recreation, interpretation, and education. The high profile groves include Bearskin, approximately one-half of Belknap, Converse, Deer Creek, approximately two-thirds of Evans, Freeman Creek, Indian Basin, Long Meadow, and Packsaddle. This management area contains an estimated 14,390 acres.

Management Emphases:

Use a management approach that limits treatment methods and also limits the amount of landscape treated per decade. Prescribed fire and hand treatments are the primary management tools to achieve desired conditions.

Expand interpretation and education opportunities.

Use fire behavior predictions to determine the amount and type of vegetation to be removed to meet restoration and protection goals.

Emphasize restoration work in those groves with high recreation values and a high risk of catastrophic fire.

Reduce impacts to recreation from grazing.

Repair and maintain roads with high or moderate access needs.

Encourage scientific research. Focus research on potential impacts of human use on giant sequoia ecology, restoration, and protection.

Standards and Guidelines:

Do not allow camping outside of designated areas.

Do not allow cattle grazing.

Management Area HLHA, Hume Lake Historic Area. This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. It contains approximately 15,680 acres.

Management Emphases:

Preserve and interpret this historical landscape and its associated ecosystems.

Provide a wide range of recreational and interpretive opportunities.

Provide interpretive and educational materials emphasizing the relevance, fragility, and values of the area's heritage resources and ecology.

Emphasize the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Standards and Guidelines: None proposed. ***Management Area GMA, General Monument Area.*** This management area consists of the part of the Monument not included in Management HPG and Management Area HLHA. It includes some of the giant sequoia groves and contains approximately 296,170 acres. It includes a wide variety of vegetation types and ecological zones. Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems.

Management Emphases:

Protect and restore giant sequoia groves as part of their surrounding ecosystems.

Emphasize re-establishment of the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Emphasize the use of restoration treatment areas to move towards desired conditions in giant sequoia groves and surrounding ecosystems.

Standards and Guidelines: None proposed.
Return to top of page.

Alternative 4

Theme: Restore ecosystems and encourage recreation.

Alternative 4 addresses the significant issues of Fire and Fuels, Giant Sequoia, Mixed Conifer Restoration, Recreation, Social Values Regarding Vegetation Treatments, Watershed, and Wildlife. It would manage monument lands as a broad, connected ecosystem, without separating or zoning for management emphasis. The exception to this would be areas of high amounts of human use, including all current developed recreation areas and other areas of concentrated human use. The primary method to reduce the risk of catastrophic fire, restore desirable forest characteristics, protect and restore giant sequoia groves, and restore a more natural fire regime would be prescribed fire and hand treatments. The majority of the giant sequoia groves would be managed as part of the overall ecosystem and not zoned into different management areas. Trees over 12 inches in diameter would not be cut, with some exceptions. These proposals are in response to the Giant Sequoia, Mixed Conifer Restoration, Social Values Regarding Vegetation Treatments, and Wildlife issues.

Areas of concentrated human use would be managed for recreation, interpretation, education, and community protection. Recreation demand would be assessed and opportunities expanded to help meet the demand for increased overnight facilities, interpretation, education, and dispersed recreation. The preferred methods to protect these areas from catastrophic fire and safety hazards would be prescribed fire, hand treatments, and mechanical thinning. The protection zones would range from 50 to 200 feet wide. These proposals respond to the Fire and Fuels, Recreation, Social Values Regarding Vegetation Treatments, and Watershed issues.

Roads or other impacted areas would be eliminated when necessary to reduce impacts to riparian areas, wildlife habitat, or other sensitive resources. New roads could be constructed to meet management goals such as to provide access to new recreation facilities, to provide access to new administrative sites, to replace roads that have unacceptable resource impacts, or to provide access for research. The transportation system would provide high levels of access consistent with the restoration of monument lands. The trail system would be expanded to increase dispersed recreation opportunities. These proposals are in response to the Recreation and Watershed issues.

An estimated 6,000 acres per year would be treated to begin restoring fire to Monument ecosystems. Restoration treatments would be the priority after initial protection treatments are completed.

The following allocations and associated management strategies from the Framework would not apply in Alternative 4: the urban wildland intermix defense and threat zones, old forest emphasis areas, and southern Sierra fisher conservation areas.

The following strategies, desired conditions, goals, management areas, management emphases, and standards and guidelines are intended to provide the direction necessary to meet the intent of Alternative 4.

Restoration Strategy: Alternative 4 focuses on restoring desired fire return intervals and desired forest characteristics (such as a mosaic of tree species and age classes), restoring plantations and roads to natural conditions, and restoring or stabilizing riparian habitat that does not meet desired conditions. Vegetation restoration methods would generally be limited to prescribed fire and hand treatments and would be focused within the General Forest Zone. The areas and amounts to be treated would be determined in part by desired fire intervals, site-specific conditions, and protection of key resources such as giant sequoia groves and wildlife habitat. Generally, no trees larger than 12 inches in diameter would be cut, for the purpose of ecological restoration and maintenance, subject to some exceptions (see standards and guidelines). Existing plantations would be managed to restore forest structure to desired conditions and to minimize the risk of catastrophic fire. Areas of riparian habitat that are degraded would be emphasized for stabilization and restoration.

Protection Strategy: Alternative 4 would protect communities and other sites occupied by people by establishing a 200-foot wide defense zone around communities and a 100-foot

defense zone on either side of major roads. The purpose of the defense zone is to provide for human health and safety and reduce the fire hazard around existing structures, major roads, developed campgrounds, and developed public use areas within the Human Influence Zone. Prescribed fire, hand thinning, and mechanical thinning would be the preferred treatment methods. Mechanical treatments would include the removal of trees and brush using such equipment as feller-bunchers or chippers. Generally, no trees larger than 12 inches in diameter would be removed unless necessary for emergencies, for public safety, or for the development and maintenance of recreation and administrative sites. There are approximately 3,600 acres in defense zones around communities within the Human Influence Zone that would receive protection treatments. These would be the highest priority for treatment, with the goal of completing initial treatments within the first 5 to 10 years of plan implementation.

Recreation/Human Use Strategy: Alternative 4 responds to the recreation demand to increase recreation opportunities by increasing both developed and dispersed opportunities, winter use facilities, trails, and interpretive facilities and opportunities. Potential areas and projects for additional recreation development would be identified. Opportunities for non-motorized winter use would be enhanced to reduce conflicts with motorized users.

Transportation Strategy: Alternative 4 would emphasize reducing environmental impacts from roads while providing for public access. For public access, emphasis would be on maintaining road access to recreation sites, special use sites, and private land. The road system would be available for recreational driving and off-highway vehicle use. For management access, emphasis would be on ecosystem restoration and fire protection. Roads with high risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on unclassified and classified roads with high risks of producing unacceptable impacts. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to new administrative sites, to relocate roads producing unacceptable impacts, or to provide access for scientific research. The maintenance strategy would be to continue to request funds to reduce the maintenance backlog and keep the road system in acceptable condition. Roads that cannot be retained to acceptable standards would receive priority for decommissioning.

Management areas are proposed to identify key areas where additional emphasis can help meet the theme and goals of the alternative. Alternative 4 proposes two management areas (see Figure II-6 in the Map Packet), as follows:

Management Area HIZ, the Human Influence Zone: This area includes communities, developed recreation sites, areas of concentrated human use, and special use sites, as well as a buffer of 50 to 200 feet around these sites. **Management Area GFZ, the General Forest Zone:** The portion of the Monument not included in Management Area HIZ. This area includes most of the giant sequoia groves.

Desired Conditions

For Alternative 4, the desired conditions are the same as for all of the action alternatives being considered (see the Desired Condition section of Management Direction Common to All Action Alternatives's).

Management Goals

Giant Sequoias and the Surrounding Ecosystems.

Protect giant sequoia groves and the surrounding ecosystems by ensuring that they are resilient to natural events (e.g. wildfires, floods, epidemic outbreaks of insects and diseases) and other events that are contrary to, or disruptive of, ecological processes that are necessary for a healthy and sustainable ecosystem (common to all action alternatives).

Restore and stabilize riparian and aquatic habitat that does not meet desired conditions.

Protect and restore blue oak in the lower Westside hardwood ecosystem, and improve the viability of black oak in the mixed conifer forest.

Protect communities, recreation facilities, and other areas of concentrated human use by reducing the risk of catastrophic fire.

Restore groves and their surrounding ecosystems to reflect historic conditions, which include a fire return interval of frequent and generally low-intensity fires; a mosaic of different age and size classes of vegetation; and regeneration and recruitment of shade-intolerant species

such as pines, giant sequoias, and hardwoods (common to all action alternatives).

In conifer plantations, apply the necessary vegetation management and fuels treatments to promote the re-establishment of natural processes and vegetation conditions consistent with the potential natural vegetation of the site (common to all action alternatives).

Reduce the risk of catastrophic fire in the conifer, chaparral, and lower Westside hardwoods ecosystems. Restore a more frequent fire return interval and create a diverse mix of age classes and structural diversity, using the historic conditions prior to 1875 as a reference (common to all action alternatives).

Adapt management strategies over time to reflect current monitoring and the best available scientific information (common to all action alternatives).

Coordinate planning and implementation of protection and restoration projects with private landowners and adjoining agencies, which include the Sequoia and Kings Canyon National Parks, Mountain Home State Forest, the Universities of California (Whitaker's Forest), and the Tule River Indian Tribe (common to all action alternatives).

Promote the restoration of natural processes, structure, and vegetation on existing permanent and temporary roads that are not necessary for the proper care of the objects of interest, public use, and management of the Monument. Maintain remaining roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems.

Promote coordinated and integrated scientific research through active participation with the Giant Sequoia Ecology Cooperative.

Dispersed and Developed Recreation.

Manage scenic resources to maintain and enhance high scenic values. Develop scenic vistas to view icons and special features of the Monument (common to all action alternatives).

Increase recreation facility capacity for overnight use, day use, education and interpretation, and other appropriate recreation activities.

Use a science-based method to collect visitor information, such as the National Visitor Use Monitoring System. Use these data, as well as other information, to help determine the demand and need for additional visitor facilities and services (common to all action alternatives).

Improve visitor facilities, information, and services for recreation and visitation in cooperation with permittees; cooperators; county, state, and federal agencies; tribal governments; recreational user groups; and the business community (common to Alternatives 3 and 4).

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, for hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Improve recreation, interpretation, and education opportunities by connecting, linking, and coordinating facilities, services, and themes whenever feasible (common to all action alternatives).

Expand overnight camping facilities consistent with the ecological protection of the giant sequoia groves, their ecosystems, and other objects of interest. Relocate facilities that are removed from sequoia groves, riparian areas, or other areas due to resource conflicts.

Expand the trail system to connect recreation facilities and interpretive sites and provide opportunities for primitive and semi-primitive recreation experiences.

Expand opportunities for non-motorized winter recreation.

Restore to the extent practical the historic locations and conditions of trails that have been disturbed by past practices such as logging or road construction.

Minimize conflicts between different types of recreational users.

Study the need for interpretive facilities to serve both the northern and southern portions of the Monument. These facilities may be in or in close proximity to the boundaries of the Monument. Encourage the support of partners and cooperators.

Ensure that any impacts of recreation on giant sequoia groves, their surrounding ecosystems,

and other objects of interest are consistent with the proper care and management of the giant sequoia groves and other objects of interest and the natural processes on which they depend.

Transportation System.

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Provide enjoyable and safe opportunities for riding off-highway vehicles, including snowmobiles, on designated roads within the Monument (common to Alternatives 2, 4, 5, and 6).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Reduce impacts from roads to wildlife habitat, aquatic habitat, and the soil resource.

Management Areas, Management Emphases, and Standards and Guidelines

Direction Common to All Management Areas

Management Emphases:

Emphasize natural regeneration for restoration of giant sequoia and associated species, including pines and oaks.

Prior to decommissioning roads or otherwise eliminating general public access on roads, consider opportunities for their use as recreation trails or for other recreational experiences.

Emphasize the restoration of recreational facilities and the expansion of existing campgrounds to increase recreation opportunities consistent with the aquatic management strategy.

Provide road access for the public and for management activities without compromising the restoration and protection of the giant sequoia groves, their associated ecosystems, and aquatic and riparian habitat.

During initial treatments, emphasize establishment of young conifer trees and other vegetation in existing openings or where existing vegetation levels are very low, consistent with applicable management strategies for the area.

During removal of vegetation to meet fuel reduction or restoration objectives, emphasize the use of service contracts.

Standards and Guidelines:

After fuel reduction treatments, leave material on-site to the extent that it does not conflict with fuel reduction objectives or create a hazard to human use of the site.

Management Area HIZ, Human Influence Zone. This management area is comprised of the developed areas on the Monument, including recreation sites, special use facilities, administrative sites, private lands with structures, other areas of concentrated human use, and the major roads that provide access to these areas. The purpose of this zone is to protect public health, safety, and property in a manner that minimizes adverse impacts to species and ecosystems. An additional 200 feet around each site and 50 to 100 feet adjacent to roads are included in this zone. This management area contains approximately 12,780 acres.

Management Emphases:

Emphasize the protection of public health and safety by reducing fuel loadings and the risk of catastrophic fire.

Complete protection projects within the first decade of plan implementation.

In areas of the landscape where fuel loadings, burning conditions, and site conditions are appropriate, emphasize the use of prescribed wildland fire to meet restoration objectives, protect special resources, and continue to move towards desired conditions.

Reduce areas of heavily impacted surfaces or large areas of hardened surfaces that are negatively impacting giant sequoia groves, their surrounding ecosystems, riparian habitat, or other special features.

Provide additional opportunities for dispersed and developed recreation without compromising the restoration and protection of the giant sequoia groves and their associated ecosystems.

Encourage scientific research. Focus research on the potential impacts of concentrated human use on giant sequoia ecology, restoration, and protection.

Emphasize the protection of special features such as monarch giant sequoias.

Identify additional suitable lands for future facility development during site-specific landscape analyses.

Standards and Guidelines:

Establish and maintain defense zones by applying fuel reduction strategies within 200 feet of structures used primarily for human habitation and within 100 feet directly adjacent to major roads, developed campgrounds, and other developed public use areas.

Where access and conditions allow, reduce heavy fuels around monarch giant sequoia and other key trees (such as sugar pine) to minimize the risk of damage from fire.

Identify the boundaries of areas for fuel reduction based upon site-specific landscape analyses.

Use heavy equipment off of roads only in the following circumstances: -To construct, reconstruct, or decommission roads. -When necessary to protect or restore aquatic and riparian habitats. -When constructing or maintaining defense zones around communities, facilities, areas of high value. -During fire suppression and other emergency ecological restoration activities. -To construct, maintain, or enhance recreational or administrative facilities, including trails. -In existing plantations for the purposes of ecological restoration or fuel reduction.

Do not remove any trees equal to or more than 12 inches in diameter except as clearly needed for emergencies, public safety, or the development, maintenance, or improvement of recreation and administrative opportunities and sites.

Management Area GFZ, General Forest Zone. This management area includes all areas not in Management Area HIZ. It includes such key features as the Hume Lake Historic Area (Management Area HLHA in other action alternatives) and almost all of the giant sequoia groves. There are approximately 313,450 acres in this zone.

Management Emphases:

Emphasize re-establishment of the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Use prescribed fire as the primary method to meet ecological restoration objectives and to move towards desired conditions such as species and age diversity and the re-establishment of more frequent and lower-intensity fires.

Restore desired fuel conditions and fire return intervals in areas where current high fuel loadings are primarily a result of untreated logging slash.

Where practical, provide protection to special features such as monarch giant sequoias and sugar pines.

Re-establish native vegetation and natural hydrologic function on temporary roads and landings.

Restore plantations to forested conditions that reflect the desired conditions, particularly a mixed species composition and a variety of age and size classes.

Encourage scientific research. Focus research on protection and restoration of natural processes and the scientific value of caves.

During removal of vegetation to meet fuel reduction or restoration objectives, emphasize the use of service contracts.

Minimize conflicts between different types of recreational uses, such as between motorized summer or winter vehicle users and those seeking solitude or using stock.

Emphasize non-mechanized recreational opportunities and provide for dispersed recreation consistent with restoration objectives.

In the northern portion of the Monument, emphasize the interpretation of historical features, especially those associated with the Hume Lake historic logging area. In the southern portion of the Monument, emphasize the interpretation of natural features and processes. Interpret restoration and protection activities as they are implemented and monitored.

Standards and Guidelines:

Do not remove any trees equal to or more than 12 inches in diameter except as clearly needed for emergencies, public safety, or the development, maintenance, or improvement of recreation and administrative opportunities and sites.

Limit hazard tree removal along roads to those trees that are taller than their distance to the road and where the hazard to public safety is clearly demonstrated.

Where access and conditions allow, reduce fuels around monarch giant sequoia trees and other key trees (such as mature sugar pine) to minimize the risk of damage from fire.

Use heavy equipment off of roads only in the following circumstances:

-To construct, reconstruct, or decommission roads. -When necessary to protect or restore aquatic and riparian habitats. -When constructing or maintaining defense zones around communities, facilities, and areas of high value. -During fire suppression and other emergency ecological restoration activities. -To construct, maintain, or enhance recreational or administrative facilities, including trails. -In existing plantations for the purposes of ecological restoration or fuel reduction.

Return to top of page.

Alternative 5

Theme: Manage groves with a wide range of management strategies to promote conditions for giant sequoia regeneration.

Alternative 5 addresses the significant issues of Fire and Fuels, Giant Sequoia, Mixed Conifer Restoration, Recreation, and Social Values Regarding Vegetation Treatments. This alternative would prescribe a broad range of management strategies to promote conditions for giant sequoia regeneration in the groves. These grove-specific management strategies include prescribed fire, mechanical treatments (including heavy machinery), and removal of trees up to 30 inches in diameter to create small openings, or gaps, to promote giant sequoia regeneration. These proposals are in response to the Giant Sequoia and Social Values Regarding Vegetation Treatments issues.

Outside of the groves, Framework allocations and management strategies (Appendix C), which include both prescribed fire and mechanical methods, would be applied. Areas designated for treatments for community protection and to reduce the risk of catastrophic fire would be the first priority for treatment. The Framework strategies would include the use of urban wildland intermix defense zones and threat zones. As these areas approach their protection goals, the Monument protection and restoration program would maintain these areas and treat additional areas for restoration objectives. Over the long term, as more areas reach their desired condition for fuels and fire, prescribed fire and wildland fire use would the primary tools used to maintain desired conditions for both fire and vegetation. These proposals are in response to

the Fire and Fuels, Mixed Conifer Restoration, and Social Values Regarding Vegetation Treatments issues.

Recreation demand would be assessed and opportunities expanded to help meet the demand for increased overnight facilities, interpretation, education, and dispersed recreation, including opportunities in or near giant sequoia groves. The transportation system would provide high levels of access for public and management use, consistent with protection and restoration of the Monument. New roads could be constructed to meet management goals such as to provide access to new recreation facilities, to provide access to new administrative sites, to replace roads that have unacceptable resource impacts, or to provide access for research. These proposals generally respond to the Recreation issue.

This alternative acknowledges that there are sites where the use of prescribed fire in conjunction with mechanical methods can give reliable results. There are areas of extreme fuel loadings or other site conditions where prescribed fire alone may not be effective in meeting management goals without unacceptable risks to other resource values.

Within the groves, the following allocations and associated management strategies from the Framework would be retained in Alternative 5: California spotted owl protected activity centers (PACs), northern goshawk PACs, great gray owl PACs, forest carnivore den sites, California spotted owl home range core areas, aquatic management strategy, and willow flycatcher habitat. Standards and guidelines from the Framework that would be retained include those for: lower Westside hardwoods, large tree retention, snags and down woody debris, incidental removal of vegetation and down woody material, noxious weeds, and grazing (as amended below). Areas within the groves that are outside of these allocations would become a new land allocation, with the primary purposes of protection and restoration of the groves. New management strategies are prescribed for this allocation.

The following strategies, desired conditions, goals, management areas, management emphases, and standards and guidelines are intended to provide the direction necessary to meet the intent of Alternative 5.

Restoration Strategy. Alternative 5 provides for the systematic reintroduction of fire to the ecosystem by following a new management strategy for the groves and by following Framework strategies outside of the groves. In the groves, both prescribed fire and mechanical treatments (including heavy equipment) would be allowed to meet restoration and protection goals. This approach reflects the somewhat more predictable results that can be achieved through the judicious combination of mechanical treatments and prescribed fire to achieve the desired condition. Outside of the groves, the treated areas would reduce the risk of catastrophic fire sufficiently over the long term to allow prescribed fire and wildland fire use to act as the primary tools to move toward desired conditions. Existing plantations would be managed to restore forest structure, hydrologic conditions, and minimize risks from catastrophic fire. By meeting the fuel load and fire model desired condition, fire can be safely returned to the ecosystem and allowed to remove excess ground fuels and vegetation. By using fire, we can eventually remove enough excess vegetation to meet the desired condition for vegetation stand structure. All vegetation types, including mixed conifer/sequoia, chaparral, and lower Westside hardwoods, would be included in treatment areas. Prescribed fire and wildland fire use would be used to move the area toward the desired fire return interval. The Framework's aquatic management strategy would be applied for the purpose of protecting, restoring, and stabilizing hydrologic function and structure.

Protection Strategy. Alternative 5 would protect communities, other sites occupied by people, and the objects of interest with the full range of Framework strategies. Key strategies include the urban wildland intermix threat and defense zones, SPLATs, and wildland fire use. **Recreation/Human Use Strategy.** Alternative 5 would assess the increased demand for recreation in the Monument and help meet that demand for a wide range of recreation uses. It would encourage the expansion of overnight camping opportunities near and in the groves. The focus of interpretation would be on historical areas on the Hume Lake District and on natural settings on the Tule River and Hot Springs Ranger Districts. **Transportation Strategy.** Alternative 5 would emphasize retaining road access for public use and for management activities similar to current access levels. For public access, emphasis would be on maintaining roads to recreation sites, dispersed areas, special use sites, and private land. An extensive road system would be available for recreation driving and off-highway vehicle use. For management access, emphasis would be on ecosystem restoration and fire protection. Roads with high risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on unclassified roads and those classified roads producing unacceptable impacts where repair or relocation is unreasonable. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to administrative sites, to replace roads producing unacceptable resource impacts, or to provide access for research. The maintenance strategy would be to continue to request funds to reduce the maintenance backlog and keep the road

system in acceptable condition.

Management areas are proposed to identify key areas where additional emphasis can help meet the theme and goals of the alternative. Alternative 5 proposes six management areas (see Figure II-7 in the Map Packet), as follows:

Management Area ZOI-NG, Zones of Influence without the Groves: The ecological zones of influence that surround the giant sequoia groves, not including the sequoia groves themselves. Generally these areas are defined by the boundaries of the watersheds where the giant sequoia groves are found. These boundaries are described in the Forest Service draft report entitled Defining Ecological Zones of Influence for Giant Sequoia Groves on the Sequoia National Forest.'s The zones of influence are the areas within which management activities could both directly and indirectly affect grove ecology. **Management Area HLHA, the Hume Lake Historic Area:** This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. This MA remains the same for all alternatives. **Management Area GML, General Monument Lands:** The rest of the Monument not included in Management Areas ZOI-NG, HLHA, GSG1, GSG2, or GSG3. It includes a wide variety of vegetation types and ecological zones. Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems.

Management Area GSG1: Giant sequoia groves that have had no significant disturbance for the last 120 years and with little regeneration.

Management Area GSG2: Giant sequoia groves that were substantially cutover during the late 1800s and early 1900s, leading to heavy stands of second growth mixed conifer-giant sequoia forests.

Management Area GSG3: Giant sequoia groves that had logging disturbances within the last 20 years, leading to well-established patches of young seral stage mixed conifer and giant sequoia vegetation.

Desired Conditions

For Alternative 5, the desired conditions are the same as for all of the action alternatives being considered (see the Desired Condition section of Management Direction Common to All Action Alternatives's).

Management Goals

Giant Sequoias and the Surrounding Ecosystems.

Protect giant sequoia groves and the surrounding ecosystems by ensuring that they are resilient to natural events (e.g. wildfires, floods, epidemic outbreaks of insects and diseases) and other events that are contrary to, or disruptive of, ecological processes that are necessary for a healthy and sustainable ecosystem (common to all action alternatives).

Protect the hydrologic functions and soil resources upon which the groves and the surrounding ecosystems depend (common to Alternatives 5 and 6).

Protect blue oak in the lower Westside hardwood ecosystem, and improve the viability of black oak in the mixed-conifer forest (common to Alternatives 2, 3, 5, and 6).

Protect communities by completing fuel treatments for community protection within the first three decades of plan implementation (common to Alternatives 2, 5, and 6).

Restore groves and their surrounding ecosystems to reflect historic conditions, which include a fire return interval of frequent and generally low-intensity fires; a mosaic of different age and size classes of vegetation; and regeneration and recruitment of shade-intolerant species such as pines, giant sequoias, and hardwoods (common to all action alternatives).

In conifer plantations, apply the necessary vegetation management and fuels treatments to promote the re-establishment of natural processes and vegetation conditions consistent with the potential natural vegetation of the site (common to all action alternatives).

Reduce the risk of catastrophic fire in the conifer, chaparral, and lower Westside hardwood ecosystems. Restore a more frequent fire return interval and create a diverse mix of age

classes and structural diversity using the historic conditions prior to 1875 as a reference (common to all action alternatives).

Adapt management strategies over time to reflect current monitoring and the best available scientific information (common to all action alternatives).

Coordinate planning and implementation of protection and restoration projects with private landowners and adjoining agencies, which include the Sequoia and Kings Canyon National Parks, Mountain Home State Forest, the Universities of California (Whitaker's Forest), and the Tule River Indian Tribe Promote coordinated and integrated scientific research through active participation with the Giant Sequoia Ecology Cooperative (common to all action alternatives).

Treat the majority of the landscape during the first three decades to protect against catastrophic fire, to restore desired fire return intervals, and to develop desired structural conditions for key ecological indicators.

Dispersed and Developed Recreation.

Manage scenic resources to maintain or enhance high scenic value. Develop scenic vistas to view icons and special features of the Monument (common to all action alternatives).

Increase recreation facility capacity for overnight camping, day use, education and interpretation, and other appropriate recreational activities (common to Alternatives 5 and 6).

Use a science-based method to collect visitor information, such as the National Visitor Use Monitoring System. Use these data, as well as other information, to help determine the demand and need for additional visitor facilities and services (common to all action alternatives).

Improve visitor facilities, information, and services to help meet projected demand for recreation and visitation in cooperation with permittees; cooperators; county, state, and federal agencies; tribal governments; recreational user groups; and the business community (common to Alternatives 2, 5, and 6).

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, for hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Improve recreation, interpretation, and education opportunities by connecting, linking, and coordinating facilities, services, and themes whenever feasible (common to all action alternatives).Increase recreation opportunities, including developed sites, in or near giant sequoia groves in order to provide a varied range of recreational and educational opportunities.

Transportation System.

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Provide enjoyable and safe opportunities for riding off-highway vehicles, including snowmobiles, on designated roads within the Monument (common to Alternatives 2, 4, 5, and 6).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Management Areas, Management Emphases, and Standards and Guidelines

Direction Common to All Management Areas

Management Emphases:

Emphasize re-establishment of the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Expand overnight recreational opportunities within or in close proximity to giant sequoia groves.

Maintain current levels of road and trail access for public and administrative use consistent with protection of the objects of interest.

During the first three decades, emphasize a protection strategy. Shift over time to a restoration strategy.

During initial restoration treatments, emphasize establishment of young conifer trees and other vegetation in existing openings in the stands or where existing vegetation levels are very low, consistent with applicable management strategies for the area.

Use natural regeneration of native species to meet long-term restoration goals.

Prior to decommissioning roads, consider opportunities for their use as recreation trails.

Standards and Guidelines:

Manage the mixed brush-chaparral ecosystem to develop and maintain a broad mix of age classes and structural diversity by burning on a 20-to-50 year cycle.

Implement restoration treatment areas across the landscape for the restoration of fire, with an annual average program based in part on the desired fire return interval by vegetation type.

Management Area ZOI-NG, Zones of Influence without the Groves. This management area is a modified version of Management Area ZOI-WG in Alternative 2, the Proposed Action. It consists of the ecological zones of influence that surround the giant sequoia groves but does not include the sequoia groves themselves. Generally these areas are defined by the boundaries of the watersheds where the giant sequoia groves are found. These boundaries are described in the Forest Service draft report entitled Defining Ecological Zones of Influence for Giant Sequoia Groves on the Sequoia National Forest.'s The zones of influence are the areas within which management activities could both directly and indirectly affect grove ecology. There are approximately 64,370 acres in this management area.

Management Emphases:

Emphasize prescribed fire and associated hand treatments as the preferred vegetation management tools, consistent with the Framework management strategies.

Encourage scientific research. Focus research on potential impacts of management and human use on giant sequoia ecology, restoration, and protection.

In the northern portion of the Monument, emphasize interpretation of historical features. In the southern portion of the Monument, emphasize natural features and processes. Interpret restoration and protection activities as they are implemented and monitored.

Standards and Guidelines: None proposed. *Management Area HLHA, Hume Lake Historic Area.* This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. It contains approximately 15,680 acres.

Management Emphases:

Preserve and interpret this historical landscape and its associated ecosystems.

Provide a wide range of recreational and interpretive opportunities.

Provide interpretive and educational materials emphasizing the relevance, fragility, and values of the area's heritage resources and ecology.

Emphasize the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Standards and Guidelines: None proposed. ***Management Area GML, General Monument Lands***. This management area consists of the part of the Monument not included in Management Area ZOI-NG, Management Area HLHA, or Management Areas GSG1, GSG2, and GSG3, the giant sequoia groves. It includes a wide variety of vegetation types and ecological zones. Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems. This management area contains approximately 219,500 acres.

Management Emphases:

Reduce fuel loads, especially down slope of the groves, and return to a more natural fire interval.

Encourage scientific research. Focus research on protection and restoration of natural processes and caves.

Standards and Guidelines:

Use restoration treatment areas in fire-dependent ecosystems to restore a more frequent fire return interval. A restoration treatment area is an area typically from 50 to 500 acres in size, where mechanical treatments and/or prescribed fire are applied for the restoration of fire to the ecosystem, rather than for protection purposes. The boundaries of restoration treatment areas are determined locally based upon landscape analysis. Overall treatment programs are based in part on the desired fire return interval for each specific vegetation type.

Management Area GSG1. Giant sequoia groves dominated by trees over 150 years old and with less than 3% in other age groups. There are approximately 12,870 acres in the following groves: Agnew, Alder Creek, Belknap Complex, Burro Creek, Cunningham, Deer Creek, Deer Meadow, Dillonwood, Evans Complex (southeast portion), Freeman Creek, Maggie Mountain, Middle Tule, Monarch, Upper Tule, Mountain Home, Red Hill, Silver Creek, South Peyrone, and Wishon. These groves have had little or no regeneration of young giant sequoia or other mixed conifer vegetation in the last 120 years or more.

Management Emphases:

Re-introduce natural processes and structural conditions that promote establishment of new groups of young vegetation.

Emphasize the use of mechanical methods in conjunction with prescribed fire to meet goals for protection and restoration.

Use a combination of prescribed fire and mechanical methods to ensure protection and ecological restoration goals are met. Mechanical methods in advance of prescribed fire would be most appropriate where the use of prescribed fire alone poses unacceptable risks to other values (e.g., wildlife habitat, recreation, watershed). Mechanical methods immediately following prescribed fire would be appropriate to meet project objectives if prescribed fire results do not meet goals.

Create desired structural conditions to meet ecological restoration goals for indicators such as vegetation gap and patch size, vertical structure, and species composition.

Standards and Guidelines:

Limit removal of live trees to those equal to or less than 30 inches in diameter. Larger trees may be removed based upon site-specific landscape analyses if clearly needed for development, restoration, or maintenance of recreation and administrative sites; for emergency situations; for public health and safety; as part of a scientific study; or for the protection or restoration of special features such as monarch giant sequoia trees.

When treating stands mechanically, create gaps that are typically one acre or less in size, irregularly shaped, and no larger than two acres in size. This does not apply to openings created to expand or develop new administration or recreation facilities, such as campgrounds.

When treating stands mechanically, limit new gaps development to approximately 5% of the area, and no more than approximately 10% of the stand area. This does not apply to openings

created to expand or develop new administrative or recreation facilities, such as campgrounds.

Management Area GSG2. Giant sequoia groves with significant amounts of trees 20 to 150 years old. There are approximately 8,070 acres in the following groves: Converse Basin, Abbott Creek, Big Stump, Cherry Gap, Evans Complex (northeastern portion), Grant Grove, and Indian Basin.

Management Emphases:

Manage the Converse Grove as an area of focused scientific research.

Manage existing second growth stands to meet the desired condition by using the key indicators discussed by Piirto and Rogers (1999).

Study the response of second-growth giant sequoia and mixed conifer forests to different management strategies and techniques.

Emphasize careful stocking control with prescribed burning, mechanical methods, or a combination of methods to meet protection and restoration goals and move toward desired condition.

Promote a return to a frequent fire return interval consistent with the desired condition.

Use a combination of prescribed fire and mechanical methods to ensure protection and ecological restoration goals are met. Mechanical methods in advance of prescribed fire would be most appropriate where the use of prescribed fire alone poses unacceptable risks to other values (e.g., wildlife habitat, recreation, watershed). Mechanical methods immediately following prescribed fire would be appropriate to meet project objectives if prescribed fire results do not meet goals.

Create desired structural conditions to meet ecological restoration goals for indicators such as vegetation gap and patch size, vertical structure, and species composition.

Standards and Guidelines:

Limit removal of live trees to those equal to or less than 30 inches in diameter. Larger trees may be removed based upon site-specific landscape analyses if clearly needed for development, restoration, or maintenance of recreation and administrative sites; for emergency situations; for public health and safety; as part of a scientific study; or for the protection or restoration of special features such as monarch giant sequoia trees.

When treating stands mechanically, create gaps that are typically one acre or less in size, irregularly shaped, and no larger than two acres in size. This does not apply to openings created to expand or develop new administrative or recreation facilities, such as campgrounds.

When treating stands mechanically, limit new gaps development to approximately 5% of the area, and no more than approximately 10% of the stand area. This does not apply to openings created to expand or develop new administrative or recreation facilities, such as campgrounds.

Management Area GSG3. Giant sequoia groves with significant amounts of trees 10 to 20 years old. There are approximately 5,730 acres in the following groves: Bearskin, Black Mountain, Landslide, Long Meadow, Packsaddle, Peyrone, Redwood Mountain, and Starvation Complex.

Management Emphases:

Ensure the careful management of the existing age classes, especially the 10-20 year old vegetation.

Manage the Redwood Mountain Grove as an area of focused scientific research.

Emphasize a collaborative research program that takes advantage of the multiple agencies that manage this area (National Park Service, UC Berkeley, USDA Forest Service).

Study the response of generally undisturbed late seral stage giant sequoia and mixed conifer forests to prescribed fire management strategies and techniques.

Emphasize prescribed fire as the primary tool to maintain desired conditions where these conditions already exist.

Promote a return to a frequent fire return interval consistent with the desired condition.

Use a combination of prescribed fire and mechanical methods to ensure protection and ecological restoration goals are met. Mechanical methods in advance of prescribed fire would be most appropriate where the use of prescribed fire alone poses unacceptable risks to other values (e.g., wildlife habitat, recreation, watershed). Mechanical methods immediately following prescribed fire would be appropriate to meet project objectives if prescribed fire results do not meet goals.

Create desired structural conditions to meet ecological restoration goals for indicators such as gap and patch size and vegetative structure.

Standards and Guidelines:

Limit removal of live trees to those equal to or less than 30 inches in diameter. Larger trees may be removed based upon site-specific landscape analyses if clearly needed for development, restoration, or maintenance of recreation and administrative sites; for emergency situations; for public health and safety; as part of a scientific study; or for the protection or restoration of special features such as monarch giant sequoia trees.

When treating stands mechanically, create gaps that are typically one acre or less in size, irregularly shaped, and no larger than two acres in size. This does not apply to openings created to expand or develop new administrative or recreation facilities such as campgrounds.

When treating stands mechanically, limit new gaps development to approximately 5% of the area, and no more than approximately 10% of the stand area. This does not apply to openings created to expand or develop new administrative or recreation facilities, such as campgrounds.

Return to top of page.

Alternative 6

Theme: Manage entire Monument with the widest range of management strategies.

Alternative 6 addresses the significant issues of Fire and Fuels, Giant Sequoia, Mixed Conifer Restoration, Recreation, and Social Values Regarding Vegetation Treatments. This alternative would prescribe a broad range of management strategies to restore and protect all of the ecosystems found in the Monument, as well as promote conditions for giant sequoia regeneration in the groves. These strategies are the same as those applied to the giant sequoia groves in Alternative 5 but, in this alternative, they apply to all of the Monument ecosystems. These monument-wide management strategies would include prescribed fire, mechanical treatments (including heavy machinery), and removal of trees up to 30 inches in diameter when needed for restoration, protection, or to create small openings, or gaps, to promote giant sequoia regeneration. These proposals are in response to the Giant Sequoia, Mixed Conifer Restoration, and Social Values Regarding Vegetation Treatments issues.

Outside of the groves, areas would be designated for ecological restoration treatments based on monument-wide strategies and site-specific analysis. Areas in need of treatment to reduce the risk of catastrophic fire would be the first priority. In addition to areas treated to reduce the risk of fire, other areas could be treated to meet the desired condition for vegetation and to return fire-dependent ecosystems to a desired fire return interval. As these treatments are completed and the areas approach their desired condition, the program would maintain the treated areas and treat additional areas. Over the long term, as more areas reach their desired condition, prescribed fire and wildland fire use would provide more reliable results and would be the primary tools used to reach and maintain desired conditions for both fire and vegetation. These proposals are in response to the Fire and Fuels and Mixed Conifer Restoration issues.

Recreation demand would be assessed and opportunities expanded to help meet the demand for increased overnight facilities, interpretation, education, and dispersed recreation, including opportunities in or near giant sequoia groves. The transportation system would maintain high levels of access for public and management use, consistent with the protection and restoration of the Monument. New roads could be constructed to meet management goals such as to provide access to new recreation facilities, to provide access to new administrative sites, to replace roads that have unacceptable resource impacts, or to provide access for research. These proposals are generally in response to the Recreation issue.

The following allocations and associated management strategies from the Framework would be retained in Alternative 6: California spotted owl protected activity centers (PACs), northern

goshawk PACs, great gray owl PACs, forest carnivore den sites, California spotted owl home range core areas, aquatic management strategy, and willow flycatcher habitat. Standards and guidelines from the Framework that would be retained include those for: lower Westside hardwoods, large tree retention, snags and down woody debris, incidental removal of vegetation and down woody material, noxious weeds, and grazing (as amended below). Areas in the Monument that are outside of these allocations would be established as a single new land allocation, with the primary purposes of ecological protection and restoration to meet the desired condition for key resources.

This alternative acknowledges that there are sites where the use of prescribed fire in conjunction with mechanical methods can give more reliable results. There are areas of extreme fuel loadings or other site conditions where prescribed fire alone may not be effective in meeting management goals without unacceptable risks to other resource values.

The following strategies, desired conditions, goals, management areas, management emphases, and standards and guidelines are intended to provide the direction necessary to meet the intent of Alternative 6.

Restoration Strategy. Alternative 6 calls for the systematic reintroduction of fire throughout the Monument to re-establish a desired fire return interval for all fire-dependent ecosystems, including chaparral, mixed conifer-giant sequoia, and lower Westside hardwood. All vegetation types would be included in a restoration treatment area. This strategy is very similar to Alternative 5, except that this alternative would manage all of the vegetation types throughout the Monument with a combination of mechanical and prescribed fire. Existing plantations would be managed to restore forest structure, hydrologic conditions, and minimize risks from catastrophic fire. The Framework's aquatic management strategy would be applied for the purpose of protecting, restoring, and stabilizing hydrologic function and structure.

Protection Strategy. Alternative 6 would protect communities, other sites occupied by people, and the objects of interest with the full range of Framework strategies. Key strategies include the urban wildland intermix threat and defense zones, SPLATs, and wildland fire use. **Recreation/Human Use Strategy.** Alternative 6 would assess the increased demand for recreation in the Monument and help meet that demand for a wide range of recreational uses. It would encourage the expansion of overnight camping opportunities near and in the groves. It would emphasize interpretation and education of management activities, focusing on the historical areas on the Hume Lake District and on natural settings on the Tule River and Hot Springs Ranger Districts. **Transportation Strategy.** Alternative 6 would emphasize retaining road access for public use and for management activities similar to current access levels. For public access, emphasis would be on maintaining roads to recreation sites, dispersed areas, special use sites, and private land. An extensive road system would be available for recreation driving and off-highway vehicle use. For management access, emphasis would be on ecosystem restoration and fire protection. Roads with high risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on unclassified roads and those classified roads producing unacceptable impacts where repair or relocation is unreasonable. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to administrative sites, to replace roads producing unacceptable resource impacts, or to provide access for research. The maintenance strategy would be to continue to request funds to reduce the maintenance backlog and keep the road system in acceptable condition.

Alternative 6 would make changes to the management goals for some of the key resources. It differs from the Proposed Action in that it would establish a new land allocation for the entire Monument, create three management areas within the groves (Management Areas GSG1, GSG2, and GSG3), and would therefore modify two of the three management areas in the Proposed Action (see Figure II-7 in the Map Packet), as follows:

Management Area ZOI-NG, Zones of Influence without the Groves: The ecological zones of influence that surround the giant sequoia groves, not including the sequoia groves themselves. Generally these areas are defined by the boundaries of the watersheds where the giant sequoia groves are found. These boundaries are described in the Forest Service draft report entitled Defining Ecological Zones of Influence for Giant Sequoia Groves on the Sequoia National Forest.'s The zones of influence are the areas within which management activities could both directly and indirectly affect grove ecology. **Management Area HLHA, the Hume Lake Historic Area:** This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. This MA remains the same for all alternatives. **Management Area GML, General Monument Lands:** The rest of the Monument not included in Management Areas ZOI-NG, HLHA, GSG1, GSG2, or GSG3. It includes a wide variety of vegetation types and ecological zones.

Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems.

Management Area GSG1: Giant sequoia groves that have had no significant disturbance for the last 120 years and with little regeneration.

Management Area GSG2: Giant sequoia groves that were substantially cutover during the late 1800s and early 1900s, leading to heavy stands of second growth mixed conifer-giant sequoia forests.

Management Area GSG3: Giant sequoia groves that had logging disturbances within the last 20 years, leading to well-established patches of young seral stage mixed conifer and giant sequoia vegetation.

Desired Conditions

For Alternative 6, the desired conditions are the same as for all of the action alternatives being considered (see the Desired Condition section of Management Direction Common to All Action Alternatives's).

Management Goals

Giant Sequoias and the Surrounding Ecosystems.

Protect giant sequoia groves and the surrounding ecosystems by ensuring that they are resilient to natural events (e.g. wildfires, floods, epidemic outbreaks of insects and diseases) and other events that are contrary to, or disruptive of, ecological processes that are necessary for a healthy and sustainable ecosystem (common to all action alternatives).Protect the hydrologic functions and soil resources upon which the groves and surrounding ecosystems depend (common to Alternatives 5 and 6).

Protect blue oak in the lower Westside hardwood ecosystem, and improve the viability of black oak in the mixed conifer forest (common to Alternatives 2, 3, 5, and 6).

Protect communities by completing fuel treatments for community protection within the first three decades of plan implementation (common to Alternatives 2, 5, and 6).

Restore groves and their surrounding ecosystems to reflect historic conditions, which include a fire return interval of frequent and generally low-intensity fires; a mosaic of different age and size classes of vegetation; and regeneration and recruitment of shade-intolerant species such as pines, giant sequoias, and hardwoods (common to all action alternatives).

In conifer plantations, apply the necessary vegetation management and fuels treatments to promote the re-establishment of natural processes and vegetation conditions consistent with the potential natural vegetation of the site (common to all action alternatives).

Reduce the risk of catastrophic fire in the conifer, chaparral, and lower Westside hardwood ecosystems. Restore a more frequent fire return interval and create a diverse mix of age classes and structural diversity using the historic conditions prior to 1875 as a reference (common to all action alternatives).

Adapt management strategies over time to reflect current monitoring and the best available scientific information (common to all action alternatives).

Coordinate planning and implementation of protection and restoration projects with private landowners and adjoining agencies, which include the Sequoia and Kings Canyon National Parks, Mountain Home State Forest, the Universities of California (Whitaker's Forest), and the Tule River Indian Tribe (common to all action alternatives).

Treat approximately 5% of the giant sequoia grove management areas per year to move toward desired future conditions and to meet protection and restoration goals.

Dispersed and Developed Recreation.

Manage scenic resources to maintain or enhance high scenic value. Develop scenic vistas to view icons and special features of the Monument (common to all action alternatives).

Increase recreation facility capacity for overnight camping, day use, education and

interpretation, and other appropriate recreational activities (common to Alternatives 5 and 6).

Use a science-based method to collect visitor information, such as the National Visitor Use Monitoring System. Use these data, as well as other information, to help determine the demand and need for additional visitor facilities and services (common to all action alternatives).

Improve visitor facilities, information, and services to help meet projected demand for recreation and visitation in cooperation with permittees; cooperators; county, state, and federal agencies; tribal governments; recreational user groups; and the business community (common to Alternatives 2, 5, and 6).

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, for hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Improve recreation, interpretation, and education opportunities by connecting, linking, and coordinating facilities, services, and themes whenever feasible (common to all action alternatives).

Increase recreation opportunities, including developed sites, in or near giant sequoia groves to provide a varied range of recreational and educational opportunities.

Transportation System.

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Provide enjoyable and safe opportunities for riding off-highway vehicles, including snowmobiles, on designated roads within the Monument (common to Alternatives 2, 4, 5, and 6).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Management Areas, Management Emphases, and Standards and Guidelines

Direction Common to All Management Areas

Management Emphases:

Emphasize natural regeneration for restoration of giant sequoia and associated species, including pines and oaks.

Emphasize re-establishment of the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Expand overnight recreational opportunities within or in close proximity to giant sequoia groves.

Maintain current levels of road and trail access for public and administrative use consistent with protection of the objects of interest.

During the first three decades, emphasize a protection strategy. Shift over time to a restoration strategy.

During initial treatments, emphasize establishment of young conifer trees and other vegetation

in existing openings in the stands or where existing vegetation levels are very low, consistent with applicable management strategies for the area.

Prior to decommissioning roads, consider opportunities for their use as recreation trails.

Use a combination of prescribed fire and mechanical methods to ensure protection and ecological restoration goals are met. Mechanical methods in advance of or immediately after prescribed fire would be most appropriate where the use of prescribed fire alone poses unacceptable risks to other values (e.g., urban areas, wildlife habitat, recreation, watershed) or will not achieve protection or restoration goals when used alone.

Create desired structural conditions to meet ecological restoration goals for indicators such as gap and patch size and vegetative structure.

Standards and Guidelines:

Manage the mixed brush-chaparral ecosystem to develop and maintain a broad mix of age classes and structural diversity by burning on a 20-to-50 year cycle.

Use restoration treatment areas across the landscape for the restoration of fire, with an annual average program based on the desired fire return interval by vegetation type. Treat fire-dependent ecosystems to restore a more frequent fire return interval, using prescribed fire as the primary treatment method to reach the desired condition. A restoration treatment area is an area from 50 to 500 acres in size where mechanical treatments and/or prescribed fire are applied for the restoration of fire, rather than for protection purposes. The boundaries of restoration treatment areas are determined locally based upon landscape analysis. Overall treatment programs are based on the desired fire return interval for each specific vegetation type.

Limit removal of live trees to those equal to or less than 30 inches in diameter. Larger trees may be removed based upon site-specific landscape analyses if clearly needed for development, restoration, or maintenance of recreation and administrative sites; for emergency situations; for public health and safety; as part of a scientific study; or for the protection or restoration of special features such as monarch giant sequoia trees.

When treating stands mechanically, create gaps that are typically one acre or less in size, irregularly shaped, and no larger than two acres in size. This does not apply to openings created to expand or develop new facilities, such as campgrounds.

When treating stands mechanically, limit new gaps development to approximately 5% of the area. This does not apply to openings created to expand or develop new administrative or recreation facilities, such as campgrounds.

Management Area ZOI-NG, Zones of Influence without the Groves. This management area is a modified version of Management Area ZOI-WG in Alternative 2, the Proposed Action. It consists of the ecological zones of influence for the giant sequoia groves and their surrounding ecosystems, *outside* of the boundaries of the groves themselves (Management Area 4 in this alternative). These boundaries are described in the Forest Service draft report entitled Defining Ecological Zones of Influence for Giant Sequoia Groves on the Sequoia National Forest.'s The zones of influence are the areas within which management activities could both directly and indirectly affect grove ecology. There are approximately 64,370 acres in this management area.

Management Emphasis:

Encourage scientific research. Focus research on potential impacts of management and human use on giant sequoia ecology, restoration, and protection.

Standards and Guidelines: None proposed.

Management Area HLHA, Hume Lake Historic Area. This area of extraordinary historical and cultural value is the general site of the logging operations of the early 1900s. Private logging companies harvested the sequoias from the surrounding areas and established a mill site, a dam, and a small town now known as Hume Lake. This management area also includes the Millwood, Abbott Mill, and Lower Abbott Mill sites. It contains approximately 15,680 acres.

Management Emphases:

Preserve and interpret this historical landscape and its associated ecosystems. Provide a wide range of recreational and interpretive opportunities.

Provide interpretive and educational materials emphasizing the relevance, fragility, and values of the area's heritage resources and ecology.

Emphasize the desired fire return interval by vegetation type in developing annual and long-range prescribed burning programs.

Standards and Guidelines: None proposed.

Management Area GML, General Monument Lands. This management area consists of the part of the Monument not included in Management Areas ZOI-NG, HLHA, GSG1, GSG2, or GSG3. It includes a wide variety of vegetation types and ecological zones. Much of it is covered with mixed conifer stands but this management area also includes low elevation chaparral, lower Westside hardwood, and red fir ecosystems. This management area contains approximately 219,500 acres.

Management Emphases:

Emphasize the use of mechanical methods in conjunction with prescribed fire to meet goals for protection and restoration.

Reduce fuel loads, especially down slope of the groves, and return to a more natural fire return interval.

Encourage scientific research. Focus research on protection and restoration of natural processes and caves.

Standards and Guidelines:

Use a combination of prescribed fire and mechanical methods to ensure protection and ecological restoration goals are met. Mechanical methods in advance of or immediately after prescribed fire would be most appropriate where the use of prescribed fire alone poses unacceptable risks to other values (e.g., wildlife habitat, recreation, watershed) or cannot meet goals.

Treat the majority of the landscape during the first two decades to protect against catastrophic fire, to restore a desired fire return interval, and to develop desired structural conditions for key ecological indicators.

Management Area GSG1. Giant sequoia groves dominated by trees over 150 years old and with less than 3% in other age groups. There are approximately 12,870 acres in the following groves: Agnew, Alder Creek, Belknap Complex, Burro Creek, Cunningham, Deer Creek, Deer Meadow, Dillonwood, Evans Complex (southeast portion), Freeman Creek, Maggie Mountain, Middle Tule, Monarch, Upper Tule, Mountain Home, Red Hill, Silver Creek, South Peyrone, and Wishon. These groves have had little or no regeneration of young giant sequoia or other mixed conifer vegetation in the last 120 years or more.

Management Emphases:

Re-introduce natural processes and structural conditions that promote establishment of new groups of young vegetation.

Emphasize protection measures to reduce the risk of catastrophic fire.

Standards and Guidelines: None proposed. ***Management Area GSG2.*** Giant sequoia groves with significant amounts of trees 20 to 150 years old. There are approximately 8,070 acres in the following groves: Converse Basin, Abbott Creek, Big Stump, Cherry Gap, Evans Complex (northeastern portion), Grant Grove, and Indian Basin.

Management Emphases:

Protect groves from catastrophic fire.

Manage existing second growth stands to meet the desired condition by using the key indicators discussed by Piirto and Rogers (1999).

Manage the Converse Grove as an area of focused scientific research.

Study the response of second-growth giant sequoia and mixed conifer forests to different management strategies and techniques.

Emphasize careful stocking control with prescribed burning, mechanical methods, or a combination of methods to meet protection and restoration goals and move toward desired condition.

Standards and Guidelines: None proposed. ***Management Area GSG3***. Giant sequoia groves with significant amounts (more than 3% of their area) of trees 10 to 20 years old. There are approximately 5,730 acres in the following groves: Bearskin, Black Mountain, Landslide, Long Meadow, Packsaddle, Peyrone, Redwood Mountain, and Starvation Complex.

Management Emphases:

Ensure the careful management of the existing age classes.

Protect the groves from catastrophic fire.

Manage the Redwood Mountain Grove as an area of focused scientific research.

Study the response of generally undisturbed late seral stage giant sequoia and mixed conifer forests to prescribed fire management strategies and techniques.

Emphasize a collaborative research program that takes advantage of the multiple agencies that manage this area (National Park Service, UC Berkeley, USDA Forest Service).

Emphasize mechanical treatments to control stocking and to meet the desired condition until vegetation conditions allow the stand to be resilient to prescribed fire, then use fire as the primary method for meeting the desired condition.

Standards and Guidelines:None proposed.

Return to top of page.

Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information displayed in Table II-1, Comparison of Alternatives by Issues and Indicators, is focused on activities and effects where different levels of effects or outputs can bedistinguished quantitatively or qualitatively among alternatives. Also included are Tables II-2, Comparison of Alternatives by Treatment Methods, and II-3, Comparison of Alternatives by Strategy.

Table II-1: Comparison of Alternatives by Issues and Indicators

The following acreages were developed for use in the analysis of effects of implementing the alternatives. They were developed using the Spectrum's computer modeling system and applying the management direction and standards and guidelines for each alternative. These figures are estimates of treatments for the first decade of implementation and are not intended to be site-specific. The actual amount of area treated would vary as landscape analyses are conducted.

Table II-2: Comparison of Alternatives by Treatment Methods for the First Decade

Table II-3: Comparison of Alternatives by Strategy

Preferred Alternative

The preferred alternative is Alternative 6.

Return to top of page.

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF
· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Chapter III Affected Environment

Affected Environment. III-1 | Resource Management. III-2 | Ecological Units. III-2 | Air Quality. III-26 | Caves. III-34 | Fire and Fuels. III-35 | Geology and Soils. III-49 | Giant Sequoia and Mixed Conifer. III-52 | Range. III-66 | Rare Plants. III-68 | Watershed. III-71 | Wildlife. III-95 | Human Use. III-111 | Heritage Resources. III-111 | Recreation. III-122 | Scenic Environment III-131 | Socio-Economics. III-135 | Transportation. III-140 | Roads. III-140

Affected Environment

This chapter presents information on the resource components for the Monument. It describes the affected environment or existing condition of each resource.

The resource components are divided into three categories, as follows:

Resource Management

Ecological Units

- Air Quality
- Caves
- Fire and Fuels
- Geology and Soils
- Giant Sequoia and Mixed Conifer
- Range
- Rare Plants
- Watershed
- Wildlife

Human Use

- Heritage Resources
- Recreation
- Scenic Environment
- Socio-Economics
- Transportation Roads

Ecological Units

The purpose of this section is to give an overview of the ecological processes and vegetative structure in the nine major vegetative plant communities found in the Monument. This discussion will help the reader understand other resource-specific discussions in both the Affected Environment and Environmental Consequences chapters of this statement. The nine plant communities are classified into ecological units. Ecological units are geographic areas used to stratify the Monument. They delineate areas with similar potential natural vegetation, soils, bedrock and surface geology, and geomorphology. In addition to physical characteristics, an ecologic unit is composed of areas with similar dominant ecologic processes such as fire and succession. By stratifying the Monument in this way it becomes possible to describe trends in these processes and properties over time.

Potential natural vegetation is the floristic community that would be established if all of the

successional sequences of its ecosystem were completed under present environmental conditions, without additional human-caused disturbance. Grazing by native fauna, natural disturbances such as droughts, floods, wildfires, insects, and diseases are inherent in the development of potential natural vegetation, which may include naturalized non-native species (USDA, 1991). Because of the many changes that have occurred since the early 1800s, the existing vegetation is not necessarily the potential natural vegetation. The existing vegetation is very similar to the potential natural vegetation, but recent ecological changes caused by fire suppression and disruption of the fire return interval have led to changes in key attributes such as species composition, age class distribution, and stand structure. The potential natural vegetation provides a baseline against which the current condition can be measured.

Landscapes in the Monument were grouped into nine ecological units based on similarities in fire regime, slope steepness, soil depth, and potential natural vegetation. These nine units repeat across the Monument wherever similar ecologic conditions and processes prevail. Their labels and acreages are summarized in the following table:

Table III-1: Ecological Units

Ecological Unit Descriptions

Each ecological unit has a general description, a discussion of historic and current trends and conditions, and a discussion of overall vegetation and structure.

General Description. The general description provides an overview of vegetation, soil relationships, and geologic and climatic factors within the ecologic unit. Points of reference are given for each unit along with the unit's approximate acreage and median elevation with standard deviation around the mean. Where available, climate information is included along with general ecological conditions.

Historic and Current Conditions/Trends. These sections describe the dominant ecosystem processes that have formed the potential natural and existing vegetation in the ecological unit. These processes are primarily disturbance regimes and succession, but the type, extent, and nature of disturbances and successional processes that shape forests in the Sierra Nevada vary considerably by forest type (Skinner and Chang, 1996; Fites-Kaufman, 1997). Disturbances are events or actions, such as fire, disease, logging, avalanches, or landslides, which can change vegetation structure and composition. Successional processes refer to changes in forest structure and composition over time, sometimes in response to disturbance, and include tree establishment, maturation, and death.

Vegetation composition and structure are affected by disturbance regimes. With few exceptions, these disturbances have occurred for millennia, and plant species and communities have evolved and adapted to them over time. Disturbance performs important functions within the Sierran ecosystems An insect outbreak within a stand not only regulates species composition and structure by thinning individuals and creating openings, it creates spatial diversity across the landscape and it can provide opportunities for shrubs, forbs, and other low vegetation to maintain species diversity through time Because of these types of interactions, disturbances cannot be viewed as necessarily destructive or damaging. They are major processes that develop resources for use by other components of the ecosystem and establish system structure (Potter, 1998).

For many vegetation types in the Monument, fire and/or fire exclusion has had a great effect on distribution, species composition, and stand structure. Historic fire return intervals and regimes are summarized for each ecological unit, followed by a discussion of how fire historically affected the ecological units distribution on the landscape and any current trends in that distribution. Since fire is a dominant ecosystem process and a process that needs to be restored in the Monument, fire regimes are described in detail. It is relatively simple to understand the influence of single fires on specific ecosystem properties, but the importance of fire as an ecosystem process is greatly amplified by the complex pattern of fire effects over long time periods, multiple fire events, and numerous ecosystem properties (Sugihara, 2002). Like any classification, fire regimes simplify the complex patterns that occur within ecosystems. The treatment of fire regimes presents a defined set of attributes that are divided into three categories: temporal, spatial, and magnitude. Temporal fire regime attributes include seasonality, the time of year when fires burn, and fire return interval. Fire size and the spatial complexity of the burns are the spatial attributes, while fire intensity, fire severity, and fire type are magnitude attributes.

It should be noted that fire return intervals are influenced by the size of the area studied. For example, a 10,000-acre area could conceivably have a fire occur somewhere within it every year, resulting in a fire return interval of one year. In this document, fire return interval refers

to the number of years between fire events within an area five acres or less in size, unless otherwise stated. This is not meant to imply that the entire 5-acre area burned. Historic fire behavior is believed to have been extremely patchy in most vegetation types. However, it gives a perspective on the influence fire has had on the development of the Sierra Nevada vegetation.

Fire condition class is used to describe existing vegetation within an ecological unit. Condition class designates the degree to which an area has departed from historical fire regimes. It is a function of the number of fire return intervals (fire return interval departures) that have passed in an area without a fire occurring (See Figure III-5 in the Map Packet). Departures from historic fire regimes result in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire suppression, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), or other past management activities. Condition class is divided into the following four categories (U.S. Forest Service, Cohesive Strategy 2000):

Category	Description
0	Water, rock, and other nonflammable areas

Fires are within an historical range and risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within an historical range. This is the assumed condition class of pre-1875 vegetation.

Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one to five return intervals (either increased or decreased). This results in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.

Fire regimes have been significantly altered from their historical range. The risk of losing a key ecosystem component is high. Fire frequencies have departed from historical frequencies by multiple (more than 5) return intervals. This results in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

Vegetation Composition and Structure. Vegetation composition is the unique combination of plant species that occur together under a specific range of ecologic processes and conditions. Species that are used to describe a given vegetation composition are generally the species that have the greatest effect on microclimate and ecologic processes, usually the trees and prevalent shrub species. Any single species may occur in more than one ecologic unit. However, it would be under different environmental conditions in the different units, and in combination with a different suite of species. For example, white fir may occur with other conifers to form the Sierran mixed conifer vegetation type, but it will also occur at higher elevations within the red fir vegetation type.

Vegetation composition can be described in terms of the existing vegetation or the potential natural vegetation. For most ecological units, it is assumed that potential natural vegetation is the historic, pre-1875 vegetation. Though today's climate differs from the pre-1875 era, the historic vegetation is considered a valid substitute. Exceptions occur along the boundary between chaparral and montane hardwood forest where today's overwhelming stand-replacing fire regime may preclude ever reaching the historic condition. Therefore it cannot be considered as potential. Comparisons of potential natural vegetation and existing vegetation are useful in that they can be used to demonstrate general trends through time.

Blue Oak and Interior Live Oak (foothill woodlands).

General Description. This foothill woodland unit is scattered along the western foot of the Sierra Nevada, generally where moderately steep slopes and open flats mix with steep slopes. The Hot Springs Ranger District office is a point of reference within the unit. The mean annual precipitation is about 18 to 30 inches. It is practically all rain. This unit is entirely within the thermic temperature regime and the mean annual temperature is about 52 to 64 degrees Fahrenheit. All but the larger streams are generally dry during the summer. Soils are largely deep and well drained, supporting a potential natural vegetation of blue oak and annual grasslands variably mixed with tree form interior live oak. Steeper inner gorge slopes with shallow, somewhat excessively drained soils have a potential natural vegetation of chaparral and a shrub form of interior live oak. The mean elevation for this unit is 3,911 feet.

Historic and Current Conditions.

Fire Regime. Historically, American Indians used fire to manage populations of key plant species, including oaks and seed producing grasses, within foothill woodlands and grasslands. Low intensity fires were frequent, and likely formed large mosaics of burned and unburned areas. The introduction of non-native grasses altered the fuels pattern by adding more organic matter and creating a nearly continuous cover of easily ignited herbaceous material. Today, most of the area that burns does so in fires that are low intensity, with flame lengths less than 3 feet. A smaller proportion of the area burns at moderate to high intensity levels. Most of this area burns with surface fires as the flaming front. Some passive crown fire and ground fire are also present, but the flaming front is primarily surface fire. Persons using hand tools can generally attack the fire at the head or flanks. Fires are likely faster moving and burn across landscapes more completely because of the continuous fuels. Introduced annual grasses result in an expanded fire season because these species dry up and will burn months earlier than native perennial grass species. In this ecosystem the fire season is the longest of all the fire regimes in California, starting in May and lasting to November. It occurs with early spring warming and drying, where fire is primarily carried in the herbaceous fuel layer. This may make recovery after fires difficult for some species, particularly young blue oak. Early season fires could occur before they have a chance to store the energy needed for re-sprouting. Conversely, exclusion of fire from foothill woodland and valley grassland zones may also allow chaparral species to expand into them.

Fire Regime Changes. The fire return intervals have been increased because these fires are relatively easy to suppress. Introduction of non-native annual grasses has extended the fire season into the early summer. Fire size is greatly reduced because firefighters can easily suppress fires before they grow. Complexity, severity, intensity, and fire type are probably not greatly changed.

Plant Community Response. Changes to the species composition and burning season have occurred due to the introduction of non-native annual grass species, which occurred in the mid-1800s. The effects of invasive, non-native species have probably played as great a role in causing change to the composition of the native plant communities as the change to the fire regime.

Trends. Landscape patterns in this unit are highly variable and complex, partly due to environmental conditions and partly due to variation in recent fire regimes. Foothill woodlands are currently believed to be relatively stable at the bioregional scale, but historical ranges of this zone are not well documented. Historic fire regimes characterized by more frequent fires, patches or stands of blue and interior live oaks would have likely been uneven-aged, with patch distributions determined by environmental conditions, such as soil depth, fire, and climate. Intensive American Indian management of oak-dominated areas may have maintained more open stands in some areas than exist today.

Based on soil surveys of the area, approximately 80 percent of this unit has the ability to support blue oak and California annual grassland (Bohna soils). Currently this type is mapped on 38 percent of the unit. Chaparral and live oak vegetation types currently make up around 55 percent of the unit, which may indicate that fire suppression has been the most prevalent force. Portions of this unit are a combination of tree live oak and blue oak, but are mapped as live oak.

Vegetation Composition and Structure. As previously mentioned, invasions of exotic annual plants into blue oak woodlands and the loss of perennial grass dominated ecosystems have changed fire behavior. Fuels are more continuous and support a longer fire season because annual grasses cure earlier than perennials. More continuous fuels cause today's fires to be larger and less patchy than historical fires. This means that, in any single fire, the chances of a small tree within the fire perimeter being burned are increased. Also, the lengthening of the fire season toward early season fires may have negative effects on plants because early fires burn when plants have less stored energy for recovery than in late season fires. Increased mortality of small trees, and higher stress levels on re-sprouting trees and shrubs, may prevent stand sustainability and reduce biodiversity in foothill woodlands.

Type conversion (where one vegetation type is replaced with another) in the foothill woodland zone is a dynamic process. In some portions of this zone, fire exclusion has allowed fuels to accumulate, generally as understory shrubs. Hence, when fire occurs, they tend to be more intense. Blue oaks are generally not adapted to high intensity fires and they do not readily sprout following stand replacing fires. Over time, this results in some foothill woodland vegetation types being replaced with chaparral, or in an increase of more fire tolerant interior live oak relative to blue oak. It is believed that this relationship between chaparral and foothill woodland is extremely dynamic, even under historic conditions.

Chaparral and Live Oak (interior and canyon live oaks).

General Description. This unit is at low elevations scattered along the western edge of the Monument in drainages and along steep inner gorges. Slopes in these areas are steep to moderately-steep and include the inner gorge slopes of the Middle Fork Tule River, the Kings River, and the Kern River. This unit is mostly within the thermic temperature regime and the mean annual temperature is about 52 to 64 degrees Fahrenheit. The mean elevation for this unit is 3,859 feet. The mean annual precipitation is about 18 to 30 inches. It is mostly rain and runoff is rapid to the major rivers and their tributaries. There is a complex of deep and shallower soils. Rock outcrops and openings are common and become dominant in steeper areas. The droughty nature of these soils is reflected in schlerophyllus (waxy-leaved) vegetation that dominates this unit. Common shrubs include white leaf manzanita, mountain mahogany, yerba buena, and wedgeleaf ceanothus (buck brush). Interior live oak and canyon live oak are prevalent in the mapping area with interior live oak more abundant on south facing, warm slopes and canyon live oak on north facing, moister slopes and at higher elevations.

Historic and Current Conditions/Trends.

Fire Regime. Chaparral was among the first ecosystems where ecologists recognized the importance of fire in the ecosystem. This is because native chaparral species are highly adapted to periodic stand-replacing fire. Chaparral shrubs often form thickets and, once ignited, chaparral fires spread very rapidly. In chaparral fires, volatile organic compounds released from the burning foliage increase the intensity of the fires and cause the fire to spread. Most of the area that burns does so with fires that are mostly stand replacing where all or nearly all of the individual mature plants are killed. A small proportion of the area burns at lower severity levels. The intensity of the fire produces flame lengths between 10 and 13 feet, a fire too intense for direct attack at the head by persons using hand tools. This fire type is commonly an active crown fire. Most of this area burns with active crown fires as the flaming front. Fire season is generally late summer to fall when live fuel moistures are at their lowest. Fire occurrence and size are greatly influenced by east winds that most commonly occur during this fire season from September to early November.

Fire return intervals in chaparral types have been limited to estimates because the severe nature of the fires in chaparral renders the areas unsuited to the reconstruction of fire history with dendrochronological techniques (Minnich and Howard, 1984). Studies in chaparral types are limited to fire records from this century and previous anecdotal accounts (Parsons, 1981). Estimates are that pre-1875 fire return intervals depended upon local site conditions, proximity to areas of human use, and elevation. Fire return intervals were probably from twenty to fifty years with ranges of approximately ten to more than a hundred years (Keeley, 1982; Kilgore, 1987; Barro and Conrad, 1991).

Fire Regime Changes. Fire created mosaics of even-aged patches at fine scales and maintained the distribution of chaparral at landscape scales. Large even-aged patches currently occupy much of the landscape in the chaparral zone, and much debate centers on how the size of these patches has changed from pre-Euro American conditions. Frequent, low intensity fires in some types, particularly in adjacent ponderosa pine and foothill woodland zones, prevented encroachment of chaparral into these areas and so regulated its distribution. Currently chaparral fires tend to move into the mixed conifer ecosystems because of no discontinuity or variation of vegetation from the chaparral ecosystem to the mixed conifer ecosystem.

Vegetation Composition and Structure. The length and frequency of fire in chaparral ecosystems can differentially favor various plant species, depending upon their method of response to fire. In some areas, fires that occur too frequently can cause shifts in species composition, generally toward post-fire sprouting species or annual grasses. Over time, highly variable fire return intervals can lead to diverse patterns of vegetative communities, whereas short fire return intervals with little variation may lead to a reduction in vegetative diversity (Keeley, 1991). Regular fire regimes increase the clumpiness in shrub land landscapes by forming smaller patches than would be formed during longer fire-free periods. Longer fire return intervals are expected to push the chaparral landscape toward a more uniform distribution. Minnich (1987), for example, noted that shrub land fuels in the San Gabriel Mountains are more continuous than they were decades ago. Similar findings have been noted for the shrub lands of the Sequoia and Kings Canyon National Parks where, instead of a mosaic of different successional stands, old-age chaparral stands were found to be dominant across the landscape, and reduced fire frequency was suggested to be the cause (Vankat, 1970; Parsons, 1976; Vankat and Major, 1978). Fire return interval departure maps indicate 46 percent of this unit has missed five or more fire events, while 19 percent is within the historic fire regime.

Existing vegetation and potential natural vegetation are similar in distribution in this unit. Deeper soils support live oaks, and more shallow or rocky soils support chaparral species. Differentiation between where live oaks have taken the shrub form or tree form follows a similar pattern, with tree forms more prevalent on deeper soils and gentler slopes. Inclusions

of California black oak and ponderosa pine may be found on the most mesic sites, like north facing slopes at the unit's highest elevations. The transition area or ecotone between this unit and its neighbors was probably very dynamic, varying with fire frequency and drought.

Montane Hardwood and Montane Hardwood-Conifer.

General Description. This unit is scattered throughout the Monument in eight distinct areas that range in size from 758 to 11,061 acres. The mean elevation of this unit is 4,952 feet. Soils in this unit are often moderately deep and/or rocky. Rock outcrops and openings occur throughout the area. Soils tend to be in the warm mesic temperature classes and have low to moderate available water holding capacities that make them subject to drought in summer months. Mean annual temperature is about 50 to 60 degrees Fahrenheit, and mean annual precipitation is about 25 to 50 inches. It is mostly rain, and runoff is rapid to the major rivers and their tributaries. Potential natural vegetation is forest dominated by montane hardwood species, primarily California black oak with ponderosa pine present on deeper soils. Chaparral is prevalent on rocky, shallow soils and on more xeric, south facing slopes. Slopes in these areas are steep to moderately steep. They are dominated by mass wasting and fluvial landforms where rock falls, rockslides, debris flows, and channel erosion are the major geomorphic processes. Today, the high amount of disturbance and droughty soils help maintain a high proportion of hardwood species (California black oak, canyon live oak, and interior live oak) in the existing vegetation, even in areas where soils develop strong surface horizons. At higher elevations and on more mesic sites, this unit contains more of the conifer-dominated types of potential natural vegetation.

Historic and Current Conditions/Trends. Montane hardwood and montane hardwood-conifer forests are disturbance climax'; communities that only form true climax communities where conditions are too rocky or dry to support mixed conifer stands. They are composed of mostly shade-intolerant species, and depend on fire or other disturbance to maintain open, sunny stand conditions.

There are no published fire histories in montane hardwood and montane hardwood-conifer forests in the Sierra Nevada. Fire return intervals were probably similar to, if not longer and more variable than, those of more conifer dominated areas. They would tend to have less fuel accumulation and less continuous fuels because of the large amount of debris sliding and rock outcrops in these steep areas. The characteristic fire regime of this type of forest was probably one of relatively frequent, spatially variable fires of low to moderate severity. Additional management of this vegetation type by American Indians contributed to a frequent fire regime (Lewis, 1993). In a fire history study in steep ponderosa pine stands in the Klamath Mountains, median fire return intervals of eleven years (with a range of 3 to 55 years) were found on three sites by Skinner (Skinner, 1995).

Historically, variable fire intensities and fire patterns in this type of potential natural vegetation encouraged the development of heterogeneity in stand structure and age across the landscape. Currently, fires are infrequent and are generally of high intensity and stand replacing. Landscape patterns at all scales are generally homogeneous where similar environmental conditions prevail. It is estimated that from five to ten fire cycles have been missed in this type. According to the fire return interval departure data, which characterizes a frequent and spatially variable fire regime, 73 percent of this unit has missed five or more fire events, while only five percent is within historic fire frequencies.

Fire exclusion in the montane hardwood and montane hardwood-conifer forests has allowed the chaparral zone to encroach into areas formerly occupied by these zones. Consequently, the presence of chaparral in these forests changes the fire regime to one characterized by high severity fires that favor chaparral. The result is an uphill expansion of the chaparral zone at the expense of these vegetation types. Currently conifers are mapped on approximately 40 percent of the unit, chaparral on 15 percent, and live oak on 35 percent.

Vegetation Composition and Structure. Potential natural vegetation in this unit is dominated by California black oak and ponderosa pine, with other hardwood species locally important. Secondary hardwood vegetation is mapped on approximately half of the conifer forests in this unit. Within a montane hardwood-conifer stand, conifer cover may have been as high as 35 percent, based on data collected in a similar vegetation type in the San Pedro Martirs of Mexico that has experienced little to no fire suppression (Stephens, 1999, personal communication). Conifer cover in existing montane hardwood-conifer stands in the Monument tend to be more dense than that, with only 23 percent having densities less than 40 percent.

Ponderosa pine was likely more prevalent in the potential natural vegetation in drainages, toward the tops of slopes above canyons, and in pockets of more stable soils. California black oak is commonly associated with ponderosa pine. Burning by American Indians is considered a primary factor in the maintenance of black oak stands (Anderson, 1993). Without such

disturbance, it has been suggested that black oak would eventually be crowded out of most suitable sites and would retreat to scattered remnants in mixed conifer forests (McDonald, 1990).

Because of its proximity to Euro American settlements, historic logging in this type was intense, and most of the older larger trees were removed for use as building materials, firewood, and mine supports. These large hardwood and conifer trees played an important role in the landscape by providing shade and moderating environmental conditions. Interior live and canyon live oaks, and chaparral species are relatively more drought resistant than ponderosa pine and California black oak, so better adapted to the harsher, modern landscape. Existing vegetation includes approximately 55 percent of these drought tolerant types. Also, current stand replacing fire regimes favor species that regenerate through sprouting, like live oaks and chaparral species, over conifers, and to some extend, over California black oak. This ability has allowed them to persist in the landscape where conifers and California black oak were removed and to perpetrate the stand replacing fire regime we see today. Debris sliding and debris flows in this unit, caused by the steepness of the slopes, also helps maintain existing chaparral species even in areas where soils have developed strong surface horizons.

Mixed Conifer dominated by Ponderosa Pine.

General Description. This unit is scattered throughout the Monument in twelve distinct areas ranging from 1,290 to 27,500 acres in size. The mean elevation is 4,985 feet. Points of reference include the west slope of McKenzie and Pine Ridges in the north and Hatchet and Sugar Loaf Peaks in the south. This unit has slopes that are mostly moderately steep, but gentle and steeper slopes also occur. Soils are deep to moderately deep and are in the mesic temperature regime. Mean annual temperature is about 45 to 55 degrees Fahrenheit, and mean annual precipitation is about 30 to 60 inches. Much of the precipitation falls as snow. Runoff is rapid from most of the area. Maximum flow in these rivers is during the spring when snow is melting rapidly. This unit is mostly composed of relatively productive soils at low elevations in the mixed conifer and ponderosa pine forests. In addition to large areas of ponderosa pine potential natural vegetation, some giant sequoia groves, such as Deer Creek Grove and the most xeric portions of Converse Basin, are also found in this unit.

Historic and Current Conditions.

Fire Regime. The historical fire return interval is generally short, with some infrequent long intervals present within the same regime. Fire frequency decreased in the ponderosa pine forests during the late 1800s due to several factors. Initially, a decline in American Indian populations reduced their burning practices. This was followed by a loss of fuels from the herbaceous layer through intensive grazing. Later, direct fire suppression activities contributed to decreased fire frequencies in this forest type. These changes in fire regimes have resulted in changes in species composition, forest stand diversity, forest structural diversity, and the distribution of ponderosa pine forest.

Fires generally occur in summer and fall fire seasons, with most of the area burning from July to October. Most of the area that burns does so with moderate-sized fires that range from tens to hundreds of acres. Smaller and larger fires do occur but account for a small proportion of the total area burned in the ecosystem. Mixed conifer burns in a highly complex pattern of burned and unburned areas and severity levels. Ponderosa pine burns at a more intermediate level of complexity, producing both fine and course-grained mosaics of vegetation.

Fire intensities are low to moderate, ranging from less than three feet to ten-foot flame lengths, with the average favoring the low intensities. Persons using hand tools can generally attack low intensity fires (less than 4 feet), but moderate intensity fires are usually too intense for direct attack at the head with hand tools. Fires usually remain on the surface, although there can be complete consumption of understory vegetation. Fires range from low severity, where fires produce only slight to no modification to the structure of vegetation, to moderate severity, where stands are moderately modified. Most of the area that burns does so with surface fires as the flaming front, with some passive crown fires and ground fires. In areas of steep complex topography supporting conifer forest, active crown fire is often the flaming front when supported by surface fuel loadings.

Fire Regime Changes. Fires have been effectively excluded from this forest type for almost a century. Periods of intensive livestock grazing created discontinuous fuels in the herbaceous layer. This allowed stand densification and further fragmentation of the herbaceous layer fuels. Fire suppression has also been quite effective in this ecosystem. Fuels have accumulated on the forest floor and in the understory.

Fire return intervals are now greatly increased, with the longest intervals much longer than they

were historically. Fires are far less likely to burn early in the season. The most common fire size is probably smaller and fire complexity lower, with most of the area burning in a few large fires. Fires are generally higher in intensity and severity. A mix of surface, passive crown, and active crown fires has replaced what used to be surface fires with occasional torching.

Plant Community Response. The changes in fire regime have resulted in a greater occurrence of longer fire-free intervals. These long intervals present opportunities for the less fire-resistant white fir and incense cedar seedlings and saplings to grow to a size that is fire resistant. The number of these species is greatly increased, as well as tree density and crown closure. There has been a change from ponderosa pine to a mixed conifer forest type. Low intensity surface fires are suppressed and now rarely occur. Fire in the ecosystem occurs as stand-replacing fires.

Trends. The potential natural vegetation of this unit, ponderosa pine forest, has trended toward extinction. At higher elevations and in mesic portions of the unit, pre-Euro American fire regimes largely eliminated white fir and favored pines. When fire was excluded from these forest types, fire-intolerant species, such as white fir and incense cedar, began to regenerate rapidly. This caused forests to become dense with more shade in the understory, a condition that further favored firs over shade-intolerant pines, hardwoods, and herbaceous species. Today, much of these formerly pine-dominated forests have been converted to mixed conifer stands, with a different structure and fire regime from the historic vegetation. The existing vegetation maps indicate that nearly half of the conifer forest in this unit is believed to include white fir and other conifer species. Currently, up to 74 percent of this unit has missed five or more fire events, and only nine percent is believed to be within the historic fire regime.

The changes to the ponderosa pine forest of the Sierra Nevada have been greatest at lower elevations. As previously mentioned in the montane hardwood and montane hardwood-conifer unit, decades of fire exclusion at low elevations have resulted in changes in fuel loading and fuel distribution. Following large severe fires, shrubs occupy sites for very long periods before the pine can again attain a superior position (Husari, 1980; Andrews, 1994). But instead of giving way to pine, these brush fields may also maintain a continual cycle of fire, therefore maintaining the brush type (Andrews, 1994) and causing the long-term retreat of the forest edge up the slopes of the Sierra Nevada. The ponderosa pine ecological unit is literally being squeezed from both sides. Current vegetation is mapped as 12 percent chaparral and 33 percent live oak types.

Fire return interval studies conducted in ponderosa pine vegetation types are not differentiated from studies conducted in the lower mixed conifer of the southern Sierra Nevada. Fire return intervals were found to range from eight to ten years on one-hectare plots (Kilgore and Taylor, 1979) and from five to seven years on 15 to 35-hectare plots (Wagener, 1961). Surface fires were most common, with occasional flare-ups occurring in brush patches or snags. Crown fires were unlikely in most stands and canopies were kept open with spaced trees in an uneven-aged structure (Husari, 1980). Long loosely packed pine needles and herbaceous species maintained frequent and mild surface burns. Landscape patterns were generally fine-grained, that is at the one-acre scale; small to moderate-sized openings were created generally by fire, where seedlings became established. When looking at the landscape as a whole (hundreds of acres), the pattern was fairly homogeneous overall. These forests are believed to have been more resilient to disturbance than the existing vegetation.

Vegetation Composition and Structure. The characteristic fire regime of much of the Sierra Nevada (frequent fires of low to moderate severity) favored the development of ponderosa pine-dominated forests on many different types of sites. Ponderosa pine (potential natural vegetation) existed where the sites were continually disturbed by fire or mass wasting, or were warmer, dryer, or had limited soil development, compared with other mixed conifer sites. Historic frequent low-severity fires created openings for pine and hardwood seedling establishment, thus maintaining their persistence. These fires also thinned saplings and maintained the relatively open understories documented by early settlers (Muir, 1894; Sudworth, 1900; Leiberg, 1902; Cooper, 1961). More open and diverse conditions meant that fires were generally less severe and that inter-tree competition was less intense than today. With less inter-tree competition, forests were better able to withstand drought and disease. Today, the denser stands have experienced extensive mortality resulting from droughts, either directly from drought stress or from stress-induced bark-beetle outbreaks (Weatherspoon, et al, 1992).

Montane hardwoods, particularly California black oak, are an important part of these forests and have been affected similarly to ponderosa pine. Though California black oak may persist for long periods of time under dense conifer canopies, it generally does not reproduce under these conditions and experiences gradual loss of crown area, ultimately leading to death. Additionally, very old trees do not sprout vigorously, so disturbance plays an important role in rejuvenating stands and maintaining stand resilience. Trees grown from seeds, though

infrequent, are important for maintaining the genetic viability of oak populations. Successfully sustaining California black oak in these stands relies on activities that open stand canopies and limit conifer competition. Fire exclusion has allowed these forest types to become denser with unthinned seedlings and brush. Effects to the herbaceous layer are unknown but, in areas of dense forest, the loss of species associated with open growing conditions is likely.

The established plantations of mixed conifer species are generally well stocked, primarily with ponderosa or Jeffrey pine. There has been a slow trend towards additional mixed conifer species as shade-tolerant white fir and incense cedar encroach into the plantations from adjacent stands. The plantations still do not meet desired conditions in such key elements as gaps and stand structure. Gaps within mixed conifer forests were historically small (1/4 acre to a few acres in size), whereas the average plantation is 12 acres in size. Within stands of this size under desired conditions, there would be a diverse mix of age classes and tree sizes. Currently these plantations, since they were started at the same time, contain little variation in tree heights or diameters. They are also highly susceptible to wildfire. The combination of heavy brush competition, low-lying tree limbs, and short crowns puts these stands at high risk of severe damage from wildfire. In plantations where trees have been thinned and brush has been controlled, this risk is greatly reduced. These kinds of plantations, with similar conditions, exist in the other mixed conifer and upper mixed conifer ecological units.

Pockets of giant sequoia can be found in this unit where soil and hydrologic conditions support them. Generally, mixed conifer (potential natural vegetation) will be found at higher elevations and in areas where cold air from above drains into and pools, creating cooler, more mesic conditions and slightly longer fire return intervals.

Mixed Conifer including Giant Sequoia.

General Description. This unit occurs predominantly in the northern portion of the Monument at a mean elevation of 6,044 feet. Points of reference include the Converse and Evans Complex Groves. This unit is in the mesic temperature regime, but is generally cooler than the ponderosa pine unit. Soils are moderately deep to very deep and have low to moderate available water holding capacities, but are usually not droughty in normal precipitation years. Potential natural vegetation is mostly mixed conifer forest: a combination of three or more conifer species, one of which is white fir. Areas of moderately deep or shallow soils will generally support more open mixed conifer forests with higher percentages of pines and hardwoods. Snow line is often found in this unit during the winter months. Giant sequoia groves comprise about 18 percent of the unit. Greater detail concerning giant sequoia ecology can be found in the Giant Sequoia and Mixed Conifer section of this chapter.

Historic and Current Conditions.

Fire Regime. In the southern Sierra Nevada, the fire regime was generally one of frequent fires of low to moderate severity, with occasional, typically small, patches of high-severity fires (Kilgore, 1973). Mean fire return intervals in five giant sequoia groves were found to range from approximately three to eight years (Swetnam, 1993). Importantly, fire scars used to document these fires were found generally in late wood, wood grown during late summer or fall. The longest fire-free interval in five of the giant sequoia groves was 30 years. Fire return intervals are believed to have been longer and fire intensities more mixed in those areas dominated by white fir and at higher elevations.

Fires generally occur in summer and fall fire seasons, most of the area burning from July to October. Most of the area that burns does so with moderate-sized fires that range from tens to hundreds of acres. Smaller and larger fires do occur but account for a small proportion of the total area burned in the ecosystem. Mixed conifer and giant sequoia mostly burn in a highly complex pattern of burned and unburned areas and severity levels.

Fire intensities are low to moderate, ranging from less than 3 feet to 10-foot flame lengths, with the average favoring the low intensities. Persons using hand tools can generally attack low intensity fires (less than 4 feet), but moderate-intensity fires are usually too intense for direct attack at the head with hand tools. Fires usually remain on the surface, although there could be complete consumption of understory vegetation. Fires range from low severity where fires produce slight to no modification to the structure of vegetation, to moderate severity where stands are moderately modified. Most of the area that burns does so with surface fires as the flaming front, with some passive crown fires and ground fires. In areas of steep complex topography supporting conifer forests, active crown fire is often the flaming front when supported by surface fuel loadings.

Fire Regime Changes. Fires have been effectively excluded from this forest type for almost a century. Periods of intensive livestock grazing created discontinuous fuels in the herbaceous

layer. This allowed stand densification and further fragmentation of the herbaceous layer fuels. Fire suppression has also been quite effective in this ecosystem. Fuels have accumulated on the forest floor and in the understory.

Fire return intervals are now greatly increased, with the longest intervals much longer than they were historically. Fires are far less likely to burn early in the season. The most common fire size is probably smaller and fire complexity lower with most of the area burning in a few large fires. Fires are generally higher in intensity and severity. A mix of surface, passive crown, and active crown fires has replaced what used to be surface fires with occasional torching.

Trends. The mixed conifer forests form a fairly continuous belt from north to south through the Monument. Breaks in this unit's continuity include river canyons, large burned areas, and private lands. Stand-replacing fires have created large homogeneous blocks of even-aged vegetation, whereas less variation used to occur at this scale. Historically, frequent fires maintained an ever-shifting mosaic of tree ages at a very fine scale. A single stand would include all age classes, from large individual trees to pockets of small regeneration. Today's fire regimes and vegetation management have created denser and more even-aged forests, substantially altering these historic fine-scale patterns. Fire return interval departure maps indicate that 74 percent of this unit has missed five or more fire return intervals, while less than two percent is within the historic fire regime.

Changes in distribution of conifer forests can be caused by a prolonged period of intense, stand-destroying fires. This is thought to convert mixed conifer ecosystems to a montane chaparral (Husari, 1980). Ten percent of this unit is currently mapped as chaparral or live oak, indicating that type conversion to chaparral does not appear to be pronounced.

Vegetation Composition and Structure. Mixed conifer forest (potential natural vegetation) in this ecological unit is highly variable in composition (Eyre, 1980), and the proportion of each species in a stand is thought to be determined by soils, elevation, precipitation, and fire frequency. More frequent fire favors a higher percentage of fire-adapted pines and giant sequoias; less frequent fire favors less fire-tolerant white fir and incense cedar. The density of white firs in the Sequoia and Kings Canyon National Parks have been observed to increase during times of reduced fire frequency (Vankat and Major, 1978). Today, some giant sequoia groves are so dense with white fir that understory species are all but absent. Typical understory species include Sierra chinquapin, white-veined wintergreen, Sierra gooseberry, false Solomon's seal, bracken fern, and California hazelnut. Mixed conifer, including white fir forest, is currently mapped as 65 percent of this unit. Ponderosa pine is mapped as 20 percent.

This ecological unit has numerous conifer plantations created primarily by harvesting and replanting in the 1960s through 1980s. The conditions in these plantations are described in the previous section (Mixed Conifer dominated by Ponderosa Pine).

Fire return intervals before European settlement were thought to maintain uneven-aged stands (Weaver, 1974), which were dominated by larger, older trees as compared with today's predominantly smaller, younger trees (Andrews, 1994). Present-day stands in Sierra Nevada national forests are significantly younger than those found in national parks. This point demonstrates the changes in structure of today's forests and the documented loss of old growth forest on national forest system lands. Approximately 30 percent of the existing conifers in this unit are mapped as medium to large trees (diameters greater than 24 inches).

Before European settlement, these ecosystems were probably more open than they are today (Weaver, 1974) and sufficiently open to support a well-developed herbaceous community of forbs, perennial bunchgrasses, and dispersed shrubs. These understory components no longer exist and are impossible to describe in detail from available historical data. Systematic removal of sugar pine from this unit and higher elevation units has further changed the species composition of these forests.

Mixed Conifer dominated by White Fir and Sugar Pine (with Giant Sequoia inclusions).

General Description. This unit occurs in the southern portion of the Monument scattered in eight areas from Dillonwood Grove to Sunday Peak. It can be found in the North Fork of the Tule River, Bear Creek, Freeman Creek, and Deer Creek, and adjacent to the Tule Indian Reservation on its north and east sides. This unit has slopes that are moderately steep to steep. This unit falls mostly in the mesic temperature regime and has a mean elevation of 6,635 feet. Mean annual precipitation is about 30 to 60 inches, much of it falling as snow. Potential natural vegetation includes mixed conifer forests: forests that are dominated by at least three conifer species, one of which is white fir. This unit's soils are moderately deep to deep, and support mixed conifer with species compositions heavy to white fir due to the elevation. Sugar pine may make up a large portion of the species composition where site conditions are more open due to fire, shallow soils, or south aspect. Red fir may be present at

upper elevations and in cold air drainages. Giant sequoia inclusions can be found on up to five percent of this unit, particularly in the southern portion of the Monument.

Historic and Current Conditions/Trends. In the southern Sierra Nevada, the fire regime was generally one of frequent fires of mostly low to moderate severity with occasional, typically small patches of high-severity fires (Kilgore, 1973). In the mixed conifer type, where white fir is well represented by large, old trees, the fire return intervals were likely to have been longer and more variable than those in areas where larger, older white fir would be found only occasionally. Studies in the southern Sierra Nevada found pre-1875 fire return intervals of seven to 20 years. Ignitions were likely higher than in the lower mixed conifer forests (Vankat, 1983). However, fire spread less readily because biomass accumulated more slowly, the fuel was more compact, and weather conditions that will support a fire occurred less often. Fire suppression actions are thought to have had less effect on this potential natural vegetation and the upper montane forest described below, because fewer widespread fires would have been expected, even without fire suppression. However, the current fire return interval departure analysis does not reflect any difference between this unit and the more mixed conifer-dominated unit.

Stand-replacing fires occasionally occurred in fir-dominated areas of this unit where they initiated large associations of white fir and red fir. However, lower severity fires that created smaller canopy openings and, consequently, smaller patches of thinned saplings were the most common historically (Kilgore, 1971; VanWagtendonk, 1986; Taylor, 1993).

Vegetation Composition and Structure. The potential natural vegetation of this unit is differentiated from lower mixed conifer forests by its dominance of fir trees. Existing vegetation contains approximately 90 percent red fir or mixed conifer dominated by fir. Differentiation of red fir from white fir by remote sensing is problematic but, based on field observation, much of this is likely to be white fir. The cooler and more mesic conditions found in this unit allowed the generally fire-sensitive, young white fir to reach large size. On more xeric portions of the unit, lower-severity fires that created smaller openings also allowed for a large contingency of sugar pine. Much of this component was removed during the railroad logging days in the northern portion of the Monument. However, a large extent of the area remains dominated by sugar pine in combination with white fir in a fairly open forest condition.

This ecological unit has numerous conifer plantations created primarily by harvesting and replanting in the 1960s through 1980s. The conditions in these plantations are described in the previous section (Mixed Conifer dominated by Ponderosa Pine).

Upper Mixed Conifer Forest dominated by Jeffrey Pine (with Giant Sequoia inclusions).

General Description. This unit is located in the southern portion of the Monument and has a mean elevation of 6,691 feet. The largest area is located between Slate Mountain and the Kern River, from Indian Rock to Parker Pass. The other major area is located between Jordan Peak and Moses Mountain, along the North Fork of the Middle Fork Tule River. A smaller area is located between Dennison Peak and the Sequoia and Kings Canyon National Parks. Soils are shallow and excessively well drained, which tends to favor a potential natural vegetation of more drought-tolerant Jeffrey pine forests over white fir. The highest elevations of this unit will support red fir on the more moist sites. At the moderate and lower elevations, Jeffrey pine occurs on warm and/or droughty sites, but white fir becomes more important on north-facing slopes and in drainages. Large amounts of rock outcrops and shallow soils may help maintain an open stand condition and trees often grow in deep soil pockets among rocky areas. Drought and competition with drought-adapted shrubs will also limit the distribution of conifers to deeper soils and more mesic conditions. Sugar pine will occur as a part of the potential natural vegetation at lower elevations wherever open stand conditions prevail. Giant sequoia inclusions are found on less than five percent of this unit.

Historic and Current Conditions/Trends. Historically, fires occurred less frequently in these potential natural vegetation types than in lower elevation forests because the fire seasons are shorter, the environments moister, and the fuels are more compact and less continuous. Large amounts of rock outcrops contribute significantly to the discontinuity of fuels in the unit. Fire return intervals are generally long in duration, but lightning ignitions are abundant. Sixty-six percent of this unit has missed five or more fire return intervals, while six percent is considered within the historic range of variability.

The use of even-aged management and the replanting of clear-cuts to pine species and other mixed conifer species were prevalent throughout the late 1960s, 1970s, and 1980s. Plantation establishment has been generally very successful, and there are many even-aged Jeffery pine stands reaching 20 to 30 years of age.

Vegetation Composition and Structure. Jeffrey pine is the dominant conifer in this unit in both

the existing vegetation and potential natural vegetation. Typically it occurs in combination with other conifers, but on ridge tops and shallow soils it would likely be the sole dominant species. On southern or western exposures and/or on excessively well-drained soils, California black oak, canyon live oak, and sugar pine are typical associates of Jeffrey pine. Canopies with these species tend to be open, allowing for a well-developed understory of green-leaf manzanita, bitter brush, grasses, and other herbs. Little change in stand density and species composition corresponding with fire suppression has been observed in these areas.

For both the existing and potential natural vegetation, white fir is patchy, distributed in cool, moist drainages and valley bottoms, or northern and eastern exposures where soils allow. At higher elevations, white fir may mix with red fir. Where giant sequoia groves occur, they primarily occupy damp, concave slopes (valley bottoms, benches, and drainages) with deeper soils. Understory vegetation in giant sequoia groves include hydrophilic species like western azalea, bracken fern, and hound's tongue. Meadow and lodgepole pine are also found in the bottoms of some drainages, on areas of deposition, typically where soils remain saturated for a significant period of time.

This ecological unit has numerous conifer plantations created primarily by harvesting and replanting in the 1960s through 1980s. The conditions in these plantations are described in the previous section (Mixed Conifer dominated by Ponderosa Pine).

Red Fir and Jeffrey Pine

General Description. This unit occurs primarily at higher elevations in the southern portion of the Monument. It has a mean elevation of 8,079 feet. Points of reference include Jordan Peak, The Needles, Mitchell Peak, and Chimney Rock. This unit falls in the frigid temperature regime and, where soils allow, conifer production is limited mostly by temperature and exposure. The mean annual precipitation is about 40 to 60 inches, mostly falling as snow. Mean annual temperature is about 35 to 50 degrees Fahrenheit. Runoff is rapid and maximum flow in these rivers is during the spring when snow is melting. Soils are deep and well drained to moderately deep, and somewhat excessively drained. Deeps soils found on metamorphic parent materials and are typically rocky. This unit falls in the upper montane vegetation zone, one of the least altered and most contiguous forested types in the Sierra Nevada. Similar to the existing vegetation, red fir as potential natural vegetation falls mostly on more productive and cooler locations, whereas Jeffrey pine occurs on shallower soils and warmer aspects. These two types are highly intermixed in this unit.

Historic and Current Conditions/Trends. Historically, fires occurred less frequently in these forest types than in lower elevation forests because the fire seasons are shorter, the environments moister, and the fuels are more compact and less continuous. Fire suppression is believed to have minimally affected the ecology of red fir and other upper montane forests because fire effects are variable and fire return intervals generally long in duration. The burn season is typically a late summer, short fire season and, while lightning ignitions are abundant, fuels are mostly sparse and discontinuous, resulting in few fires. Red fir trees are considered intolerant of fire and large stand-replacing fires are rare in this type. However, the small openings that lightning fires create in the forest canopy play an important role in allowing for the germination of new trees and in maintaining a mosaic of trees of different ages.

Don Potter (1998) listed several fire interval studies and stated that: On the basis of a sample of 16 trees adjacent to three stands in the southern Sierra Nevada, Pritcher (1987) estimated an average return interval of 65 years with a range of 5 to 126 years. On the basis of 117 trees within 68 stands in the central and southern Sierra, an interval of 53 years with a minimum of 7 years and a maximum of 141 years was estimated (Unpublished data on file at Supervisor's Office, Stanislaus National Forest, California).'; Potter (1998) goes on to say that Fire size in the upper montane ranges widely; however, the overwhelming majority of fires appear to be small. Thus, of 39 lightning-caused fires reported in the Emigrant Basin Wilderness Area of the Stanislaus National Forest between 1951 and 1973, nearly 80 percent were less than a quarter acre, and none were larger than 10 acres (Greenlee, 1973).';

Most of this unit (65%) is believed to have missed between one and five fire events, placing it at a moderate risk of losing a key ecosystem component. An additional 12 percent is considered within the historic fire frequency.

Avalanches may play an important role in the disturbance regimes of this unit. They are more common in years of heavy snowfall and typically originate on slopes greater than 40 percent where tree cover is sparse. Avalanche chutes are often located where previous avalanches have occurred. They provide important diversity at the landscape scale by providing refuge for open-growing herbaceous and shrubby species (Potter, 1998).

Vegetation Composition and Structure. Potential natural vegetation and existing vegetation are

highly mixed vegetation types and reflect the mosaic of soil productivities and aspects in this ecological unit. Red fir, often in association with white fir, will dominate more productive sites, with Jeffrey pine occurring on rockier and more south-facing slopes. At lower elevations in the unit, soils with low site productivity or rock outcrops will generally support montane chaparral like huckleberry oak, Prunus sp., and bitterbrush. Wooly mule's ears and high elevation grasses may dominate shallow soils and openings at the higher elevations. Lodgepole pine will be present in drainages and on flatter terrain. At the lowest elevations in this unit, white fir and sugar pine may become important.

Regeneration is limited by temperature and exposure. Soil temperatures at approximately 8,000 feet elevation on the Stanislaus National Forest never exceeded 44 degrees Fahrenheit when measured throughout one summer. Red fir trees do not initiate root growth until soil temperatures are above 40 degrees, so the growing season is very short.

Red Fir and Lodgepole Pine with Meadow Inclusions.

General Description. This unit occurs in the higher elevations of the Monument between Grant Grove and Marvin Pass to Chimney Rock; between Quaking Aspen and Junction Meadow; and on the west side of the Greenhorn Mountains at Tobias Pass. It has a mean elevation of 7,543 feet. The mean annual precipitation is 40 to 60 inches, mostly falling as snow. The mean annual temperature is about 35 to 50 degrees Fahrenheit. This unit occurs frequently in broad canyon bottoms and slopes tend to be moderately steep to gentle. Meadows are a common inclusion. Small amounts of mixed conifer as potential natural vegetation occur at the lowest elevations in the unit, and Jeffrey pine as potential natural vegetation can be found on shallow soils. Aspen can be found in very limited locations and amounts in both the northern and southern portions of the Monument.

Historic and Current Conditions/Trends. Historic fire frequencies in this ecological unit were high, with many lightning-caused ignitions. However, similar to other upper montane units, spread of fires was limited and fires were generally small. This unit also has a certain amount of inherent patchiness due to the large proportion of rock outcrops and poor soils. Fire suppression is believed to have had little effect on landscape patterns and distribution of vegetation types in this unit. Unlike at lower elevations, stand-replacing fires are still not common because of this unit's patchiness and cool temperatures. Lodgepole pine has likely increased in this unit over time, at the expense of pine or fir-dominated types. This is largely the result of logging, where tree removal followed by site preparation (either mechanical or burning) has encouraged the establishment of lodgepole pine where seed-bearing trees are nearby.

Lodgepole pine is considered a pioneer species. It is adept at regenerating in moderately sized openings created by fire, avalanche, or wind throw. Lodgepole pine is maintained in areas where severe disturbance regimes recur at relatively frequent intervals.

Vegetation Composition and Structure. Large portions of this unit are comprised of areas with gentle terrain where shallow water tables are common and the potential natural vegetation and existing vegetation are a mosaic of red fir-white fir forest, meadows, and lodgepole pine. Lodgepole pine in this area is a pioneering species that expands into areas where tree removal by logging, fire, or windthrow has raised the water table. As trees grow, transpiration increases and soil infiltration improves, allowing for hydrologic recovery and succession to red fir-white fir forest. Densification of red fir forests appears to have occurred with fire suppression (Potter, 1998). Where red fir is found growing in association with lodgepole pine, fire suppression appears to coincide with decreases in the pine. Today, canopies of red fir-white fir forest are generally dense and understory species include bitter cherry, chinquapin, and bracken fern. Because most of the Monument is at lower elevations, pure red fir forest, in the classic sense of a pure red fir canopy, occurs only on northern and eastern aspects at the highest elevations. Chinquapin and pine mat manzanita are common understory species in these stands.

Lightning fires create small to moderate-sized openings in the forest canopy that provide the necessary conditions for red fir germination. In addition, small lightning fires play an important role in creating uneven-aged red fir stands. The abundance of lightning-caused ignitions is believed to be similar to pre-Euro-American fire regimes. However, fire suppression has also had an effect. Fifty percent of this unit is believed to have missed one to five fire events, while an additional 40 percent is believed to have missed more than five and to be at extreme risk of losing a key ecosystem element.

Return to top of page.

Air Quality

General Meteorology, Climatology, and Transport Mechanisms

The Monument lies within the San Joaquin Valley Unified Air District. The San Joaquin Valley has a northwest to southeast orientation, with approximate dimensions of 100 miles wide by 300 miles long (see Figure III-1: California Air Districts). The district consists of 24,840 square miles, about 16% of California's geographic area. The California Department of Finance estimates that the San Joaquin Valley Air Pollution Control District (District) has a population of about 3,174,400. The major urban centers include Bakersfield, Fresno, Modesto, and Stockton. Air pollution movement, including smoke, is restricted in both vertical and horizontal directions. Vertical air movement is restricted by radiation and subsidence inversions. In the valley, the inversion base is 500 feet or less (at the surface for a ground-based inversion) in the morning during all seasons. In winter, the inversion base is 1,000 to 1,500 feet or lower throughout the day because heating from the sun is reduced (lower sun angle). During the rest of the year, the inversion base is often lifted by mid-day to 1,500 to 3,000 feet or more. In the summer, the inversion layer can sometimes be entirely destroyed. Local nightly radiation inversions in mountain valleys are also common. Horizontal air movement is restricted on three sides by the mountains that surround the San Joaquin Valley. These include the Coastal Mountains to the west, the Tehachapi Mountains to the south, and the Sierra Nevada to the east. In the spring and summer when the marine layer is shallow, westerly winds enter through low coastal gaps, primarily the Carquinez Straits, and flow down the valley toward the southeast. Daytime wind speeds increase as the valley heats up and are strongest in the afternoon. During storm-free periods in the fall and winter, the airflow is more variable, with light wind speeds resulting in less air movement. These air transport mechanisms are responsible for daily and seasonal variation of air pollution and smoke movement.

During the day, air near the mountain slopes is heated, resulting in upslope and up-valley winds. With sunset, the process is reversed. Terrain-driven winds provide a means to diurnally transport pollution out of, and back into, the valley (Blumental, et al, 1985). Several tracer studies have demonstrated pollutant transport into the mountains (Lehrman, et al, 1994; Shair, 1987; Tracer Technologies, 1992). Similarly, other research suggests that pesticides applied in the valley are transported to the Sierra Nevada, with levels decreasing with increasing distance and elevation from the valley floor (Zabik and Seiber, 1993).The meteorology of the San Joaquin Valley has a significant influence on pollutant transport and ozone and secondary particle formation in the region. Weather patterns moving from California's central valley carry pollutants generated in the valley and deposit them in the central and southern Sierra Nevada foothills and mountains (Zabic and Seiber, 1993). A nocturnal inversion forms in the San Joaquin Valley nearly every day of the year. During winter months, wind flows in the San Joaquin Valley are from the south, with stagnant conditions prevailing except during passage of winter storm systems.

Summer wind patterns in the Sierra Nevada Mountains are complex due to rugged terrain and intense daytime solar radiation. During summer months, the predominant surface wind direction in the San Joaquin Valley is from the northwest to southeast, down valley from Stockton towards Bakersfield. In Fresno, the morning surface flow is frequently from the south or west and is characterized by light wind speeds. Wind speed increases during the day, shifting towards a northwest to southeast direction, peaking around 5:00 p.m. Pacific Daylight Time (Ewell, et al, 1989.).

The general summer daytime flow can be slightly, but significantly, modified in the late evening and early morning hours. The modified pattern occurs when ozone concentrations in the valley are high. The influence of two major phenomena, the nocturnal jet and the Fresno Eddy, which regularly occur during the ozone season, have significant influence on ozone concentrations in the valley (Roberts, et al, 1990). The jet provides a mechanism for rapid transport of pollutants from north to south, while the eddy spreads pollutants throughout the southern part of the valley and possibly into higher levels. Computer modeling during a summer pollution episode showed that the bay area and Sacramento area contributed 27%, 10%, and 7% to the ozone exceedances in the northern, central, and southern valley, respectively (District, 1994).

An assessment of impacts of transported pollutants on ozone concentrations by California Air Resources Board (CARB) in 1993 indicates that transport of pollutants from the broader Sacramento Area, San Francisco Bay Area, and the San Joaquin Valley has overwhelming impact on the central and southern Sierra Nevada.

Demographics

Population growth plays an important role in the competition for air pollution capacity and the

frequency of smoke-induced public nuisance episodes. During the time period from 1980 to 1999, the population of the San Joaquin Valley Unified Air District increased 58%, from about 2 million in 1980 to nearly 3 million in 1999. The statewide average growth during this period was 43%. During this same time, the daily vehicle miles traveled more than doubled in the district, rising from about 4 million miles in 1980 to over 9 million miles per day in 2000, a 125% rise compared to a statewide average of 87%. Because these growth rates are so much higher than the growth rates in other parts of the state, there has not been the same level of air quality improvement in the San Joaquin Valley Unified Air District, especially with respect to ozone (CARB, 2001).

Air Regulatory Structure, Principal Legislation, and Policy

The air quality regulatory structure and agencies responsible for compliance are as follows:

Federal - Environmental Protection Agency (EPA).

State - California Air Resources Board (CARB).

Local - San Joaquin Valley Air Pollution Control District (District).

Environmental Protection Agency (EPA). The federal government sets air quality standards, oversees state and local actions, and implements programs for toxic air pollutants, heavy duty trucks, locomotives, ships, aircraft, off-road diesel equipment, and some types of industrial equipment. The role of federal, state, and local governments is defined in the Clean Air Act and its amendments of 1977 and 1990.

Some of the principal components, regulations, and policies related to the Clean Air Act that may directly or indirectly affect planning in the Giant Sequoia National Monument are discussed below.

National Ambient Air Quality Standards (NAAQS) - These are standards for pollutants considered harmful to public health and the environment. The EPA has set the NAAQS for six principal pollutants, which are called criteria pollutants'; (see Table III-2: National Ambient Air Quality Standards). Smoke contributes to PM10 and to a lesser degree NO2, CO, and O3.

Class I Areas - These include National Parks, Wilderness Areas, and some U.S. Fish and Wildlife Refugees that were in existence at the passage of the 1977 Clean Air Act amendments. These areas are provided special protection from new and modified major stationary sources. Federal land managers are mandated an affirmative responsibility to protect values that might be impacted by air pollution, including visibility (air quality-related values).

Regional Haze Rule - These regulations require states to review how pollution emissions within the state affect visibility at Class I'; areas across a broad region. These rules also require states to make reasonable progress'; in reducing any effect this pollution has on visibility conditions in Class I Areas and to prevent future impairment of visibility. The states are required by the rule to analyze a pathway that takes the Class I Areas from current conditions to natural conditions'; in 60 years. Natural conditions'; is a term used in the Clean Air Act that means that no human-caused pollution can impair visibility. This program, while aimed at Class I Areas, will improve regional visibility and air quality throughout the country.

Conformity Rule - This rule implements the Clean Air Act conformity provision, which mandates that the federal government not engage, support, or provide financial assistance for licensing or permitting, or approve, any activity not conforming to an approved State Implementation Plan. Federal actions will not:

Cause or contribute to new violations,

Increase the frequency or severity of existing violations, or

Delay timely attainment or interim emission reductions.

EPA Interim Policy on Wildland and Prescribed Fire - This EPA interim policy integrates two public policy goals: (1) to allow fire to function, as nearly as possible, in its natural role in maintaining healthy wildland ecosystems, and (2) to protect public health and welfare by mitigating the impacts of air pollutants on air quality and visibility.

Table III-2: National Ambient Air Quality Standards

California Air Resources Board (CARB). State governments are responsible for developing state implementation plans that describe how each state will achieve the requirements of the Clean

Air Act. In California, the state implement plan is a collection of regulations used to clean up polluted areas. EPA maintains oversight authority, must approve each SIP, and can take over enforcement action if reasonable progress is not made. CARB has set more stringent standards, oversees state and local actions, and implements programs for toxic air pollutants, heavy-duty trucks, locomotives, ships, aircraft, off-road diesel equipment, and some types of industrial equipment.

The Smoke Management Guidelines for Agricultural and Prescribed Burning (Title 17) are the regulatory basis for California's Smoke Management Program. Amendments to California's Title 17 may directly or indirectly affect planning in the Giant Sequoia National Monument. The smoke management guidelines became effective on March 14, 2001. Local air pollution control districts use these guidelines in local rule development.

San Joaquin Valley Air Pollution Control District (District). Local air pollution control districts in California develop plans and implement control measures in their areas of jurisdiction. These collectively make up California's SIP. These controls primarily affect stationary sources but do include sources of dust and smoke. The District also conducts public education and outreach efforts. The District is comprised of eight counties that share a common air district: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare Counties. The following District regulations may directly or indirectly affect planning in the Giant Sequoia National Monument:

Public Nuisance (Rule 4102) - Prohibits air discharge of material that causes nuisance or annoyance to any considerable number of people.

Prescribed Burning and Hazard Reduction (Rule 4106) - This rule was adopted June 21, 2001, in response to California's Title 17, and is designed to permit, regulate, and coordinate the use of prescribed burning and hazard reduction burning while minimizing smoke impacts on the public.

Fugitive Dust (Regulation 8) - The existing Regulation 8 rules were developed to implement control strategies for major sources of dust. These include construction, demolition, excavation, extraction, handling/storage, landfills, paved/unpaved roads, and open areas. EPA has recently cited deficiencies in these existing rules and the District is evaluating a series of new rules aimed at further reductions in particulates.

Pollutants of Concern

Most of the pollutants that have damaged ecosystems and impaired visual conditions existed to some extent within natural systems. Thus, many native species and ecosystem processes evolved in the presence of these pollutants. In fact, trace amounts of many of these pollutants are required for many biogeochemical processes. However, changed availabilities (including amount and timing), and changed frequency and duration of exposure can have negative effects on ecosystem elements and processes. The important distinction between these differing effects occurs when amounts of air pollution become greater than historical levels.

The primary air pollutants that can cause detrimental effects to public health or ecosystems, or which can impair visual quality include particulates, include oxides of sulfur and nitrogen compounds, elemental carbon and oxides, ozone, and toxic air pollutants. A more detailed discussion of these pollutants is provided in Chapter 3 of the Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement (January, 2001), pages 325 to 326. Air pollutants may result from natural or human processes. Natural pollution may occur from volcanic activity, forest fires, decomposition of plants and animals, soil erosion, pollen and mold spores, volatile organic compounds emitted by vegetation, ocean spray, electrical storms, and photochemical reactions. Human pollution sources include industrial sources, prescribed burning, animal production, agricultural burning, residential and business development, and vehicle emissions.

Current Air Quality Conditions

District Designations. The District is considered to be in non-attainment (not meeting standards) federally for ozone and PM10 (particulate matter less than 10 microns in diameter). The District is considered to be in severe condition for ozone and serious for PM10. In addition to ozone and PM10, the District does not meet the state standards for carbon monoxide in the Fresno urban area. Smoke from various sources is a contributor to PM10 and ozone.

Visibility Conditions. Visibility conditions in the Sierra Nevada improve from south to north and from low elevations to high elevations. Sequoia and Kings Canyon National Parks, the southernmost and lowest elevation monitoring sites, experience some of the worst visibility

conditions among western Class I Areas. Smoke can sometimes contribute to visibility impairment. The Interagency Monitoring of Protected Visual Environments (IMPROVE) site at Sequoia National Park is considered representative of visibility conditions in the Monument. This site shows high nitrate concentrations, indicating an urban influence.

Ozone Impacts to Vegetation. Amounts of ozone have increased in the San Joaquin Valley as a result of increased levels of nitrogen compounds and volatile organic compounds. The Forest Service and National Park Service have tracked injury to conifers in the southern Sierra Nevada since 1991. Some of the earliest plots have been evaluated for a period of over 20 years. The data confirms injury in Jeffrey and Ponderosa pines with the bulk of injury occurring in stressed trees. There is inadequate monitoring data to fully understand the physiological effects.

Sulfur and Nitrogen Compounds. Nitrogen compounds in the air have shown an overall increase compared to the native system, although the total amount has not been quantified. Bytnerowicz and others (in press) found that wet deposition of nitrogenous and sulfurous pollutants was the highest at elevations below 7,000 feet on the western slopes of the Sierra Nevada. Deposition from urban and agricultural sources may be approaching saturation in southern areas of the Sierra.

Return to top of page.

Caves

The Monument contains several caves, primarily located in the northern portion of the Monument, in Kings Canyon. They are found in Kings Terrain metamorphic roof pendants. The Kings Terrain consists of Triassic and Jurassic metamorphosed sedimentary rocks and sparse intermediate to silicic metavolcanic rocks. The dominant rock types in the Kings Terrain are phyllite, quartzite, schist, marble, gneiss and metavolcanic rocks (Matthews and Burnett, 1965). The marble is a metamorphosed limestone that is conducive to the formation of caves, and carbonate endemic flora and fauna may be present. Caves are found where stream channels cross the marble outcrop. This marble easily dissolves in Sierra Nevada waters and, if a marble outcrop is subjected to stream flow, a cave can result.

The location of fifteen caves is known; these include Boyden Cave, Church Cave, and several named and unnamed caves. There are probably as many as 100 caves located in the Monument (Despaine, personal communication). No caves have gone through the process of being evaluated as significant'; under the Federal Cave Resource Protection Act of 1988.

Boyden Cave is a commercially developed cave that is operated under a special use permit. The operators of the cave offer a 40-minute walking tour between April and November. Approximately 35,000 people visit the cave each year. A survey of Boyden Cave is nearly completed, with 0.63 miles of mapped cave features. This cave contains outstanding karst features including stalagtites, stalagmites, and flow sheets.

Church Cave is one of California's most important caves. As of 1997, the Southern California Grotto had surveyed up to 3.45 miles of the cave, and there are still many openings to explore and survey. The passages of Boyden Cave come within 400 feet of Church Cave. Church Cave is available to a limited list of authorized leaders to lead parties into the cave. Each trip has to be approved with an access permit.

Access to Windy Cave has been blocked to protect the features in this cave. Forest Service and National Park Service personnel know of several other caves, but their locations have not been formally documented. A cave survey has not been completed.

Some caves in the Monument may contain paleontological information from the last 50,000 years. These caves contain information on the prehistory of the giant sequoias that is important to understand the paleoecology of this species. Some of these caves were used by prehistoric people, as attested to by petroglyphs near cave openings.

Caves are prime habitat for some wildlife species, including forest sensitive species such as the Townsend's big-eared bat, spotted bat, and pallid bat. Other bats use caves for hibernation and breeding and include the little brown myotis, Yuma myotis, California myotis, and big brown bat. Other rare and endemic species found in caves include spiders, other invertebrate species, tight coin snails, packrats, and cave-dwelling salamanders.

Caves offer good opportunities for recreation and education if their resources can be protected. Boyden Cave is a good example of a recreational cave where the general public can study cave ecology.

Return to top of page.

Fire and Fuels

Existing Policy

This section reviews recent reports, management direction and policy changes that respond to the trend toward larger and more severe fires in the nations wildlands.

The recognition of increased fuel loading due to past logging, fire exclusion, and fire suppression is made clear in the Proclamation. Woody debris has accumulated, causing an unprecedented buildup of surface fuels. One of the most immediate consequences of these changes is an increased hazard of wildfires of a severity that was rarely encountered in pre-Euroamerican times'; (White House, 2000).

The Sierra Nevada Ecosystem Project Report to Congress validated emerging science reports that changing stand structure and surface fuel accumulation have created forests that are more likely to support large, severe fires'; (McKelvey, et al, 1996). There has been little or no variation from that theme in subsequent reports and policy.

The Forest Service Cohesive Strategy Report outlines a strategy to reduce wildland fire threats and restore ecosystem health. It is built on the premise that within fire adapted ecosystems, reducing fuel levels and using fire at appropriated intensities, frequencies, and time of year are key to: restoring healthy, resilient conditions, sustaining natural resources, and protecting people'; (USDA Forest Service, 2000). The priorities for treatment under this strategy are the wildland urban intermix, municipal watersheds, and habitat for threatened and endangered species, as well as maintenance of areas that are currently in a desirable condition.

The fire management objectives and priorities for fuel treatment in the Framework (USDA Forest Service, Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement, 2001) follow those of the Cohesive Strategy Report. Currently, the existing policy is designed to achieve the same goals of restoring more characteristic fire regimes and reducing wildfire threats to people, property, and natural resources. However, there is a certain level of uncertainty in using Framework guidelines to meet the needs of fuel reduction at the same time as meeting the requirements for wildlife habitat.

Not only has there been a change in the belief that fire is a missing element within the ecosystem, but that recognition has also led to the Wildland and Prescribed Fire Management Policy of 1995. Direction now provides for using an appropriate management response when appropriate and within the parameters of a signed Fire Management Plan. Management actions on wildland fires will no longer be driven by fire type designation. Fires will no longer be extinguished under a default response but will be suppressed for specific reasons. The specific rationale for fires that are managed for resource benefits will be identified in the Fire Management Plan.

A presidential directive called for a plan from the Departments of Agriculture and Interior to manage the impacts of wildfires on communities and the environment. The impact of fires in the year 2000 heightened the awareness of the severe nature of wildland fires. The National Fire Plan was developed and is intended to serve as an umbrella document for the other major tactical reports to improve wildland fire management and prevention. The five key points of the National Fire Plan are firefighting, rehabilitation and restoration, hazardous fuel management, community assistance, and accountability.

Return to top of page.

Fire History

Fire history on the Sequoia National Forest shows that almost twice as many fires are started by lightning than are started by human ignitions. And almost four times the acreage burned is from human ignitions rather than the higher frequency lightning fires.

Figure III-2: Acres of Wildfires from the last 33 Years

Table III-3 shows the percentage of lightning and human-caused wildland fires by administrative area

The percentage of lightning-caused fires is close to what would be expected given the amount of acres within the Monument. The human-caused fires, however, are a little higher than what

would be expected given how the acreage is divided by administrative area.

Table III-4 shows the percentage of acres and acres of lightning and human-caused wildfires by administrative area.

The acres burned historically by wildfires are lower within the Monument than would normally be expected for both human and lightning-caused fires (see Figure III-3). So although ignitions are plentiful within the Monument, these fires have a lower incidence of resulting in large fires as compared to the rest of the national forest. This can be partially explained by the number of initial attack resources within the Monument as compared to the rest of the forest. Table III-5 shows a comparison of suppression resources found inside and outside the Monument on the Sequoia National Forest. There are almost equal numbers of resources for different numbers of acres. The reasons for the larger number of resources within the Monument relate to loss of value. Historically, the risk of loss within the Monument was mainly the commodity value of the timber and communities threatened by hazardous fuel conditions.

Table III-5: Initial Attack Resources by Administrative Area

It should be noted that, even though suppression crews have had good success in keeping large fires out of the forested acres, the ability to control fires in the chaparral that leads to the mixed conifer ecosystems would in large part determine the success in protecting the Monument. Chaparral fires tend to move into the mixed conifer ecosystems because of a lack of discontinuity or variation of vegetation from the chaparral ecosystem to the mixed conifer ecosystem (Sugihara, 2002).

Fuels Management

This section describes the elements of fuels that are key to the assessment of wildland fire behavior.

Fuels. Fuels are that part of fire behavior that can be changed or manipulated to meet the desired objectives of a management activity. Fuels consist of the vegetation of the ecosystem, both living and dead. They are usually quantified when there is more vegetation or down material than is normal compared to a historic condition.

Fuels are described in terms of arrangement such as vertical or horizontal, surface fuels, or crown fuels. Ladder fuel is a term for the vertical arrangement of fuels that provide continuity between surface fuels and crown fuels. Fuels can also be described in terms of stand structure and species composition (discussed more under Managing Fuels).

Fuel loading is a quantifiable measure of fuels in a given area, usually expressed in tons per acre by size class. Fuel loadings are often assessed before treatment to determine how much to reduce the fuels.

Table III-6 shows six areas i n the Monument that have been assessed for fuel loading recently. Although the analysis area may have been very large>, every acre of ground did not carry the fuel loading as indicated in the table. It would be appropriate to say that the fuel inventory that was completed is an average, representing areas of high as well as areas of low fuel loading.

Table III-6. Surface Fuel Loadings found within the Mixed Conifer and Pine Forests of the Monument

**There are two general types of inventory methods used in the Monument. James K. Brown's intercept method is a more detailed approach of inventory that involves counting all fuel within a plot. This method can be time consuming. The Photoseries method is an ocular estimation by size class quantified in a photo set, where the person doing the inventory compares the analysis area to the set of photos.

Managing Fuels

Fuels management is that part of the fire organization that takes the fire behavior assessment and develops goals and objectives to move the fuels situation toward the desired condition. The Forest Plan strategy from the last decade made the assumption that whether the forest was to be cut for timber or set aside for preservation as a natural feature, fires were destructive and should be prevented, the exception being in Wilderness. The Forest Plan recognized the role of fire as a natural process and a needed component in these natural areas. However, even though the policy of appropriate suppression response was adopted in 1983, and

adopted with the Forest Plan in 1988, the preferred choice of suppression on this national forest has continued to be control, even in Wilderness (Husari, 1996). Outside of Wilderness, laws were passed to require the disposal of slash by safe methods in timbered areas (Wright and Heinselman, 1973).

Technically fuels management can be viewed as managing potential fire intensity. Fire intensity refers to the amount of energy released by the fire (USDA Forest Service, 2001, Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement, Chapter 3, page 242), and is a physical parameter that can be related to flame length. It can be determined from the product of biomass consumption (energy) and rate of spread of the fire (Agee, 1996). Fire severity is a description of fire effects on the biologic and physical components of the ecosystem (Sugihara, 2002).

A natural baseline comparison of what fuel conditions should be is the historic fire regime (see Classification of Fire Regimes for Ecosystems in the Monument in the Ecological Units section). Each fire regime has a characteristic range of frequency and severity which influences, and is influenced by, the vegetation within it. The characteristics of the fire regime help define the mosaic of vegetation types, age classes, and succession stages on the landscape (Turner, et al, 1993). Fuels managers often measure the spatial distribution of fuels in the current fire regime and relate it to the historic fire regime to determine the appropriate direction of fuels management (Sando, 1978). The characteristics of the historic fire regime are often represented by a fuel loading and structure that existed before European settlement.

Fire Susceptibility. To quantify the shift of vegetation from a resilient fire dependent ecosystem to an ecosystem that is susceptible to wildfire, a fire susceptibility rating was developed on the forest. The rating uses severity, hazard, and risk to identify areas on the forest that have high, moderate, or low susceptibility to wildfire. This index is used for prioritizing areas that need treatment, particularly communities within high fire susceptibility areas (a more in-depth discussion of fire susceptibility is in the Measures and Indicators section). Figure III-5 in the map packet shows the high, moderate, and low fire susceptibility areas in the Monument.

Management Implications of Re-Introducing Fire into a Protected Ecosystem. The ecosystem of the Monument has largely been protected from the effects of fire for almost a century. As a result, live and dead fuels have increased along with the development of denser conifer forests. Logging on Forest Service and private lands has been primarily of the large overstory trees, accelerating growth in the dense understory and increasing landscape-level homogeneity of fuel structure (Weatherspoon, 1996; McKelvey and Johnston, 1992). Therefore, compared with presettlement [1875] conditions, the current Sierra Nevada forests are generally younger, denser, smaller in diameter, and more homogeneous (McKelvey, 1996). Due to high productivity and various forest management activities, the lower and middle-elevation mixed conifer forests have likely experienced greater change in structure and fuels conditions than have either higher elevation forest or foothill vegetation (Weatherspoon and Skinner, 1996).

The need for a strategy to manage the fuel problem was addressed in the Sierra Nevada Ecosystem Project report. Although adding to the suppression capability was considered, it was deemed not to be the solution by both researchers and professionals (Weatherspoon and Skinner, 1996). Large-scale fuel management with a careful consideration of strategy was thought to be a better solution. If treatments were placed in the most logical, efficient, cost-effective places and ladder and surface fuels were targeted, then fuel treatments might provide a long term solution by reducing the likelihood of tree mortality and crown fires and produce defensible zones in which fires can be more successfully controlled (McKelvey and others, 1996). In general, conditions need to be moved away from dense, small tree-dominated forests toward more open, large tree-dominated forests (Weatherspoon and Skinner, 1996). The Framework used this logic in the development of the Strategically Placed Area Treatments (SPLATs) to enhance protection within defense and threat zones.

In the Monument the historic fire regime'; has been our guide for restoring our forests. The underlying assumption is that the natural forest is one that has many biodiversity characteristics we wish to maintain in the future: viable animal populations and structural diversity (Agee, 1993). Old forests of mixed conifer and ponderosa pine developed with much more frequent and low severity fires. These forests had more open understories, fewer down logs, and possibly fewer snags (Agee, 1993) The Sequoia National Forest, through the Framework, still manages biodiversity by retaining biological legacies (such as snags, down logs, and canopy cover) within project areas to maintain a habitat characteristic. There is a conflict between the natural forest paradigm and the biological legacy paradigm, especially with what we know about natural forests. Natural fire does not always leave a significant component of snags and down logs. In fact, logs on the forest floor may have been consumed on a regular basis during frequent low intensity surface fires (Agee, 1993).

Table III-7 shows the acres of wildlife habitat that are currently in high, moderate, and low fire

susceptibility areas. Fire susceptibility is the relative ranking to large severe fires (a more in-depth discussion of fire susceptibility is in the Measurements and Indicators section). Acres with high fire susceptibility would, under high fire weather, contribute to stand-replacing fire. Areas of low fire susceptibility, under high fire weather, would not contribute to stand-replacing fire. The wildlife habitat included in this table consists of: fisher/marten den protected activity centers, goshawk protected activity centers, and California spotted owl home range cores and protected activity centers. Wildlife protection areas cover about 13 percent of the Monument.

Table III-7: Acres of Fire Susceptibility

Habitat retention requirements in the Framework range from complete avoidance to thinning trees up to six inches in diameter to various levels of prescribed fire. How requirements of habitat protection areas affect the ability to treat fuels to the spatial extent needed for protection of the ecosystem and wildland urban intermix is not clear. The environmental effects discussion will show how much of the strategically located treatments would fall into these areas for each alternative.

Fuel Treatments Over the Last Ten Years.

The Sequoia National Forest maintained a fuels program that included treating activity-created fuels from harvesting and natural fuels. Activity-created fuels were typically paid for by the timber sale or trust funds specifically designed to pay for the fuels treatment. The two funds are Brush Disposal (BD) and Knudsen-Vandenburg (KV)funds. Over the last ten years, the number of treatment acres funded by BD and KV has declined, whereas those funded by Fire Funds have increased.

Costs for Fire and Fuel Management.

The Sequoia National Forest strives for an efficient program to manage fire and fuels. Accomplishing this requires an organization and infrastructure that minimizes the combined cost of wildland fire suppression and losses of resource values on public lands and private property. Suppression costs and risks of loss are specific to a site. Factors such as surface fuels loads, fire weather patterns, site access, topography, land ownership patterns, and resource values influence the cost of containing wildfires. Fire and fuels management efficiency is difficult to assess because of the value placed on non-monetary benefits such as scenic values, biodiversity, and benefits that may only be realized in the future, such as restored ecosystems.

Table III-8 shows there is a wide range in cost per acre associated with a wide range in the size of fires. Typically, smaller fires are more costly on a cost per acre basis. The average of all the fires in the table is $1,010 per acre. In comparison, average costs for fuel treatments are $349 per acres for prescribed fire, and $568 per acre for mechanical treatment. Prescribed burning costs include brush burning, pile burning, and underburning. Mechanical treatment includes thinning, biomass removal, and machine piling.

Table III-8: Costs of Recent Large Fires on the Sequoia National Forest

Preparedness. The National Fire Management Analysis System (NFMAS) is a tool to help determine the most efficient level (MEL) for the fire management program. The MEL displays the tradeoffs between the dollars spent on fire preparedness versus the fire suppression costs, plus the change in value of the natural resources burned. The NFMAS process only considers lands for which the Forest Service has direct fire protection responsibilities. Costs associated with protecting non-federal lands, including protecting the wildland urban intermix from a fire originating on a national forest, are not incorporated into the NFMAS model. The cost of protecting these values and the urban interface can be significant in some areas.

One critical component of the NFMAS model and the determination of MEL is Net Value Change. The Net Value Change is the dollar difference between the natural resources before and after a fire. Two other components of the NFMAS model are costs of fire preparedness and the cost of fire suppression. The NFMAS model optimizes the appropriated dollars spent on fire preparedness versus the costs of fire suppression, plus the value of the natural resource after it has been burned. The number of acres burned is also displayed at each appropriated funding level.

Collaborative Efforts with Outside Partners. The effectiveness of fuels projects is enhanced when performed across administrative boundaries, where the projects can contribute to large-scale fuel reduction. In order to respond to large-scale fire hazard reduction, the Sequoia National Forest makes an effort to collaborate with neighboring agencies and private landowners. Local collaborative efforts include the Fire Safe Council, a California Department

of Forestry program that brings all interested parties together to find ways to reduce fuels either on private land, public land, or both. The Tulare County Fire Safe Council has a demonstration project that showed the public how fuels could be treated on both private and public lands within the Monument to reduce the threat of wildfire to communities. Other efforts include working directly with communities inside the national forest boundary to reduce fuels, as well as providing assistance to communities to reduce fire hazard.

Other areas of collaboration with neighboring agencies include sharing resources on prescribed burn projects and implementing projects that cross agency boundaries. The effect of sharing resources is to increase the available number of local resources. Implementing projects across boundaries broadens the focus of fuel reduction.

Wildland Urban Intermix. This zone is an area where human habitation is mixed with areas of flammable wildland vegetation (USDA Forest Service, Pacific Southwest Region, 2001). Defense zones are a ¼-mile buffer around communities as established in the Framework, totaling approximately 17,600 acres in the Monument. These defense zones can still be delineated upon further analysis at the project level. The defense zone allocation allows removal of trees up to 30 inches in diameter to meet hazard reduction objectives for reduced fire behavior in close proximity to communities. The threat zones have been locally delineated based on predicted fire behavior analysis on the forest and within the Monument and total approximately 133,310 acres. The threat zones have more limitations on vegetation removal to meet wildlife habitat objectives. The standards and guidelines associated with spotted owl home range core buffers, the fisher habitat canopy cover rule, and late seral old growth canopy cover appear to be the most limiting.

Management direction for urban wildland intermix zones from the Framework (USDA Forest Service, Pacific Southwest Region, 2001) is current direction and is as follows:

Design fuel treatments to provide a buffer between developed areas and wildlands

Design and distribute treatments to increase the efficiency of firefighting efforts and reduce risks to firefighters, the public, facilities and structures, and natural resources

Determine the distribution, schedule, and types of fuel reduction treatments through collaboration with local agencies, air regulators, groups, and individuals

Place the highest density and intensity of treatments in developed areas within the urban wildland intermix zone Measures and Indicators

Indicators:

- Fire Susceptibility
- Fire Return Interval

Measures:

- Acres with a prescription that moves the fire susceptibility rating from moderate or high toward low.
- Acres of predicted movement of the fire return interval to historic ranges.

Fire Susceptibility. Severity and hazard typically quantify the amount and condition of fuels available for burning, fire behavior, and the timing for fuels to burn (USDA Forest Service, 2001, Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement, page 243). One of the contributors to intense fire behavior and fuel availability is the shift from fire-resistant species naturally found in the Monument to more fire-susceptible ones. Even-aged stand management, density of trees, and the kinds of tree and shrub species that have replaced ecosystems in place prior to 1875 have produced a forest more susceptible to catastrophic fire.

An index was developed on the Sequoia National Forest to provide a relative ranking of fire susceptibility to large, severe fire. This index is a tool for the forest in prioritizing areas that need treatment, particularly for those communities within high fire susceptibility areas. Fire susceptibility was developed using three separate map layers: hazard, risk, and severity for the Sequoia National Forest (see Figure III-5 in the Map Packet).

Fire Return Interval. Fire return interval describes how often fires occur in a particular location. This is a temporal attribute of the fire regime (see the classification of fire regimes in the Ecological Units section of Chapter III) that is measurable by determining when fire occurred last on each of the acres of the Monument. It is an indicator of how close the Monument is to the historic fire regime. There is no expectation that every prescribed burn,

either done alone or in conjunction with mechanical treatment, would fully restore the historic fire regime of a particular ecosystem. Some attributes of the fire regime that would not be addressed by simply putting fire back into the ecosystem are: seasonality, severity, intensity, fire type, extend, and complexity.

A fire return interval departure map was developed by the Sequoia and Kings Canyon National Parks from vegetation, fire history, and historic fire frequency data to assess the departures from the historical fire interval in areas within the Monument (see Figure III-5 in the Map Packet). A fire return interval departure index ranging from -16 to 1 was reclassified into five categories: extreme, high, moderate, low and rock/water. Where condition class is a measure of departure from historical fire regimes, the following assignments were made.

Table III-9. Fire Return Interval Departures

Return to top of page.

Geology and Soils

Geology

The Monument is located in a seismically active region that is influenced by three major physiographic and geologic provinces. These provinces include the Sierra Nevada, San Joaquin Valley, and, to a lesser extent, the Coastal Range. While there are no active faults, several active or potentially active faults have been identified within 100 miles of the southern section of the Monument. Numerous earthquakes of magnitude 3.7 and greater on the Richter scale have occurred within 100 miles. Several minor faults are associated with Redwood Creek and the ridgeline separating the Kings and Kaweah drainages. Minor earthquakes (<5.5) have been recorded in the last 20 years near Shell Mountain and immediately south in the upper Kaweah drainage. At least 50 active or potentially active faults have been identified within 100 miles of Terminus Dam (the dam that holds the waters of Kaweah Reservoir), producing numerous earthquakes of magnitude 3.7 on the Richter scale.

The major active faults in the area are the San Andreas (81 miles west), Owens Valley (53 miles east), White Wolf (45 miles south), and Garlock (73 miles south). All of these faults have the potential to generate earthquakes of magnitude 6.5 or greater on the Richter scale (U.S. Army Corps of Engineers, 1999). They are distant from Terminus Dam but are known to be active with long-duration shaking. The San Andreas and Owens Valley faults would be the most likely to generate critical motions within an area of influence to Lake Kaweah. While greater amounts of ground motion would likely occur from the Owens Valley fault group, earthquakes are expected to occur more frequently from the southern segments of the San Andreas Fault. Past records indicate that the magnitude of any future earthquake from either of these faults could be in excess of 8 on the Richter scale (U.S. Army Corps of Engineers, 1996).

The Monument basins are composed of five major geologic groups: (1) the Paleozoic metamorphic Calaveras Complex and equivalents, (2) the late Paleozoic-Mesozoic Kings River ophiolite and associated Kings-Kaweah structure, (3) the Mesozoic metamorphic Mariposa and Logtown Ridge Formations, (4) the Mesozoic grandodioritic Sierra Nevada batholith, and (5) recent alluvial and colluvial valley fill deposits.

The Calaveras Complex is exposed as roof pendants to the Sierra Nevada batholith. The Calaveras Complex rocks had originally extended across much of the Sierra Nevada, but have been mostly stripped off by uplift and subsequent erosion. The Lemoncove schist and quartzite that underlie Terminus and Success Dams and form the isolated peak Lime Kiln probably belong to the Calaveras Complex.

The recent valley-fill deposits are unconsolidated sands and gravels averaging approximately 20 feet in depth at Terminus Dam and increasing to the west over the river delta in the form of alluvial fan deposits. Sands in the region are predominantly grains of feldspar, mica, and quartz, while boulders are predominantly composed of granite, quartzite, and aplite.

The northern portion of the Monument in the Kings and Kaweah drainages is comprised of granitic and decomposed granitic rock, with protrusions of metasedimentary and metavolcanic rock along with marble in the Goddard and Kings Terrains located on the edge of the Sierra Nevada batholith.

Soils

Soils are somewhat acidic, with higher acidity in the region of caves. This is from the

formation of carbonic acid as ground water flows through marble roof pendants. Granitic rocks form soils that are less acidic. Where granitic-derived soils are shallow, they are associated with less organic matter and have high runoff rates. Meadow areas and areas of high organic matter are more acidic. Soils have higher acidity in the mixed conifer and pine-dominated stands. The foothill chaparral and grasslands are generally near neutral in pH due to the limited amount and slow breakdown of organic matter, as well as minimal moisture.

In the northern Monument, high runoff is common in the southeastern portion and occurs because the infiltration rate of the soils is often exceeded by rainfall intensity. This has the potential to affect rainfall runoff amounts and timing. Soils are deeper in the northwestern portion and, as a result of the water holding capacity of the soil, so are infiltration rates. Caves have formed because the water reacts with marble to form carbonic acid. Rainwater and snowmelt disappear into fissures and later flow into underground rivers, eventually flowing into the Kings River downstream of the marble bearing formations.

Soil infiltration and depth is moderate to good due to generally moderate to deep soils on granite bedrock at the lower elevations in the Eshom area. Soil infiltration and depth is poor to moderate at the higher elevations around Stony and Woodward Creeks. Better infiltration is found where soils deepen in flatter terrain along the central portion of Eshom and Dry Creeks. Soils are shallowest in the northeastern portion and deepen in the southwestern portion of the Monument. Better infiltration is found where soils deepen in the basins formed by the upper middle portions of Tenmile, Converse, and Mill Flat Creeks. Soils are xeric in the northern and western portions and shallower due to steepness and dryness.

Soils found in the lower Sierra Nevada foothills are typically moderately deep, gently rolling to very steep, and well drained. The soils range from rock outcrops to coarse sandy loam to clay. The soils in the drainages consist of medium and fine-textured soils developed in alluvium weathered from igneous and metamorphic rocks. The soil chemistry varies in acidity from neutral to medium acid, with infiltration rates that vary from slow to moderate.

Soils in the Kern River Watershed are predominantly comprised of coarse sandy loam and sandy clay loam of the Glean Variant, Bald Mountain, Chaix, Chawanakee, Holland, Woolstaff, Wind River, and Hotaw series. These soils were formed in place from parent granitic bedrock and limited areas of metamorphic rock. Minor deposits of alluvium and colluvium occur at scattered locations throughout Monument.

Giant Sequoia and Mixed Conifer

The Proclamation emphasizes the giant sequoia groves and the surrounding mixed conifer forest. This section describes the important ecological conditions that exist within these specific vegetation types. It also includes a comparison of existing versus desired conditions. For the purposes of this analysis, the giant sequoia groves in the Monument are defined by the boundaries that were located and posted as required by the Sequoia National Forest's Mediated Settlement Agreement (1990).

All of the groves and surrounding mixed conifer forests in the Monument have been affected to varying degrees by human activity, whether by the disruption of the fire return interval or by logging. Examples include the suppression of all fires, leading to a disruption of the fire return interval, increased ozone levels, logging, and recreation developments. This is consistent with what is found in giant sequoia groves outside of the Monument. Throughout the range of giant sequoias, approximately 53% of the area in the giant sequoia groves has been continuously protected from both fire and logging, while an additional 18% has been protected from logging but has been treated with prescribed fire (Stephenson, 1996).

Mixed conifer forests are subject to recurring interactions from a wide range of environmental events (stressors'; to ecosystems) such as insects, diseases, and climatic events (wind, rain, snow). The forests are most resilient to these agents when forest structural conditions and natural processes reflect conditions similar to those that existed prior to 1875 (Scientific Advisory Board, 2001, Advisory III). Under lower stocking conditions, there is less inter-tree competition for available sunlight, nutrients, and growing space. This reduced competition allows trees to be more stable and resistant to severe alteration by stressors, and be more resilient as they respond to stressors. Currently, much of the forested landscape is much more dense and has much more surface fuel than it did before 1875, which reduces the forest's resilience and stability and increases the risk of catastrophic wildfire. The restoration of forest structural conditions and natural processes (using pre-1875 conditions as a reference) would allow natural events to operate within an historic range of conditions and would maintain healthy growing conditions (Fullmer, et al, 1996).

There are approximately 38,150 acres of giant sequoia groves scattered throughout the Sierra

Nevada mountain range. Of this total, approximately 29,400 acres are under national forest administration and about 27,000 acres are located in the Monument on the Sequoia National Forest. There are approximately 2,400 acres in three groves located on other national forests (the Sierra and Tahoe National Forests).

The 27,000 acres in the Monument are within 34 groves or grove complexes. A grove complex is a grouping of two or more groves in very close proximity to each other. There are approximately 19,400 acres of giant sequoia groves in the Monument, as measured by their tree-to-tree or tree line boundaries. Surrounding most of the groves is an administrative boundary, generally 500 feet from the tree line. This administrative boundary was established as required by the Sequoia National Forest Mediated Settlement Agreement of 1990. This posted boundary represents the area within which, if conditions allow, giant sequoia trees and other associated species can spread seed in order to adapt to changing environmental conditions. It is also an important area to manage fuel loadings in order to reduce the potential catastrophic effects of wildfire and to encourage a more natural fire regime that meets desired conditions. There are approximately 7,600 acres of this administrative boundary, adding up to a total of approximately 27,000 acres of groves within it.

Approximately 70% of the Monument grove acreage has been continuously protected from both fire and logging. The disruption of the natural fire regime, along with the elimination of any other large-scale disturbances, has led to a cessation of giant sequoia reproduction (Harvey, et al, 1980; Stephenson, 1996). The dramatic changes in certain climatic growing conditions for giant sequoia during the last 130 years or so have not been mirrored by continual pulses of natural regeneration. Since reproduction is the primary process through which species adapt to changing environmental conditions, it appears that much of the grove acreage has missed opportunities to establish new reproduction and allow genetic adaptation to occur.

Twenty-five percent of the grove acreage has been logged but has had little or no prescribed fire. Of this 25%, the vast majority was logged near the turn of the 20th century and was concentrated in several groves (Converse Basin, Grant, Indian Basin, and Big Stump) in the northern portion of the Monument. These harvested groves have re-vegetated with conifers and second growth giant sequoias are a significant component of the stand composition. Since the logging, however, no other disturbances have occurred to promote the establishment of new generations of giant sequoia.

During the last 25 years, four percent of the grove acreage in the Monument has had disturbance, through logging and subsequent burning for fuel reduction and site preparation, that has led to the regeneration of young giant sequoia, associated mixed conifer species, and other vegetation. After harvest occurred in these areas, they were replanted primarily to ponderosa and/or Jeffrey pine. Survival and growth of young trees is excellent in almost all areas, and naturally occurring giant sequoia seedlings have become established in close proximity to overstory monarch'; giant sequoias.

Conditions of Giant Sequoia Groves and Their Regeneration

This section discusses the status of the reproduction of giant sequoia and other species associated with mixed conifer-giant sequoia forest. One of the key ecological issues facing the sustainability of giant sequoias is the lack of reproduction of the species over the last 100 years (Stephenson, 1996). This is due to the influence of human activities, primarily the disruption of frequent fires by a highly successful fire suppression program (see the description of the Gap and Patch Frequency Indicator in the next section, Existing versus Desired Conditions of Key Ecological Characteristics). In order to provide proper management direction, the extent and nature of the regeneration issue must be understood.

The status of reproduction of giant sequoia and other species associated with the mixed conifer-giant sequoia ecosystem is examined in two perspectives: 1) the overall status of broad age classes based on the forest's response to the recent disturbance regimes, and 2) the status of trees based on current inventories. Although the problem of giant sequoia regeneration (or lack thereof) is well documented, different groves exhibit this problem to varying degrees. Piirto and Rogers (1998) discuss four broad age classes that are used here to compare current age-class distributions to desired distributions as follows:

Age Class 1: 1-10 years old

Age Class 2: 10-20 years old

Age Class 3: 20-150 years old

Age Class 4: >150 years old

The groves can be categorized into four general groups based on the amount and status of these four age classes. These four groups reflect the groves' conditions since being subjected to altered disturbance regimes (primarily fire suppression and logging) since their discovery by Euro-Americans in the 1800s. They apply only to national forest lands within the Monument and are described as follows:

Group 1: Groves protected from or not subjected to wildfires and/or logging. These groves have very little reproduction of giant sequoia or other shade-intolerant species such as Jeffrey, ponderosa, or sugar pine, because of the lack of new openings from disturbance. Of the 27,000 acres of giant sequoia groves, there are approximately 19,000 acres (70%) in this group. The vegetation in this class is almost completely in Age Class 4. The groves and their associated mixed conifer forest have dense canopies with generally very high fire susceptibility.

Group 2: Groves logged between approximately 1880 and 1920. The disturbance from heavy logging has led to a pulse of regeneration in these groves. There are approximately 6,830 acres (25%) of second growth giant sequoia-mixed conifer reproduction, all about 100 years old. The vegetation in this group is primarily in Age Class 3 and the trees average 90 to 100 years old. Stocking is very heavy due to the lack of significant processes that would control stocking, such as understory fires or thinning.

Group 3: Groves logged or burned by wildfire between 1950 and 1980. Between approximately 1925 and 1980, giant sequoia groves on the Sequoia National Forest were not heavily disturbed by either logging or wildfire. The McGee fire on the Hume Lake Ranger District burned in 1955 through the Cherry Gap Grove and, as a result of this event, young giant sequoia and other vegetation were established. There are a total of 171 acres in this area, representing less than 1% of the 27,000 acres of groves in the Monument. The vegetation is in Age Class 3 and is typically 50 years old.

Group 4: Groves logged from 1980 to the late 1980s. The Forest Service began active management in approximately 13 of the groves by harvesting, followed by site preparation and planting. These activities led to the establishment of approximately 1,040 acres (4%) of regeneration in the 27,000 acres of groves. Of these 1,040 acres, about 640 acres were planted with young giant sequoias and other mixed conifer species. On the remaining acreage, mixed conifer species were planted that did not include giant sequoia. Natural regeneration was relied upon for the re-establishment of giant sequoia. Natural regeneration was successful where openings were adjacent to seed-bearing mature giant sequoia. The vegetation is in Age Class 2.

Table III-10: Giant Sequoia Grove Groups

Of the 34 groves and grove complexes in the Monument, only 13 have had significant disturbances in the last 120 years that have led to new pulses of regeneration. The remaining 21 groves have had little or no regeneration. In comparing this existing distribution with the desired distribution, it is evident that there is a discrepancy. Figure III-7 displays this discrepancy between existing age class distribution and desired age class distribution in the giant sequoia groves in the Monument. Special attention is given to the following differences:

Age Class 1 (1-10 years): There has been no new vegetation established in the giant sequoia-mixed conifer grove areas in the last ten years. According to desired conditions, there is a lack of gaps so that vegetation mosaics can be established, which can then feed into the pipeline of older vegetation and gaps.

Age Class 2 (10-20 years): There is a lack of vegetation in this age group as compared to the desired condition, however the need varies by grove. There are approximately 1,040 acres of recently established (mid-1980s) openings, located primarily in 11 groves. The amount of acres in each grove in this age class ranges from 3.12% to 23.42% (see Table III-10). These openings have large amounts of young trees and early seral stage brush. Fuel loads continue to accumulate. As vegetation increases in size, the options become more limited for controlling the fuel accumulation as well as preventing the overcrowding of vegetation, and thereby helping to ensure healthy growing conditions. Many of these openings have large amounts of pine and do not meet the desired conditions for species composition.

The twelve groves with significant (>3%) of their acreage in this age class are Bearskin, Black Mountain, Converse Basin, Evans Complex (especially the western side), Landslide, Long Meadow, Packsaddle, Mountain Home, Peyrone, Red Hill, Redwood Mountain, and Starvation Complex.

Age Class 3 (20-150 years): There is a lack of vegetation in this age group as compared to the desired condition in almost all of the groves. There are approximately 6,830 acres, 82% of them in only 2 groves (Evans Complex and Converse Basin). These areas are stocked heavily

with mixed conifer and are in need of fuel reduction to reduce the risk of catastrophic fire. In addition, the very dense growing conditions increase the possibility of mortality, as weakened trees are more susceptible to drought, insects, and disease.

Age Class 4 (>150 years): The vast majority of acres in the mixed conifer-giant sequoia groves belong in this age group. Twenty-three of the 34 groves have had no or extremely limited disturbances in the last 120 years that have led to the establishment of new age classes and vegetation mosaics. There is an abundance of this age group as compared to desired conditions.

The structure of the regeneration established in the last 120 years is very different from regeneration established prior to that time. The primary disturbance agent in the thousand-year period up until 1875 was a regime of low-intensity, high frequency fires. This fire regime typically created a mosaic of vegetation and gaps, with the gaps ranging in size from less than ¼-acre to two acres. Prior to 1875, the groves were less dense and had fuel conditions that generally led to low or moderate wildfire intensities (Stephenson, et al, 1991; Stephenson, 1996). Larger gaps were more infrequent, although intense wildfires occurred that were possibly several hundred acres in size (Swetnam, et al, 1992; Caprio, et al, 1994). The variability in gap size provided a range of growing conditions that led to a variety of species, from shade-intolerant (pines, giant sequoia, black oak) to shade-tolerant (incense cedar, white fir). The shift to logging as the primary disturbance regime led to a shift in the structural characteristics of openings. For instance, the Converse Basin Grove was completely cutover while under private ownership around the turn of the 20th century, and the re-growth is an almost continuous 120-year old 4,000-acre stand, with little variability. This is an extreme case; however, other groves such as the national forest portions of Big Stump, Indian Basin, and Cherry Gap all exhibit similar gap size characteristics that are outside the range of natural variability as described by Piirto and Rogers.

This same situation is displayed in the openings created by logging in the 1980s within, and immediately adjacent to, some giant sequoia groves on the Sequoia National Forest (now within the Monument). The approximately 1,000 acres of openings average 10 to 15 acres in size, and many of these openings were re-planted to pines and lesser amounts of other species such as white fir, sugar pine, and giant sequoia. Recent stand exams and field observations indicate that other species are becoming more common through natural succession. However, these openings are still dominated by the planted trees and the average gap sizes are outside the range of natural variability (Piirto & Rogers, 1999).

Current Amounts of Giant Sequoia Trees

This section describes the current regeneration and stocking status of giant sequoia. Although the focus is on their status within the naturally occurring groves, the status of giant sequoia outside of the groves will be discussed as well.

Status of Giant Sequoia within Naturally-Occurring Groves. The Sequoia National Forest has an ongoing grove-specific integrated inventory program. To date, data is available for five groves within the Monument, as well as two other groves on other national forest system lands. These groves (except for Converse Grove) are considered by forest personnel to be representative of conditions in other groves that have had no significant recent disturbance. The data were analyzed to characterize the amount of existing giant sequoia trees by diameter. The data points were located only in the mature forest portions of groves in order to understand the current conditions without any recent (within 100 years) gaps created by harvest practices. The results clearly indicate that giant sequoia trees are almost non-existent in the smaller diameter classes. Given an expected level of mortality from various agents (drought, insects, tree competition, fire), there are not enough young trees to provide for future monarch trees. Only Deer Creek Grove has a significant number of small trees (approximately 60 trees less than 10 inches in diameter per acre). See Figure III-8 and Table III-11 for information on diameter distribution of trees in inventoried groves. Table III-11 demonstrates the lack of giant sequoia less than 40'; in diameter in most of the groves that have been inventoried. Based on field observations by forest personnel, these results are likely to be found in the remainder of the giant sequoia groves in the Monument.

Figure III-8: Distribution of Giant Sequoia Trees by Diameter Class in Inventoried Groves

Table III-11: Number of Giant Sequoia Trees in Inventory Plots by Grove and Diameter Class

Status of Giant Sequoia Outside of Naturally-Occurring Groves. Giant sequoia seedlings have been planted in many areas outside of groves in the mixed-conifer forest, where growing conditions are generally similar to those found within the groves. These plantings have occurred for several decades and are located where harvesting created openings. The sequoia seedlings are grown from seeds that are collected within the local seed zone. Some of the

planting sites are in immediate proximity to groves, while other sites are several miles from the nearest grove. Typically, giant sequoia seedlings are intermixed with other species, primarily ponderosa or Jeffrey pine. Some of the largest and oldest planted sequoias are over 16 inches in diameter and 70 feet tall, although these are exceptional. The majority of the trees were planted in the 1980s in openings created by harvesting and the trees are typically 15 to 25 feet tall, intermixed with other conifer species. The giant sequoia seedlings are the fastest growing of the planted trees. The largest single planting of giant sequoia occurred adjacent to the boundaries of the Monument, in the area of the Stormy Fire of 1990. The site of the Stormy Fire is farther south than the southernmost grove (Deer Creek Grove) and farther east than the easternmost grove (Freeman Creek Grove). As part of the re-establishment of the mixed-conifer forest, several thousand giant sequoia seedlings were planted in areas with a wide variety of site conditions. These trees are generally the fastest growing of the planted stock and are surviving and growing extremely well.

Existing vs. Desired Conditions of Key Ecological Characteristics

This section summarizes the conditions of key vegetation characteristics. The Proclamation noted the lack of regeneration of giant sequoia and the risk of catastrophic fire. Special attention is given in this section to important characteristics of structure, species composition, age class distribution, and fuel loading. These existing conditions are compared to the desired conditions. The foundation for the desired condition is two-fold: 1) Advisory III as submitted to the Forest Service by the Giant Sequoia National Monument Scientific Advisory Board (Scientific Advisory Board, 2001), and 2) the report An Ecological Foundation for Management of National Forest Giant Sequoia Ecosystems'; (Piirto & Rogers, 1998). This report describes a recommended range of management variability (RMV) for specific structural and process conditions in the mixed conifer-giant sequoia forest ecosystems in the Monument. These recommended ranges of variability are considered to be the desired conditions for the purposes of the Monument management plan. The recommended ranges of variability for key terrestrial elements are as listed in Table III-12.

Table III-12: Summary of Ecosystem Elements and Desired Conditions

Gaps and Patch Size Indicator. This indicator addresses the general physical arrangement of gaps (openings in the forest canopy) and patches (gaps that have become occupied with vegetation). The absence of fire and the scope and magnitude of harvest treatments in the groves have led to existing structural conditions and natural processes that are not consistent with desired conditions. The elimination of a low intensity-high frequency regime of fire (characteristic of pre-1875 conditions) has led to major changes in stand structure. Piirto and Rogers state that Giant sequoia mixed conifer forests now have: 1) more smaller trees with higher proportions of white fire and incense-cedar than were present historically; and 2) increased levels of fuel both on the forest floor and as fuel ladders (McKelvey, et al, 1996; Skinner and Chang, 1996; Stephenson, 1994).'; In addition, the elimination of an historic fire regime has shifted to a more continuous forest cover structure, rather than a highly variable stand structure with varieties of gaps, patches of vegetation, and ages, which were typical forest conditions prior to 1875 (Piirto and Rogers, 1999). The vast majority of recent gaps and vegetation patches in the groves were created in the 1980s by harvesting. These gaps typically range from five to 25 acres in size. It is within these gaps that regeneration of giant sequoia and other mixed conifer species has occurred. The desired range is much smaller than this, with average gap sizes of 0.1 to 2.0 acres in size (Piirto and Rogers). Larger gaps are expected, but with reduced frequency (Fry, 1933, 1948; Stephenson, et al, 1991; Stephenson, 1994, 1996).

Gap and Patch Frequency Indicator. This indicator addresses the status of existing and desired gaps and patches of vegetation in the groves. To date, data is available for five groves within the Monument, as well as two other groves on other national forest system lands. These groves are representative of conditions in other groves that have had no significant recent disturbance. Data from these groves were analyzed to determine the extent and characteristics of existing gaps and associated patches of vegetation that exist within the undisturbed portions of the groves, rather than the openings from recent harvesting.

Table III-13: Percent of Grove Area by Basal Area Stocking

These data indicate that, in four of the five inventoried groves, there appear to be sufficient gaps in the forest where there is almost no stocking of trees (<20 square feet per acre). These openings were examined further to determine the nature of the vegetation that was within these non-stocked or very poorly stocked gaps. The data indicate that the vegetation in these gaps is brush and scattered small trees, with the large majority of the trees being white fir and cedar less than 6 inches in diameter, species already well represented in adjacent well-stocked areas. These results also indicate that some groves may have sufficient existing openings to initiate new age classes of giant sequoias and other mixed conifer species with little or no

disturbance of the adjacent better-stocked forest. Establishment of new trees in these gaps could meet the desired condition of between 1% and 10% of each grove in trees less than ten years old. Establishment of subsequent new pulses of young trees in future years would generally need to occur in gaps created in adjacent stands in order to promote establishment of a range of age classes.

Plant Community Indicator. This indicator addresses the type of species and density of vegetation. Inventory data and field observations of numerous groves indicate that existing conditions do not meet the desired conditions. There has been a sustained and dramatic increase in shade-tolerant species such as white fir and incense cedar and a concurrent reduction in shade-intolerant, fire-dependent species such as giant sequoia and pines (sugar, Jeffrey, and ponderosa pines). For both percent of trees per acre and basal area per acre, almost all groves were outside the recommended management variability documented by Pirrto and Rogers. The only exception was in Long Meadow Grove, where the basal area of giant sequoia is within the recommended range. However, the amount of other mixed conifer species, and white fir specifically, is larger than the recommended range. See Table III-14 for a display of data for each grove, both existing and desired.

Table III-14: Amounts of Giant Sequoia and Other Mixed Conifer in Five Inventoried Groves

Fire Severity Indicator. The recommended management variability (RMV) for this indicator is that between 10 and 25% of the grove area be in the high to extreme range for fire severity. Fire susceptibility was calculated for the entire area of the Monument and is used as a measure of the risk of catastrophic fire. Of the 34 groves and grove complexes, 24 do not meet the RMV. Sixteen of the 24 have extremely high percentages of high susceptibility (typically >50%). Ten of the 34 meet the RMV. Table III-15 compares the groves that do or do not meet the RMV for this indicator, and also recommends a priority for fuel reduction treatment based solely on their fire severity indicator status.

Table III-15: Groves by Fire Severity Indicator

Return to top of page.

Range

There are 25 grazing allotments within or partially within the Monument (see Table III-16). They are organized into 19 functional allotments. Fourteen of the allotments are based on annual grasses, four include a mixture of annual and perennial grasses (primarily meadows) and one is based on perennial grasses alone. A combined total of approximately 18,000 animal months (AMs) and 3,200 head of livestock are permitted within the Monument.

Current condition and trend transects have been established in 18 meadows within the Monument. All of these show vegetation, rooting depth, and soil condition to be in high mid seral stage. Condition and trend are not applicable to vegetation that is highly variable season to season as are annual grasslands. In annual grasslands, soil conditions are monitored. Stream condition has been evaluated for many of the streams within the grazing allotments and is discussed within the affected environment for watershed.

Table III-16: Grazing Allotments in the Monument

Rare Plants

Fourteen of forty-eight special status plants, including one federally listed species, listed for the Sequoia National Forest, are found in the Monument. Additional species are included in a special watch list for the forest.

Habitat Guilds

For ease of analysis and better tracking, the effects analysis uses guilds outlined in the Framework. Plants are rated according to vulnerability and grouped by their ecological requirements for soil type, moisture regime, and/or canopy closure. Guilds are grouped into two major subsets: spatially and temporally defined guilds.

Since there are fewer plants to address, and less complexity, subdivisions under spatial and temporal guilds addressed in the Framework were condensed into aquatic and terrestrial groups. For the most part, the aquatic group is protected by the Framework's aquatic management strategy. This group has a very low risk of impact except from grazing and

recreation as discussed in the Framework. The terrestrial guilds are mostly found on or in rock outcrops, in small openings with soil characteristics that limit other competing vegetation, or around other natural features that provide protection from management-related disturbances.

Greater detail on individual species is available from CalFlora (CalFlora, 2000), California Native Plant Electronic Inventory (California Native Plant Society, 1997), the national PLANTS Database (USDA NRCS, 1997), and the biological resources working papers for this statement.

Spatially Defined Guilds

Spatially defined guilds include species inhabiting mapped landscape features, or patches, expected to remain in a specific geographic location over the next 50 years. Within this subset, guilds are further sorted into riparian or terrestrial environments. Riparian Guilds. Riparian guilds include habitats such as bogs/fens, meadows/seeps, vernal pools, lakeshores, or streamsides in non-forested settings, riparian forest, and riparian woodland. The watershed section describes the current condition of riparian habitats in general. The specific characteristics of the riparian guilds are adapted from the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants (Skinner and Pavlick, 1994).

There is considerable overlap of species between riparian guilds and proposed management provides similar protection under each alternative. Species occurring in the riparian guilds include: Botrychium crenulatum, Hydrotheria venosa, and Meesia triquetra.

Terrestrial Guilds. Terrestrial guilds include rock outcrops and cliffs. Plants associated with rock outcrops, cliffs, and special edaphic features include: Delphinium inopinum, Dicentra nevadensis, Erigeron aequifolius, Eriogonum breedlovei var. breedlovei, Erogonum prattenianum var. avium, Eriogonum twisselmanii, Lewisia disepala, Monardella linioides ssp.oblonga, Oreonana purpurascens, and Raillardiopsis muirii.

Temporally Defined Guilds. Temporally defined guilds include species that require ephemeral habitats. In an ecologically functioning forest, habitats for these species are always present, but availability varies over time and space. Temporally-defined habitats include: (1) small natural gaps in forest interior (openings created when one or several trees die - referred to as gap-phase';), (2) larger openings created by disturbances (such as wildfire, mechanical treatments, and landslides), and (3) openings created by fire alone. Some species are strictly fire-followers and depend on first order fire effects (such as soil heating) to germinate and reproduce. Species in this last guild are typically seen only the first year or two after a fire. Species from all terrestrial guilds, including undefined guilds that inhabit dry openings, are treated similarly, have similar effects, and are grouped together for this analysis. Species assigned to this guild are Brodiaea insignis, Calochortus westonii, Clarkia springvillensis, Heterotheca shevockii, Hulsea brevifolia, and Monardellalinioides ssp. oblonga.
Table III-17: Federally Listed and R5 Sensitive Plants, Sequoia National Forest

Watershed

The waters from the watersheds of the Monument all flow into the Tulare Lakebed. The Tulare Lakebed is located in the southern San Joaquin Valley about equidistant from the cities of Fresno and Bakersfield. Historically, the Tulare Lakebed received runoff from the Tule, Kaweah, Kern, and Kings Rivers, as well as other tributaries in these basins. The lakebed was the largest inland body of water west of the Mississippi River. Because the lakebed lacked an outlet to the sea, it acted as a sink in most years. In 1862, the wettest year on record, Tulare Lake encompassed about 486,000 acres to depths of 40 feet. During those wet periods of large-scale flooding, floodwaters reached the outlet to the Sacramento-San Joaquin River Delta. Floodwater flows from the Tulare Lakebed to this outlet last occurred in 1878.

In the late 1800's and early 1900's, reclamation districts were formed to prevent flooding in the lakebed, allowing agricultural production to begin. The lakebed is currently defined as an area that encompasses from 200,000 to 250,000 acres. The lakebed is extensively farmed in crops such as cotton, barley, wheat, safflower, alfalfa seed, as well as others. Flooding is controlled by dams and diversions upstream on the Tule, Kaweah, Kern, and Kings Rivers, and by flood control features such as detention basins, levees, and pumps within the lakebed (U.S. Army Corps of Engineers, 1999).

There are 13 watersheds that are at least partially within the Monument (see Table III-18 and Figure III-9). Two of these watersheds, the Lower South Fork Kings River and the Converse-Mill Flat Creek are shared between the Sequoia and Sierra National Forests. The Converse-Mill Flat Creek, the Upper North Fork Kaweah River, and the Upper Dry Creek are shared with the Sequoia and Kings Canyon National Parks. The South Fork Tule River is shared with the Tule

River Indian Reservation. The North Fork Tule River and the Middle Fork Tule River are shared with Mountain Home State Forest. The Middle Fork Tule River is the only watershed that is almost completely located within the Monument. The following table displays the basins and watersheds located within the Monument.

Table III-18: River Basins and Watersheds In the Monument

The California State Water Resources Control Board, U.S. Department of Agriculture, U.S. Environmental Protection Agency, and the Natural Resources Conservation Service conducted a unified watershed assessment in accordance with the Federal Clean Water Action Plan (U.S. Environmental Protection Agency, 1998). The purpose of the watershed assessment was to identify those watersheds with the most critical water quality needs and to help guide resources toward correcting the identified problems. The information from this analysis has been incorporated into the watershed analysis for the Monument. The Unified Watershed Assessment was performed at the basin or 4th field hydrologic unit code (HUC) level. Watershed assessments for watersheds in the Monument have been done at the 5th field HUC or watershed level. A watershed is a smaller unit within a basin. Information used to characterize watersheds includes data collected at all levels. This analysis may be found in Volume 4, Appendix I-7, Aquatic and Riparian Information, of the Sierra Nevada Forest Plan Amendment (USDA Forest Service, Pacific Southwest Region, 2001).

The following table displays the beneficial uses existing within the watersheds of the Monument. Beneficial uses are documented in the State Water Quality Control Tulare Lake Basin Plan and consist of designated uses to be protected, water quality objectives to protect uses, and a program of implementation needed for achieving the objectives (California Water Code, 1975). Beneficial uses, together with water quality objectives, meet federal regulatory criteria for water quality standards. Therefore, the protection of those past, present, and probable future beneficial uses of water constitutes compliance with state water quality standards. According to the Water Quality Control Plan for the Tulare Lake Basin (California Regional Water Quality Control Board, 1995), all water-related problems can be stated in terms of whether there is water of sufficient quantity and quality to protect or enhance beneficial uses.

Table III-19: Beneficial Uses for Monument Watersheds

*These watersheds are less than 10 percent national forest system lands or are less than 10,000 acres. These watersheds were excluded from analysis under the Framework. Those watersheds less than 20,000 acres may have been included with a larger neighboring watershed for analysis.

**Rare indicates known occurrences or potential habitat for threatened, endangered, or sensitive species.

(1) Western pond turtle, mountain yellow-legged frogs, and willow flycatcher

(2) Hardhead minnow, western pond turtle, foothill and mountain yellow-legged frogs, California red-legged frogs, western pond turtles, and willow flycatchers

(3) Western pond turtle, foothill and mountain yellow-legged frogs, California red-legged frogs, western pond turtles, and willow flycatchers

(4) Western pond turtle, foothill and mountain yellow-legged frogs, California red-legged frogs, western pond turtles, and willow flycatchers

(5) Western pond turtle, foothill and mountain yellow-legged frogs, California red-legged frogs, western pond turtles, and willow flycatchers

(6) Kern Canyon slender salamander, mountain and foothill yellow-legged frog, western pond turtle, willow flycatcher, and Kern River rainbow trout

(7) Western pond turtle, mountain and foothill yellow-legged frog, relictual slender salamander, and legless lizard

(8) Western Pond Turtle, foothill yellow-legged frog, and relictual slender salamander

(9) Western pond turtle

(10) Western pond turtle, foothill yellow-legged frog, relictual slender salamander

(11) Foothill yellow-legged frog, relictual slender salamander

(12) Western pond turtle, foothill yellow-legged frog, relictual slender salamander

Upper Kings River Basin

The Kings River basin is located in the southeastern part of the San Joaquin Valley. It is bounded on the north by the San Joaquin River and on the south by the Kaweah River. The Kings River originates high in the Sierra Nevada and flows in a southwesterly direction as it leaves the foothills and enters the San Joaquin Valley. Below Pine Flat Dam, it divides into numerous channels, which converge into a single channel, and then separates again into Kings River North and Kings River South. Kings River North flows into the San Joaquin River and Kings River South flows into Tulare Lake.

Pine Flat Dam, completed by the Corps of Engineers in 1954 and situated about 25 miles east of Fresno, impounds Kings River flows for flood control, water conservation, recreation, and hydroelectric power generation. Pine Flat Lake has a capacity of about one million acre-feet at gross pool. Downstream of Pine Flat Dam, the Corps constructed levees, channel improvements, and weirs to control flood flows (Federal Register, April 5, 1996).

The Upper Kings River Basin was rated as a Category II in the Unified Watershed Assessment. A Category II rating describes watersheds with good water quality that, through regular program activities, can be sustained and improved. Category II watersheds currently meet clean water and other natural resource goals and standards and support healthy aquatic ecosystems.

The Kings River represents the southernmost tributary to the San Joaquin River system that is known to have supported Chinook salmon. In the past, the Kings River emptied into Lake Tulare. The waters of the two streams connected during period when levels of Tulare Lake overflowed into the San Joaquin. Presently, both native and introduced fish species are found in perennial streams within the Upper Kings River watershed. In addition to salmon, historically the Kings River and the lower reaches of some tributaries contained rainbow trout, hardhead minnow, Sacramento sucker, Sacramento pikeminnow, and California roach (Moyle, 2002). Other fish species introduced into the watershed include non-native rainbow trout, brown trout, eastern brook trout, golden trout, smallmouth bass, and spotted bass. Chinook salmon have been stocked in Pine Flat Reservoir and there have been reports of spawning in the river (Mitchell, 2000, personal communication).

Fishing in most of the Upper Kings River within the Monument is managed by the California Department of Fish and Game as a wild trout fishery. Regulations pertaining to this fishery apply to approximately 18 miles of the Kings River. It extends upstream from Pine Flat Reservoir to the confluence of the Middle and South Forks of the river. Wild trout waters are managed principally by protecting, maintaining, and rehabilitating habitat, and adopting appropriate angling regulations.

Lower South Fork Kings River Watershed (1803001003). The Lower South Fork of the Kings River Watershed is located on the western slope of the Sierra Nevada Mountains. This watershed drains one of three main forks of the Kings River, and is fairly typical of the rugged, partially glaciated river basins of the west side Sierra streams. Itis approximately 81,520 acres in total, of which about 57,890 acres are in the Sequoia National Forest. Approximately 23,800 acres are within the Monarch Wilderness and 7,000 acres are within the Jennie Lakes Wilderness, and 400 acres surrounded by national forest system lands are under private ownership. Kings Canyon National Park makes up about 23,790 acres of this watershed. Approximately 35,470 acres of the watershed within the Sequoia National Forest is also within the Monument. This area includes the 9,300-acre Agnew Roadless Area and approximately half of the Monarch Wilderness (estimated 11,900 acres).

Elevation ranges from about 4,000 to 9,000 feet. The watershed is comprised of granite bedrock, which intruded pre-existing ocean floor sediments, which now form roof pendants. These rock types are marble and meta-volcanic and sedimentary rocks. About one quarter of the watershed has been glaciated and the remaining three quarters was formed from stream or fluvial processes. Just east of the confluence of the South Fork Kings River and Grizzly Creek, glacial features terminate. The South Fork of the Kings River flows in a rugged river gorge beyond this point. The drainage is characterized by steep, bedrock boulder-dominated river gorges below Grizzly Creek Falls and the wider, flatter uplands above this confluence. Uplands are steep in sections near the watershed divide and exhibit evidence of glacial polish in the headwaters.

Riparian vegetation consists of stringers of willows and aspen, along creek or meadow edges. Vegetation has good vigor and density and meadow species are flooded for about one month each spring during snowmelt. Steep bedrock and boulder channels cannot grow lush riparian vegetation along their limited flood planes. This type of riparian ecotype makes up of about

one-third of the watershed streams.

U.S. Geological Service (USGS) stream gages for the watershed have a 22-year period of record for the Lower South Fork of the Kings River near Hume, California between 1922 and 1957, and a 6-year period of record at Cedar Grove between 1951 and 1956. Measured peak flows from these stations range from 1042 to 2097 cubic feet per second (cfs) and minimum flow from 378 to 409 cfs. Duration of minimum flow is estimated at 22 days and occurs in the month of October. The peak flow in 1952 and minimum flow in 1924 correspond to USGS stream gage readings from other rivers in the vicinity.

The western pond turtle is the only threatened, endangered, or sensitive aquatic/riparian species known to occur within this watershed. However, there is potential habitat for mountain yellow-legged frogs, relictual salamander, and willow flycatchers. The potential habitat for the willow flycatcher is in the Horse Corral and Big Meadows areas.

Both native and introduced fish species are found in perennial streams within this watershed. Historically, this segment of the Kings River, and the lower reaches of some tributaries, contained rainbow trout, hardhead minnow, Sacramento sucker, Sacramento pikeminnow, and California roach (Moyle, 2002). Other fish species introduced into this watershed include rainbow trout, brown trout, eastern brook trout, golden trout, and small mouth bass. Grizzly Lakes, Jennie Ellis Lake, and Weaver Lake are the only large water bodies in this watershed and were stocked with non-native trout species starting in the early 1900s. Due to the conflict between native amphibians and non-native trout, the California Department of Fish & Game does not currently stock these high mountain lakes. Introduced fish species have become self-sustaining through the majority of the watershed.

Natural disturbances to water quality include wildfires and floods. Man-caused impacts include roads, residences, recreation, grazing, stock use, and vegetation management. Past disturbances have the potential to affect water quality. Watersheds of concern due to past disturbances include Big Meadow Creek and Buck Rock Creek.

Converse-Mill Flat Creek and Mill Creek Watersheds (1803001005, 1803000801). Converse, Mill Flat, and Mill Creeks are the main tributaries to the Kings River on the western slope of the Sierra Nevada Mountains and flow south into the Kings River at or above the Pine Flat Reservoir. Included with this watershed is the portion of the Mill Creek Watershed that falls within the Monument. The uppermost portion of Mill Creek encompasses approximately 4,000 acres that drain approximately 3.5 linear miles of perennial streams west into the Kings River below Pine Flat Reservoir. The Converse-Mill Flat Creek Watershed is divided into seven basins: Upper Tenmile Creek, Lower Tenmile Creek, Cabin Creek, Converse Creek, Verplank Creek, Mill Flat Creek, and Davis Creek. Approximately 1/3 of the Davis Creek basin lies outside the Monument.

The Converse-Mill Flat Creek Watershed consists of approximately 101,480 acres, of which about 73,170 acres are within the Sequoia National Forest. Within the national forest, about 9,360 acres are under private ownership, approximately 64,800 acres are within the Monument, about 22,450 acres are in the Kings River Special Management Area, and approximately 12,400 acres are in the Oat Mountain RARE II Planning Area. Within the Oat Mountain area, about 580 acres are under the jurisdiction of the Army Corps of Engineers and administered by the Sequoia National Forest. Some of these areas overlap with 9,500 acres of giant sequoia groves and the 26,690-acre Mill Flat Creek Critical Aquatic Refuge. Approximately 3,840 acres are within the Kings Canyon National Park and Wilsonia, and 92,970 acres are in the Sierra National Forest.

Elevation ranges from about 900 to 8,000 feet in the drainage and is predominantly granite bedrock, with alluvial fans and basins. Approximately 50 percent of area is steep, bedrock, boulder-dominated river gorges draining into the main stem of the Kings River. Headwater drainages are generally bedrock boulder-dominated streams as well. The wetlands riparian morphology is mainly narrow, steep, boulder/bedrock-dominated channels with little riparian vegetation in the Kings River gorge and along the main tributaries. In the upland basins there are wider riparian areas, generally in the form of meadows or willow clumps along the streams, with substrates ranging from boulder to sand and silt. Several of the meadows have standing water in early spring with high sinuosity, low gradient channels.

Flows from the watershed are extremely variable. It was reported on January 1, 1997, that a low of 6,247 acre-feet per day flowed into the Pine Flat Reservoir, and on January 2, 1997, a maximum of 32,821 acre-feet per day was reported. In the Oat Mountain area, it is estimated that an average of 4,000 acre-feet per day flows into the Pine Flat Reservoir (USDA Forest Service, Sequoia National Forest, 1988, Land and Resource Management Plan Final Environmental Impact Statement, Appendix C, page C13).

Riparian vegetation consists of stringers of willows and aspen, usually along creeks or meadow

edges. This vegetation generally has good vigor and density. However, the aspen stands along upper Tenmile Creek are over-mature. Meadow forbs and grasses are in standing water approximately one month each spring. There is minimal riparian vegetation in channels with a predominant bedrock/boulder substrate. These drainage types comprise about ¼ of the drainages in the watershed.

These watersheds have potential aquatic/riparian habitat for threatened, endangered, and sensitive species. While western pond turtles are known to occur within these watersheds, there is possible habitat for foothill and mountain yellow-legged frogs, California red-legged frogs, relictual slender salamander, and willow flycatchers. The Mill Flat Creek drainage has been designated a critical aquatic refuge for western pond turtles and native fish associations including hardhead minnows.

Presently, both native and introduced fish species occur within the watershed. Historically, these watersheds represented the upper extent of migration by Chinook salmon (and possibly steelhead trout) in the Kings River system, near the confluence of the North and South Forks. Completion of Friant and Pine Flat Dams, along with natural flow reductions within the San Joaquin River, resulted in the extirpation of native salmon in the upper Kings River system (Yoshiyama, et al, 1996). Other native fish species in this segment of the Kings River and the lower reaches of some tributaries are rainbow trout, hardhead minnow, Sacramento sucker, Sacramento pikeminnow, and California roach (Moyle, 2002). Fish species introduced into the watershed include rainbow trout, brown trout, eastern brook trout, golden trout, and smallmouth bass. Streams and impoundments are stocked annually by the California Department of Fish and Game. Hume, Sequoia, and Pine Flat Lakes are water impoundments with dams.

Natural disturbances to water quality include floods and wildfires. Large scale flooding in January of 1997 damaged facilities at Hume Lake Christian Camps. The areas burned by the Robinson, Converse, McGee (1955), and Highway (2001) fires cover approximately 50% of this watershed. Human-caused impacts include those from roads, recreation residences, private camps and houses, recreation, Hume Lake Dam, grazing, and vegetation management activities. These disturbances currently affect the subwatersheds located in the Sampson Creek, Mill Creek, Upper Abbott Creek, and Mill Flat Creek drainages.

Upper Kaweah Basin

The following passage describing the Kaweah Basin was taken from theSan Joaquin District, Department of Water Resources, Division of Planning and Local Assistance, Kaweah Ground Water Basin Preliminary Report, and the 1996 Kaweah River Basin Investigation Draft Environmental Impact Statement/Report, U.S. Army Corps of Engineers:

The Kaweah Basin lies between the Kings Basin on the north, the Tule Basin on the south, the Sierra Nevada foothills on the east, and the Kings River Conservation District on the west. Major rivers and streams in the basin include the Kaweah and St. Johns Rivers. The Kaweah River is the primary source of recharge to the area.

The Kaweah River Basin ranges in elevation from 175 feet in the Tulare Lakebed to 12,600 feet in the Sierra Nevada. Along the western foothill front, granitic and basic intrusive rock outcrops form outliers of low to irregular hills rising from the valley floor. The topography above Terminus Dam is steep, mountainous terrain with deeply incised canyons. Mountain peaks and ridges characterize the area above 10,000 feet. Below the dam the foothills slope gently to the Tulare Lakebed.

The Kaweah River originates from a group of glacial lakes near Triple Divide Peak on the Great Western Divide, a secondary ridge parallel to the main crest of the Sierra Nevada. The Kaweah River is comprised of the North, Middle and Marble Forks above the town of Three Rivers. Below Three Rivers, the South Fork of the Kaweah confluences into the main drainage at the head of Lake Kaweah. These forks have an overall slope of 350 feet per mile and are fed by numerous short, steep streams with slopes ranging from 400 feet per mile to almost 1,000 feet per mile.

More than one-half of the basin tributary to Lake Kaweah lies within the boundaries of Sequoia National Park. The 561 square-mile watershed above Terminus Dam drains to the west and reaches the flattened slopes of the San Joaquin Valley floor about 2 miles below the dam. As the Kaweah River flows toward the valley floor, many distributaries branch from the main river creating the effect of a delta. A few of the Kaweah River's distributaries eventually reach the Tulare Lakebed.

The sediments that comprise the Kaweah Basin aquifers are unconsolidated deposits of Pliocene, Pleistocene, and Recent age. On the east side of the basin, these deposits consist of

arkosic material derived from the Sierra Nevada and are divided into three stratigraphic units: continental deposits, older stratigraphic, and younger alluvium. In the western portion of the basin, near the Tulare Lakebed, unconsolidated deposits consisting of flood-basin and lacustrine and marsh deposits interfinger with east side deposits.

The continental deposits of Pliocene and Pleistocene age are divided into oxidized and reduced deposits on the basis of depositional environment. The oxidized deposits, which crop out along the eastern margin of the valley, consist of deeply weathered, poorly permeable, reddish-brown sandy silt and clay with well-developed soil profiles. The reduced deposits are moderately permeable and consist of micaceous sand, silt, and clay that extend across the trough in the subsurface to the west side of the valley. Older alluvium, which overlies the continental deposits, is moderately to highly permeable and is the major aquifer in the basin.

Younger alluvium consists of arkosic beds, moderately to highly permeable, consisting of sand and silty sand. Generally less than 55 feet thick, it is an important aquifer in the Hanford-Lemoore area.

Flood basin deposits consist of poorly permeable silt, clay, and fine sand. Ground water in the flood-basin deposits is often of poor quality. Lacustrine and marsh deposits consist of blue, green, or gray silty clay and fine sand and underlie the flood-basin deposits. Clay beds of the lacustrine and marsh deposits form aquitards that control the vertical and lateral movement of ground water. The most prominent clay bed is the Corcoran clay, which underlies the western half of the Kaweah Basin at depths ranging from about 200 to 500 feet. In the eastern portion of the basin, ground water occurs under unconfined and semi-confined conditions. In the western half of the basin, where the Corcoran Clay is present, ground water is confined below the clay (San Joaquin District, Department of Water Resources, Division of Planning and Local Assistance, 1995, Kaweah Ground Water Basin Preliminary Report).

The Kaweah Basin was rated as a Category II in the Unified Watershed Assessment. A Category II rating describes watersheds with good water quality that, through regular program activities, can be sustained and improved. Category II watersheds currently meet clean water and other natural resource goals and standards and support healthy aquatic ecosystems.

Upper North Fork Kaweah River, South Fork Kaweah River, and Upper Dry Creek Watersheds (1803000704, 1803000705, 1803000706). The upper north fork Kaweah River drainage is on the western slope of the Sierra Nevada Mountains. Stony, Woodward and Eshom Creeks flow into the Kaweah River above Kaweah Lake. Dry Creek flows into the Kaweah just below the Reservoir. The north fork of the Kaweah is one of three main forks of the Kaweah River, and is fairly typical of the rugged, partially-glaciated river basins of the west side Sierra streams. Floods rarely occur in the upper portion of the Kaweah on Sequoia National Forest. U.S. Geological Survey stream gauge stations are located on the north fork of the Kaweah River.

These watersheds are approximately 232,240 acres in total, of which approximately 27,530 are within the Sequoia National Forest and 24,480 are in the Monument. Within these boundaries, there are approximately 1,270 acres in private ownership, and approximately 310 acres are in the UC Berkeley-owned Whitaker Forest. Approximately 62,120 acres of the upper Kaweah drainage are within Kings Canyon and Sequoia National Parks; the remaining 22,900 acres are privately owned. Of the portion within the Sequoia National Forest, approximately 1,430 acres are within the Redwood Mountain Grove.

Elevation in the Upper Kaweah drainage ranges from about 4,000 to 8,500 feet. The basin is comprised predominantly of granite bedrock, with alluvial fans and basins. Approximately 30 percent of the area is in steep, bedrock, boulder-dominated river channels draining into the upper Kaweah River. Approximately 35 percent is in basins and other areas of alluvial deposition, with the remaining 35 percent in the steeper headwater drainages leading to the watershed boundaries.

The wetlands and riparian areas are characterized by narrow steep boulder/bedrock-dominated channels, with little riparian vegetation in the Stony and Woodward Creek drainages and in the lower Eshom drainage outside national forest. Dry and Eshom Creeks have more pronounced riparian area at higher elevations where gentler stream gradients favor meadow and willows associated with boulder to sand and silt substrates. Several of the meadows, such as Pierce Meadow, have standing water in early spring with low gradient meandering channels.

Riparian vegetation consists of stringers of willows, along creeks or at meadow edges. Vegetation has good vigor and density. There are small aspen patches in the upper Woodward Creek area.

Western pond turtles are known to occur within these watersheds. There is also possible habitat for foothill and mountain yellow-legged frogs, California red-legged frogs, relictual

slender salamander, Sequoia slender salamander, and willow flycatchers. There are no known Forest Service sensitive plant species in the Upper Kaweah River drainage.

Both native and introduced fish species are found in perennial streams within the watersheds. Historically, these segments of the Kaweah River contained hardhead minnow, Sacramento sucker, Sacramento pikeminnow, and California roach (Moyle, 2002). Other fish species introduced into the watershed include rainbow trout, brown trout, eastern brook trout, golden trout, and smallmouth bass. Fish stocking efforts in the early 1900s have resulted in self-sustaining populations. Streams and impoundments are stocked annually by the California Department of Fish and Game. The Montecito Sequoia Resort Lake and Pierce Pond are the only bodies of water other than the stream courses in this watershed, and both are water impoundments with earthen dams.

Natural disturbances to water quality include wildfires and floods. Areas severely burned in historic fires and recent fires (Pierce) cover approximately 10% of the watershed. Human-caused impacts are predominantly associated with roads, grazing, and vegetation management activities.

Kern River Basin

The Kern River Basin drains a 2,300 square mile watershed above Bakersfield, California. The North Fork of the Kern River begins at over 10,000 feet in elevation along the Kings-Kern Divide, Junction Peak, and Triple Divide Peak, which separate the south-flowing North Fork of the Kern from the headwaters of the Kings River and the west-flowing Kaweah River. The North Fork Kern tributary system flows over 400 miles from its headwaters to Lake Isabella. The South Fork of the Kern River begins at over 10,000 feet in elevation in alpine meadows on the Kern Plateau. The South Fork and its tributary streams total over 200 miles and flow from near Mount Whitney to Lake Isabella. The Kern Basin is unique because five of California's six major bioregions merge in the valley: the Great Basin Desert, the Mojave Desert, the Coastal Chaparral, the Sierran Forest, and the Great Valley Grassland. This area includes the largest remaining contiguous riparian forest in California.

Glaciers covered most of the high Sierra Nevada mountain range during the Pleistocene Age (10,000 to 2,000,000 years ago). Geologic forces uplifted the mountains of the Kern Plateau, which then experienced the down cutting of the Kern River, erosion, volcanic activity, and glaciation over the past 1.5 million years. This combination of forces left hanging valleys,'; or basins with high waterfalls, which are natural barriers to fish migration. These migration barriers isolated rainbow trout in the upper Kern River basin. Over thousands of years, this isolation resulted in the development of the golden trout complex of fish. The golden trout complex consists of the Little Kern golden trout, the California Creek golden trout, and the Kern River rainbow trout. The vividly colored golden trout are prized by anglers throughout the world and the California golden trout has been designated the state fish.

The Kern River flows out of the Sierra Nevada foothills across the Kern River fault. It undergoes a dramatic change in slope as it spreads out from the confines of the Kern River Canyon onto the grasslands of the southern San Joaquin Valley. This water is used for crop irrigation, domestic water, and allowed to seep into the alluvial river bottom to recharge the aquifers in the old Tule Lakebed.

The upper reaches of the North Fork of the Kern River, from its confluence with the Little Kern River upstream to its confluence with Tyndall Creek, was designated a Heritage Trout Stream in 1999. This stream is within the Golden Trout Wilderness in the Sequoia National Forest and Sequoia National Park. The southeastern edge of the Little Kern River Critical Aquatic Refuge overlaps the Monument boundary. Because the Monument affects so little of this watershed, it has been included in the discussion of the Kern River Basin.

Over 151 miles of the North and South Forks of the Kern River above Lake Isabella were made a part of the National Wild and Scenic River system in 1987. The upper reaches of the North Fork are remote and accessed only by hiking and horseback. The four-mile section of the North Fork upstream of Johnsondale Bridge, which is about 20 miles north of Kernville, is a catch-and-release wild trout fishery managed under special angling regulations. Deep pools and fast runs characterize this part of the river, which has good trail access.

The Upper Kern Basin was rated as a Category II in the Unified Watershed Assessment. A Category II rating describes watersheds with good water quality that, through regular program activities, can be sustained and improved. Category II watersheds currently meet clean water and other natural resource goals and standards and support healthy aquatic ecosystems.

Middle Kern River Watershed (1803000105) and Little Kern River Watershed (1803000104). This watershed encompasses approximately 204,180 acres. About 200,900 acres are national

forest system land, of which approximately 73,400 acres lie within the Monument and about 2,120 acres are private land. Less than two acres lie outside the national forest boundary.

The Middle Kern River watershed is subdivided by the Kern River and borders the southern edge of the Golden Trout Wilderness. The Monument encompasses all of this watershed west of the Kern River. The watershed extends south to the community of Fairview. The morphology of the drainage basin is U-shaped along the Kern River, suggesting glacial influences. Terrain changes to more moderate slopes as elevation decreases towards the Kern River.

Elevations range from approximately 4,000 feet along the Kern River to a high of 8,270 feet at Needles Lookout. Streams exhibit a dendretic drainage pattern. Dominant channel types in the watershed are steep and moderate gradient, confined, boulder and bedrock channels with deep pools. High flows are associated with the Kern River and occur in the spring. Meadow environments occur most frequently at higher elevations.

Approximately 4,500 acres of the Little Kern River Watershed lies within the Monument. It comprises the uppermost sections of Fish Creek, Clicks Creek, and North Fork Creek. It also includes Loggy Meadow, Log Cabin Meadow, Junction Meadow, and White Meadow. These streams and meadows drain in an easterly direction into the Little Kern River that confluences downstream with the Middle Kern River. The Little Kern River Watershed contains the Golden Trout Wilderness and Little Kern golden trout. The Little Kern River comprises their critical habitat and has been designated a critical aquatic refuge for the species. This portion of the watershed is part of the Jordan Grazing Allotment.

The Kern Canyon was formed by numerous episodes of uplift, deformation, deposition, and intrusion of igneous rocks. The canyon has steep rock walls, cluttered with bedrock outcrops and large boulders. Alluvial fans have formed along the base of the canyon walls. Soils consisting of fine, well-sorted sandy loams have developed from the alluvial fans. Coarse sandy loams have developed from the weathering of the bedrock, boulders, and steep canyon walls. The steep rock walls and bedrock outcroppings are a result of the watershed having rapid runoff rates combined with concentrated flows.

The basins on the western half of the Middle Kern watershed, within the Monument, form both a physical and ecological boundary. This watershed contains ten sub-watersheds including Lloyd Meadow Creek, Nobe Young Creek, Mill Creek, Peppermint Creek, Freeman Creek, Dry Meadow Creek, Needle Rock Creek, Parker Meadow Creek, and sections of the Kern River. These sub-basins have a southern or eastern aspect, drain in a south or southeasterly direction, and feed the Middle Kern River, a wild and scenic river. Drainages outside the Monument within the Middle Kern Watershed have a western aspect and flow in a southwest direction into the Kern River. These sub-basins include Durwood Creek, Brush Creek, and sections of the Kern River.

The mountain yellow-legged frog is known to occur in the Little Kern River Watershed and potential habitat for the species occurs throughout the Middle Kern River Watershed above 5,600 feet in elevation. The foothill yellow-legged frog occurs at several sites on tributaries to the North Fork Kern River and potential habitat for the species occurs throughout the Middle Kern River Watershed below 5,600 feet. Potential habitat for the western pond turtle would be lower-gradient segments of streams within the lower portion of these watersheds. The Middle Kern River Watershed is also known to contain the Kern Canyon slender salamander and willow flycatcher.

Non-native fish species are presently widely distributed among streams in the Middle Kern Watershed. Streams and impoundments are stocked annually by the California Department of Fish and Game. Streams are dominated by rainbow and brown trout. Fisheries habitat condition is generally considered good in the Peppermint, Nobe Young, Freeman Creek, and Little Kern drainages, where canopy cover is generally dense and riparian vegetation is vigorous and diverse. While general conditions are good, there are site-specific sediment increases from off-site locations that negatively affect channel width to depth ratios. High use areas affect habitat conditions. High use is concentrated in the Pyles Camp area, Jerkey Meadow, and Forks of the Kern trailheads. In the South Creek watershed, fisheries habitat has been degraded in approximately 38% of the channel due to large amounts of sediment, high water temperatures, and low complexity cover due to areas of almost non-existent bank vegetation.

The Little Kern River Watershed contains the Golden Trout Wilderness and Little Kern golden trout. The Little Kern golden trout is native only to the Little Kern River Watershed. This species has been negatively affected by the introduction of non-native trout within its range. Rainbow trout and eastern brook trout were introduced in the Little Kern River Watershed in the 1930s and 1940s. By 1977, this trout was reduced to five isolated populations and occupied about 10% of its historic habitat within the watershed. Little Kern golden trout was listed as threatened under the Endangered Species Act due to cross breeding with rainbow trout and competition with eastern brook trout. The California Department of Fish and Game, Sequoia

National Forest, Sequoia and Kings Canyon National Parks, and the U.S. Fish and Wildlife Service are working together to restore pure populations of Little Kern golden trout through its native range. Since 1975, 90 miles of stream and eight lakes have had their non-native trout removed. Eight artificial barriers to upstream trout migration and 32 erosion control structures have been constructed to facilitate the recovery effort. The Little Kern River comprises the trout's critical habitat and has been designated a critical aquatic refuge for the species.

The main subwatershed of concern in the Middle Kern Watershed is the Holby Creek drainage. This is predominantly due to the effects of urbanization on water quality in the watershed.

Upper Tule River Basin

The Tule River Basin is located in Tulare and Kings Counties, in the southeast portion of the San Joaquin Valley, and the Tule River flows from the Sierra Nevada westward toward the Tulare Lakebed. Hydrologically, the basin is a closed system with the river terminating in the lakebed. Lake Success is located on the main branch of the Tule River about 6 miles east of Porterville. It is located within Tulare County, bounded on the north by the Kaweah Basin and on the south by the White River-Deer Creek Basin. Success Dam, with construction completed in 1961 by the U.S. Army Corps of Engineers, provides flood protection and storage for irrigation water. The earthfill dam is 142 feet high, 3,404 feet long, and has a gross pool elevation of 652.5 feet. Currently, the dam and its reservoir provide 82,300 acre-feet of water storage capacity.

The Tule River Basin is a fan-shaped area of about 393 square miles above Success Dam on the western slope of the Sierra Nevada. Three main forks form the Tule River Basin: the North, Middle, and South Forks, which are fed by numerous small tributaries.

Downstream of Lake Success, the Tule River flows through low foothills for three miles until it emerges on the valley floor above the City of Porterville. Downstream of Porterville, it flows through predominantly agricultural land to the Tulare Lakebed. Normally, during the irrigation season irrigation diversions deplete the river west of Porterville, long before it reaches the lakebed.

As the Tule River leaves the foothills, it enters the flat expanse of the San Joaquin Valley. The river passes along the southern edge of the City of Porterville, continues across the valley floor, converges with Elk Bayou (a distributary of the Kaweah River), and continues towards the Tulare Lakebed. A few miles upstream of Porterville is a natural distributary called Porter Slough that is used to convey irrigation water. In addition to Porter Slough, there are numerous irrigation diversions along the river. Water that is not diverted terminates in the Tulare Lakebed.

Elevations range from about 175 feet at the lowest point in the lakebed, to 450 feet in Porterville, to 550 feet at the dam, to a maximum of 10,000 feet in the upper watershed. The higher elevation areas are steep and mountainous, but transition to gentle slopes on the valley floor. Slopes range from 400 to 1,000 feet per mile. Soil cover below 9,000 feet is moderate to deep.

A non-federal hydroelectric plant is located below Lake Success. Two small hydroelectric power plants are located in the upper reaches of the Tule River. One plant is owned by the Pacific Gas and Electric Company and located on the North Fork of the Middle Fork Tule River. The other is owned by Southern California Edison and located on the Middle Fork Tule River. These plants operate on the unregulated flow of the Middle Fork Tule River.

Two types of floods could occur on the Tule River: winter and spring rain and spring/early summer snowmelt. Sharp peaks characterize the winter floods with most of the flood volume occurring within a few days. The spring flood events are usually not as sharp as the winter events. Winter floods generally occur between November and April. Snowmelt floods, on the other hand, have a greater volume, but the runoff occurs over a number of months. The time frame for snowmelt flooding is April through June. To date, peak snowmelt flow releases in the spring have not exceeded the channel capacity below Success Dam. When the reservoir is full and water spills over the spillway at the dam during major storm events, the flows could exceed channel capacity in the reach between the dam and the Tulare Lakebed and cause flood damages. Between water years 1904 and 1997, the average runoff of the Tule River was 145,020 acre-feet (U.S. Army Corps of Engineers. 1999).

Tule River waters can be classified as rich in calcium carbonate. Salinity concentrations are low; electrical conductivity ranges from 112 to 365 micromhos per centimeter. Occasionally, inflow levels of iron, lead, and zinc have exceeded EPA standards for freshwater aquatic life. At the South Fork inflow, total and dissolved iron levels exceeded the federal drinking water standards in the summers of 1995 and 1996. Total iron values also exceeded the drinking water standard at the North Fork inflow in the spring of 1995. Additionally, in the spring of 1995,

copper exceeded the aquatic life criteria at the North Fork inflow, and mercury exceeded the standard at the South Fork inflow. Both copper and mercury have exceeded federal standards in past years. However, mineral and nutrient concentrations in the inflow to Lake Success do not pose a threat to water quality within the lake or downstream of the dam.

No detectable levels of pesticides or polychlorinated biphenyls (PCBs) were found in recent sampling years, but in April of 1976 the PCB concentration in the South Fork was over twice the EPA limit.

Downstream of the dam at Lake Success, Tule River water has periodically contained some heavy metals, including cadmium, iron, manganese, and mercury. Cadmium has exceeded the aquatic life criteria and the EPA standard for agricultural irrigation water. Total iron and manganese in the outflow from Lake Success exceeded the federal water quality criteria during the summers of 1995 and 1996. Mercury, which has exceeded federal standards in the past, was below the limit during the 1994 to 1996 period.

PCB concentrations have been below detection limits on all but one occasion. However, the level was well below the 1986 EPA freshwater acute criteria. Nutrient and mineral concentrations below Success Dam do not pose a threat to downstream water quality or beneficial uses. Changes in release schedules at the dam have occasionally caused rapid changes in downstream water temperatures. Although there are no significant fisheries downstream of the dam, such temperature changes can harm downstream native aquatic habitat. Hydropower operations create low concentrations of dissolved oxygen in water releases below the dam for two to five miles downstream. These low dissolved oxygen values could also negatively affect the aquatic habitat (U.S. Army Corps of Engineers, 1999).

Incoming sediment is carried at a rate of 80 acre-feet per year. Presently, approximately 6,500 acre-feet of space remain for sediment in the Lake Success minimum pool. It is estimated this area could be filled by the year 2080.

The Upper Tule River Basin was rated as a Priority Category I in the Unified Watershed Assessment. Category I rating describes watersheds that are candidates for increased restoration activities due to impaired water quality or other impaired natural resource goals (emphasis on aquatic systems). Category I watersheds have flows that have been modified through the existence of dams, channels, canals, ponds, water transfers, and additional criteria listed in the Process for Development of the Final Unified Watershed Assessment (*California Unified Watershed Assessment Fact Sheet, Index of Indicators). Most of the activities leading to the classification occur in the lower reaches of the watershed. Roads, water diversions and hydroelectric power generation, private residence tracts, recreation, vegetation management, grazing, natural and prescribed fires, slope stability, and floods influence water quality in the watershed.

Both mountain and foothill yellow-legged frogs occurred historically in this basin, although there have been no confirmed identifications of these species here in the last 20 years. Potential habitat for both species exists along both perennial and intermittent streams. The western pond turtle occurs along the Tule River in the lower portion of this basin. Other sensitive species that may be present based on habitat include the relictual slender salamander and the pallid bat.

Rainbow trout, hardhead minnow, Sacramento sucker, Sacramento pikeminnow, and California roach were native to lower portions of this basin. The fishery is now dominated by non-native rainbow trout, brown trout, smallmouth bass, and green sunfish, although roach are still locally abundant. Trout are found in the Tule River upstream from Upper Coffee Camp. Some trout are caught of this site, but generally the stream is occupied by species that prefer warmer temperatures. The Tule River is stocked with trout by the California Department of Fish and Game periodically during the summer.

Middle Fork Tule River Watershed (1803000601). The Middle Fork Tule River is one of three large tributaries that feed the main stem of the Tule River. Its watershed encompasses approximately 66,260 acres within the Monument and drains approximately 99 linear miles of perennial streams. The basin is concave in nature with a drendetic drainage pattern. Headwaters of the watershed are dominated by steep rugged granitic slopes and rock outcrops, which gradually shift to rolling hills at lower elevations. The watershed drains west through Springville into Success Reservoir.

The total acreage within the watershed is 70,480 acres. National forest system lands occupy approximately 67,120 acres. Private property and state lands within the Monument encompass 4,160 acres and 2,450 acres, respectively. Approximately 3,270 acres of private lands occur at lower elevations west of the Forest. The entire watershed lies within the Monument.

Elevation ranges 1,070 feet at Springville to nearly 9,300 feet at Slate Mountain. Dominant channel types include steep and moderately steep bedrock and boulder channels with deep pools. Sedimentation levels tend to increase near channel confluences. Meadow environments occur in headwater areas. Most channels have standing water in the springs within meadow environments.

Western pond turtles are found in lower elevation river segments within this watershed. Other species that may have been present historically based on habitat include the mountain yellow-legged frog, foothill yellow-legged frog, relictual slender salamander, and legless lizard. Rainbow trout were native in the Tule River Watershed. However, fish stocking by locals and the California Department of Fish and Game has resulted in hybridization with non-native rainbow trout. There are self-sustaining populations of rainbow, brown, and brook trout in various locations throughout the watershed. Stream channels are in medium-good condition with adequate bank protection and abundant aquatic vegetation.

North Fork Tule River Watershed (1803000602). The watershed encompasses approximately 62,360 acres. Of these, about 30,475 acres are national forest system lands that fall within the Monument, approximately 4,370 acres are private land, 2,380 acres are state lands, and 32,120 acres lie outside the Monument. Approximately 6000 acres of the watershed comprise the Mountain Home State Forest.

This watershed drains approximately 39 linear miles of perennial streams. It is separated into two basins, North Fork Tule River and Bear Creek. The streams these two basins are the North Fork Tule River, Bear Creek, Rancheria Creek, Dillon Creek, Pine Creek, South Bear Creek, Backbone Creek, Kramer Creek, an unnamed tributary to Rancheria Creek, and Jenny Creek.

The elevation ranges from approximately 2200 to 9300 feet. Approximately 60 percent of the watershed within the Monument is in steep terrain with high gradient bedrock and boulder channels. The remaining 40 percent of the watershed is composed of moderate gradient boulder and cobble channels.

Surveys were conducted in 2001 on portions of Rancheria Creek, an unnamed tributary to Rancheria Creek, and Bear Creek within the Bear Creek drainage, as well as the North Fork Tule River in the North Fork Tule River drainage. Naturally stable bedrock, boulder, and cobble type channels dominate the watershed. However, areas of naturally unstable landslide-dominated channels and meadow-dominated stable sensitive channels exist in the headwaters of Rancheria Creek and the unnamed tributary to Rancheria Creek.

Forest Service Sensitive species with documented presence in this watershed include the California spotted owl (4 PACS), fisher, marten, goshawk (1 PAC), and western pond turtle. All of these species are associated with the use of riparian environments during various phases of their life cycle. Additional sensitive species that may be present based on habitat include the relictual slender salamander, foothill yellow-legged frog, mountain yellow-legged frog, and pallid bat.

The main subwatershed of concern in the Upper Fork Tule River Watershed is the Bear Creek drainage.

South Fork Tule River Watershed (1803000603). The South Fork Tule River and its tributaries, which include Cedar Creek, Kessing Creek, and Crawford Creek, drain west through the Tule River Indian Reservation into Success Reservoir and eventually into the Tulare Lakebed. The watershed encompasses approximately 64,440 acres. Of these, about 8,920 acres are national forest system lands within the Monument, approximately 160 acres are private land, and 1,440 are other residential properties.

Elevation ranges from approximately 5,000 at the Monument boundary to 9,000 feet at Slate Mountain. Most of this watershed lies within the Tule River Indian Reservation.

The main subwatershed of concern in the South Fork Tule River Watershed is the unnamed drainage tributary to Windy Creek.

Upper Deer-Upper White River Basin

Most of the Upper Deer-Upper White River Basin is located off of national forest system lands. Headwaters for this basin begin along the Greenhorn Summit, which separates these two east-flowing watersheds from the south-flowing North Fork of the Kern River. Tobias and Bull Run Peaks are high points along this divide. Deer Creek Basin is roughly 90 square miles and terminates 10 miles east of Terra Bella. The White River Basin is roughly 100 square miles and ends about 20 miles east of Delano on the Tulare/Kern County line. Both Deer Creek and White River become intermittent drainages once they hit the valley floor. Historically, both of these

drainages flowed directly into the old Tulare Lakebed. Both of these drainages have had years of no flow for several months in most years; however, high flows have reached 2,720 cubic feet per second and 5,330 cubic feet per second for White River and Deer Creek, respectively.

These basins were both rated as Category II in the Unified Watershed Assessment. A Category II rating describes watersheds with good water quality that, through regular program activities, can be sustained and improved. Category II watersheds currently meet clean water and other natural resource goals and standards and support healthy aquatic ecosystems. Roads, private residence tracts, recreation, vegetation management, grazing, natural and prescribed fires, slope stability, and floods influence water quality in the watershed.

Rainbow trout are native to this watershed. However, fish stocking by locals and the California Department of Fish and Game have resulted in hybridized rainbow trout. Fisheries habitat is in satisfactory condition in Starvation, Tyler, and Deer Creeks. Fish abundance is considered good in these creeks, but is limited by the quality of the habitat. Overall, a lack of cover complexity and high sediment loads appear to be the limiting factors. White River and Capinero Creek are associated with rainbow trout fisheries in degraded condition. High sedimentation, width-to-depth ratios, low cover complexity, and water temperatures affect fisheries habitat. Gordon, Rube, and Alder Creeks are Class IV streams with no known fisheries.

Upper White River Watershed (1803000501). The White River and its tributaries are located on the west slope of the Sierra Nevada Mountains and drain in a westerly direction into the Central Valley south of Ducor.

The morphology of the drainage basin ranges from deep V-shaped canyons with steep rugged terrain to moderate slopes at lower elevations. The White River Basin comprises the entire Upper White River Watershed that lies within the Monument boundary.

The watershed encompasses approximately 57,490 acres. Of these, approximately 6,440 acres are national forest system lands that fall within the Monument, about 350 acres are private land, and 51,030 acres lie outside the Monument. Elevations range from 4,000 feet at Twin Springs to 8,025 feet at Bull Run Peak. Dominant channel types include moderate to steep bedrock/ boulder/ cobble channels and there are several minor springs and seeps that occur within the watershed. No giant sequoia groves are located in this watershed and there are no known dams within the Monument in this watershed.

Forest Service Sensitive species that may have been present historically based on habitat include the western pond turtle, foothill yellow-legged frog, mountain yellow-legged frog, relictual slender salamander, and pallid bat.

Wildfires have burned approximately 31,503 acres within the watershed since 1910. The main subwatersheds of concern in the Upper White River Watershed are the Upper and Middle White Rivers. This is predominantly due to the effects that urbanization has had on the water quality in the watershed.

Upper Deer Creek Watershed (1803000502). Deer Creek and its tributaries are located on the western slope of the Sierra Nevada Mountains and drain west into the Central Valley between Terra Bella and Porterville. The morphology of the drainage basin ranges from deep V-shaped canyons with steep rugged terrain to moderate slopes at lower elevations. The watershed encompasses approximately 65,340 acres. Of these, about 25,935 acres are national forest system lands that fall within the Monument, approximately 4,160 acres are private land, and 39,310 acres lie outside the Monument boundary.

Elevations range from approximately 3,600 to 8,285 feet at Tobias Peak. Dominant channel types include high gradient bedrock boulder or landslide-dominated channels in steeper terrain within the watershed, and moderate gradient cobble channels in the more moderate terrain. Several meadows occur in the upper portions of the watershed. They include Parker Meadow, Pack Saddle Meadow, Pup Meadow, and Dead Horse Meadow. The Upper Deer Creek Watershed is comprised of four sub-watersheds: Gordon Creek, Rube Creek, Tyler Creek, and Deer Creek. There are several minor springs and seeps that occur within the watershed.

Forest Service Sensitive species that may have been present historically based on habitat include the foothill yellow-legged frog, mountain yellow-legged frog, relictual slender salamander, and pallid bat

Roads, private residence tracts, recreation, vegetation management, grazing, natural and prescribed fires, slope stability, and floods influence water quality in this watershed. This type of past disturbance has the potential to affect water quality. Watersheds of concern resulting from past disturbances include the tributaries to Rube Creek, Merry Creek, Alder Creek, the Headwaters of Deer Creek, and Capinero Creek.

Upper Poso River Basin

Rivers forming the headwaters of the Upper Poso River Basin drain southwest into the Central Valley near Famoso in Kern County and then run north toward the old Tulare Lakebed. The basin covers more than 250,000 acres. Precipitation on this watershed ranges from six to 30 inches. The morphology of the drainage basin ranges from deep v-shaped canyons with steep rugged terrain to moderate slopes at lower elevations. Poso Creek drains into the Kern National Wildlife Refuge. Poso Creek is an intermittent stream, which spills floodwaters onto the Kern National Wildlife Refuge only during wet years. Kern National Wildlife Refuge is found just south of the historic Tulare Lake in the San Joaquin Valley. The region was a vast wetland prior to the 1900s. Starting in the 1850s and ending in the early 1950s, most of the wetlands were drained and reclaimed for agriculture.

The Poso Creek Basin was rated as a Category II in the Unified Watershed Assessment. A Category II rating describes watersheds with good water quality that, through regular program activities, can be sustained and improved. Category II watersheds currently meet clean water and other natural resource goals and standards and support healthy aquatic ecosystems.

Upper Poso Creek Watershed (1803000401). The Poso Creek watershed encompasses approximately 136,090 acres. Of these, approximately 7,940 acres are national forest land within the Monument, about 2,390 acres are private land, and 96,820 acres lie outside the Monument boundary.

Elevations range from about 4,000 feet at Poso Cabin to 8,295 feet at Sunday Peak. Tributaries include Von Hellum Creek, Peel Mill Creek, and Spear Creek. Dominant channel types include steep to moderate gradient cobble/boulder/bedrock channels. Meadow habitats are limited and restricted to the upper portions of the watershed (Marshall Meadow).

Upper Poso Creek Watershed contains the sub-watersheds of Poso Creek, Fulton Creek, Cedar Creek, Lumreau Creek, and Little Poso Creek. Only a portion of the Poso Creek drainage is within the Monument.

Forest Service Sensitive species that may have been present historically, or may be present based on habitat include the western pond turtle, foothill yellow-legged frog, mountain yellow-legged frog, relictual slender salamander, and pallid bat.

Fisheries habitat in the Upper Poso Creek Watershed is degraded by large width-to-depth ratios and sedimentation. Stream banks are unstable and provide poor cover and water quality; cover complexity is moderate. Fish are not present in Von Hellum and Peel Mill Creeks.

Return to top of page.

Wildlife

The Framework serves as a background document for discussion of biological resources. Basic methods of species assessment are discussed in the Framework, as are detailed species accounts and cumulative effects discussions at the bioregion scale. Those discussions are not repeatedsummarized in this document with added local detail. Species are grouped by habitat requirements to reduce redundancy. Species are addressed in detail only when potential effects on that species were identified as an issue or concern during public and/or internal scoping. Detailed discussions for all species at risk, including Threatened, Endangered, proposed for listing, Forest Service Sensitive, and management indicator species, are deferred to the SNFPA and biological resources working papers. Working papers also include a biological assessment and evaluation for species at risk and the rationale for excluding species from detailed study where appropriate.

Habitats of Special Interest and Management Indicator Species

The National Forest Management Act directs the Forest Service to select and track species that are of special interest and/or indicative of management trends. These species are called management indicator species. The Forest Service also tracks species that are considered at risk to evaluate potential impacts and loss of viability. The Forest Plan selected a number of species that are indicative of selected habitats or habitat elements, but in many cases they are too few in number or too difficult to count, such that changes in number of detections may not be meaningful. A tri-forest monitoring plan for wildlife was developed that looked at avian assemblages or bird guilds that uses ecotypes rather than seral stage habitat. By spreading monitoring over a three-forest area (Sequoia, Sierra, and Stanislaus National Forests), enough

sample points can be gathered to be statistically sound. By using assemblages, monitoring is not tied to a single species that only uses a single or a few habitat element(s). Use of assemblages in monitoring gives greater numbers, increases statistical reliability, and reflects a wide range of habitat conditions, elements, and mix of seral stages for an ecotype. The mobility of birds, the wide range of habitats they use, and their relative ease of detection make birds a useful tool for monitoring terrestrial and wetland habitats. Historically, funding for monitoring at the national forest land management plan level has been limited, so the primary monitoring for wildlife will be through the Framework.

Aquatic and Riparian. There are approximately 640 miles of perennial and 395 miles of intermittent streams within the Monument. Approximately 180 miles of perennial and 130 miles of intermittent streams below 4,500 feet elevation provide low elevation aquatic habitat. Low gradient (<4%) streams have a higher potential for presence of sensitive aquatic and riparian species, as well as impacts from recreation, livestock, and off-site effects of roads. Stream conditions, water quality, and habitat conditions are addressed in the watershed section.

Rainbow trout are the management indicator species for riparian habitats in the Forest Plan. Management indicator species for this ecotype are also covered in the monitoring plans for the Framework and in this EIS. Other aquatic or riparian species of interest include the foothill yellow-legged, mountain yellow-legged, and California red-legged frogs; Little Kern golden trout; and a native assemblage of fish including the hardhead minnow, Sacramento sucker, and Sacramento pike minnow.

Early Seral. There is very little early seral habitat within the Monument. Open grassland, meadow, and recent burns or other disturbances that serve as early seral habitat within the Monument are generally minor inclusions with the mature forest. Exceptions are recent wildfires that are mostly limited to chaparral and a few hundred acres of prescribed underburns. Management indicator species associated with early seral stage habitats are valley quail and mule deer. Populations of mule deer appear to be in decline in most of the Sierra Nevada, including the Sequoia National Forest.

There are portions of four deer herds within the Monument: the Hume, Kaweah, Tule River, and Greenhorn. Population estimates for each herd were between 10,000 to 15,000 animals for each herd during the late 1960s and early 1970s. Current estimates are 2,000 or fewer animals for each herd. Reasons for decline include lack of early seral habitat, human encroachment in winter range, poaching, and predation.

Late Seral. Late seral, old growth (LSOG) forest conditions appear to be important to a number of species (see Appendix F, Advisory XII). Late seral, old forest associated species include the pacific fisher, American marten, California spotted owl, great gray owl, and goshawk. Habitat requirements for each species are slightly different but they appear to have common ties to nest/den requirements or prey that prefer habitats with large trees, high canopy closure (40% or greater), high volume of down logs (greater than 132 cubic feet per acre, or greater than 5 tons per acre). These species appear to be able to use a wide range of habitats if these elements are available on a watershed or landscape scale. LSOG rankings from the Sierra Nevada Ecosystem Project (SNEP, 1996) are used as an indicator for habitat availability and quality for these species.

LSOG rankings are based on watershed scale assessments that provide subjective estimates of snags, large trees, down logs, and stands with higher canopy closure. The rankings reflect lower ratings based on fragmentation from natural rock outcrops, wildfire, poor soils, or past management activity. Rankings range from 0 (little or no habitat for closed canopy, mature forest species) to 5 (high canopy closure, high numbers of large trees (>30 inches in diameter), high decadence large down woody debris and snags)). LSOG rankings are relative to idealized habitat for LSOG species, not potential natural conditions, and they are not reflective of the full range of habitat conditions used by these species. They are not an appropriate measure for comparing current conditions to potential natural conditions.

LSOG rankings for habitat within the Monument are shown in Table III-20. An elevation of 4,500 feet was used as a proxy for the oak woodland/mixed conifer transition. Area below this elevation generally has little potential to rank at LSOG levels above 1 or 2. The majority of areas ranked below 3 and above 4,500 feet represent fire scars, such as the McGee fire, areas with high natural rock outcrop and poor soils or extensive heavy timber harvest near the beginning of the 20th century. In many cases, these areas have little or no potential to produce highly ranked LSOG habitat or will take a long period of time to recover. Extensive areas of second growth and areas in which more fine-grained modern logging methods have been used have a high potential to respond to thinning and prescribed burning to reach a higher LSOG rating. Areas around Big Stump and Indian Basin Groves were heavily logged and burned in the early 1900s. These areas currently support reproducing goshawk, spotted owl, fisher, and marten, with a moderate LSOG ranking of 3.

Table III-20: LSOG Rankings for Habitat

Lower Westside Hardwoods. Hardwoods, primarily oaks, were identified as an ecosystem of particular concern in the Framework. Reasons for concern include development and loss of hardwoods on private lands adjacent to national forests, lack of regeneration, and ecosystem changes in the absence of natural fire regimes. Management indicator species associated with these habitats include gray squirrel and deer.

Special Status and Species at Risk

The Forest Service requests a species list from the U.S. Fish and Wildlife Service (USFWS) on a quarterly basis. The list includes all federally listed, proposed for listing, and candidate species found within or near the Sequoia National Forest. Forest Service Sensitive species are also addressed. Only species believed to be in the Monument area and at risk from proposed management activities are addressed here. For detailed species accounts, please see the biological resources working papers for this statement. Plants are addressed in the Rare Plants section.

Table III-21: Threatened, Endangered, Proposed, and Sensitive Animals, Sequoia National Forest

California Condor (USFWS Endangered). The California condor's historic range included foraging and reproduction with the Sequoia National Forest (USDI, 1996). Released condors revisited the forest in 1998. Six condors were observed over Breckenridge in June 1998. Five more were observed in the Blue Ridge area in August 1998. It is possible that condors may re-establish themselves on the forest in the future. Habitat is maintained to preserve that option (USDI, 1996).

At present, breeding in the wild population is limited to a few individuals and occurs only in the central coast population. Breeding on the Sequoia National Forest is not anticipated for several years. Close monitoring by the Fish and Wildlife Service is used to evaluate this potential on a yearly basis.

Historically, the California condor (Gymnogyps californianus) occurred in the coastal ranges of California from Santa Clara and San Mateo Counties south to Ventura County and east to the western slope of the Sierra Nevada and Tehachapi Mountains (DeGraaf, et al, 1991). It occurred primarily from sea level to 9,000 feet elevation and nested from 2,000 to 6,500 feet (Zeiner, et al, 1990a).

The California condor was listed by the USFWS as a federal endangered species in 1967. Specific causes contributing to the decline of the condor over the last several decades have included incidental shootings, lead poisoning, egg collecting, collisions with power lines or other obstacles, and various forms of poisoning (DDT, cyanide, strychnine, compound 1080, antifreeze from car radiators). A recovery plan was developed for the condor in 1984 and in April 1996.

In 1987, all known wild condors were taken into captivity to facilitate breeding. In 1992, the first two re¤introductions occurred on the Los Padres National Forest. In recent years, condors have frequented the rangelands west of the Sequoia National Forest and roosted at night on the forest.

Critical periods for this species are associated with nesting activities. Nest selection, egg laying, and rearing young can start as early as January with the fledgin in October or November (USDA, 1986). Roosting may also take place at the nest site even when there is no nesting activity (USDA, 1984). Although roosting birds are less susceptible to disturbance, activities that may disturb roosting sites may be restricted within ½-mile or more, depending on the type of activity (USDA, 1996).

If condors nest or are actively searching for nest sites in the vicinity of the Starvation Grove Nest Management Area, or any other area on the Sequoia National Forest, there will be a seasonal suspension of travel on Roads 23S29, 23S03C, and 23S68, as well as any other roads that travel in the vicinity of nest sites where nesting attempts are made (USDA, 1986). A permanent suspension of public vehicle traffic on Road 23S64 will be maintained by Forest Supervisor Order. Permits and contracts within the nest management area contain clauses that provide for immediate cessation of all activities when condors are using the nest management area. Forest Supervisor Order will implement area closures. The area closure includes all of the nest management area except that portion west of County Road H-50 to the watershed divide (USDA Forest Service, 1984). The limited operating period for this species for all activities within ½-mile of the nest site is January 1 to June 30 (USDA Forest Service, 1990).

Both designated critical habitat and habitat identified in the 1984 recovery plan as essential to

recovery occur on the Sequoia National Forest (USFWS, 1984a). The Sequoia National Forest also identified approximately 1,000 acres in the Starvation Grove Condor Nest Management Plan, and nineteen potential giant sequoia nest trees. These areas all receive special management consideration for the protection of current and potential condor use.

Factors influencing the choice of nest sites by condors are poorly understood. The appearance of many nest sites suggests that they have been in long use, perhaps for centuries, whereas other apparently suitable sites in undisturbed areas show no signs of condor use. Two documented incidences occurred where condors nested in giant sequoias near or within the Sequoia National Forest. Nesting habitat on the Sequoia National Forest is limited due to the availability of large conifer trees necessary to support an adequately-sized nest cavity. A survey of giant sequoia groves found nineteen trees with cavities large enough to support nesting condors.

Critical habitat designated for the condor by the USFWS includes the area from Blue Ridge south to Springville and the Kern County foothills west of the national forest boundary near Glennville. The Blue Ridge critical habitat includes approximately 120 acres of national forest system lands at Lumreau Mountain. Essential habitat for the condor has been identified within the Sequoia National Forest. This habitat has no legal status but is managed under the 1984 Condor Recovery Plan as if formally listed as critical habitat. Essential habitat includes roost areas near Basket Pass, Breckenridge, and Lyon Ridge. The 1996 Recovery Plan does not address essential habitat (USDI, 1996).

Valley Elderberry Longhorn Beetle. The valley elderberry longhorn beetle was federally listed as threatened on August 8, 1980 (Federal Register, 45:52807; USFWS, 1991). Critical habitat has been designated, but none occurs on national forest system lands. Threats to this species include urbanization, insecticides, herbicides, and fluctuations in stream water levels (Steinhart, 1990). Numbers have declined due to widespread elimination of the streamside woodlands that support elderberry, which have been developed or converted to agricultural uses. Streamside woodlands have been largely developed or converted to agricultural uses, eliminating most of the elderberry (Sambucus spp.) necessary for the beetles' survival. Headwater disturbances that result in downstream flooding or mudslides could result in the destruction of elderberry plants (USFS, 1993d). Grazing on Sambucus by domestic or wild herbivores as well as human pruning or burning of the plants may be a concern (Barr, 1991).

The species range in California consists of patchy distribution from as high as 3,000 feet from Redding south to Bakersfield, and the western Sierra Nevada foothills to the eastern Coast Range foothills. Surveys on the Sequoia National Forest have been limited. Possible exit holes for this beetle have been found in the Kern Canyon, in the Tule River drainage, and at Pine Flat Reservoir on the Kings River.

Habitat consists of elderberry shrubs and trees in a variety of habitats and plant communities, but most often in elderberry-dominated riparian areas or moist valley oak woodlands. Elderberry shoots generally must be at least one inch in diameter at the base to support the beetle. Suitable habitat and elderberries are widely distributed across the Monument. Although elderberries are found at higher elevations, the valley elderberry longhorn beetle appears to be limited to the chaparral belt below 3,000 feet in elevation.

California Red¤Legged Frog. The final listing of the species as threatened was on May 23, 1996. A revised Draft Recovery Plan is presently out for review. Central valley populations of the red ¤legged frog are currently extinct, and only three areas in the remainder of the state currently support over 350 adults. Critical habitat was proposed on September 11, 2000, with specific areas identified within the planning area. Factors that caused this dramatic decline and continue to threaten this species include: habitat loss and alteration from agricultural and urban development, construction of reservoirs and water diversions, stream channelization, grazing, off¤road vehicle use, mechanical treatments, increased siltation of streams (directly or indirectly caused by road maintenance, grazing, mechanical treatments, or off¤road vehicle use), and drought; introduction of exotic predators and competitors, such as bullfrogs (Rana catesbeiana), mosquitofish (Gambusia affinis), smallmouth bass (Micropterus dolomieui), and largemouth bass (M. salmoides); use of frogs for food and research; and stochastic events, which can have severe impacts due to highly fragmented habitat and low population numbers (USFWS, 2000).

In addition to being detrimental to red¤legged frogs, habitat alterations, including the loss of aquatic or riparian vegetation, reduced stream flows, and sedimentation of pools, creates favorable conditions for bullfrogs, which out¤compete as well as prey on red¤legged frogs (USFWS, 2000). The California red-legged frog was probably extirpated from the floor of the central valley before 1960 (USFWS, 1996a). The last verifiable record of this species on the valley floor was a sighting in Lodi (San Joaquin County) in 1957. The last record of a reproducing population on the valley floor is from the vicinity of Gray Lodge Wildlife Area

(Butte County) around 1947, although this record is unverified. Elimination of the frog from the floor of the valley was particularly significant in that it isolated Sierra Nevada foothill populations that may have depended on immigrants from the valley floor (USFWS, 2000).

California red-legged frogs historically occupied portions of the western slope of the Sierra Nevada from Shasta County south to Tulare County, but these populations have been fragmented and nearly eliminated. In 1960, isolated populations were known from at least 30 Sierra Nevada foothill drainages bordering the central valley. Records show that the lower elevations of some national forests and Yosemite National Park were once occupied by California red-legged frogs (USFWS, 2000). Adjacent to the Plumas National Forest (Butte County), many sightings of the frogs were reported in the early 1960s near Lake Oroville. Much of the Sierra Nevada range is unsurveyed, particularly private lands, and therefore, the true status in this region is largely unknown. Only one potential historic site is within the Sequoia National Forest. This was a reported sighting at Sampson Meadow on the Hume Lake Ranger District. No voucher speciment was taken and no red-legged frogs have been found since the report in 1929, despite repeated surveys. The next nearest observation is approximately 13 miles away in low gradient valley floor habitat near Centerville. Other near observations have been on the valley floor near Rio Bravo and Visalia.

During dry periods, the California red-legged frog is rarely encountered far from water. During periods of wet weather, starting with the first rains of fall, some individuals may make overland excursions through upland habitats. Most of these overland movements occur at night. Evidence from marked and radio-tagged frogs on the San Luis Obispo County coast suggest that frog movement, via upland habitats, of about one mile are possible over the course of a wet season. Frogs have been observed to make long-distance movements that are straight-line, point to point migrations rather than using corridors for moving in between habitats. Dispersing frogs in northern Santa Cruz County traveled distances from 0.25 mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors. The manner in which these frogs use upland habitats is not well understood. The amount of time they spend in upland habitats, patterns of use, and whether there is differential use of uplands by juveniles, subadults, and adults is being studied. Dispersal distances are considered to be dependent on habitat availability and environmental conditions (USFWS, 2000).

California red¤legged frogs are associated with dense, shrubby, or emergent riparian vegetation, especially willows and cattails, close to deep (greater than 2.3 feet), cool, still or slow¤moving waters, healthy invertebrate and algae populations, and little siltation during the breeding season. They might be negatively affected by processes or activities that degrade riparian systems and lead to increased sedimentation, decreased vegetation along shorelines, increased water temperature, or other factors that also might decrease invertebrate populations. This aquatic subspecies finds medium and high importance in the affected California Wildlife Habitat Relationships habitat type of riverine. Invertebrates are an essential habitat element (Timossi, 1990).

Forest Service Sensitive

The following are Forest Service Sensitive species for the Sequoia National Forest.

California Spotted Owl (USFS Sensitive, USFWS Species of Concern). There are 72 spotted owl territories located on the three ranger districts that encompass the Monument. Surveys for the California spotted owl were conducted by Sequoia National Forest personnel and consulting biologists in accordance with Forest Service Region 5 protocol in various portions of the Monument from 1986 through 2002.

Nesting activities commence in March, depending on the elevation, with egg laying and incubation occurring in May and June. Young are usually fledged in late July and early August (USDA, 1993).

According to the California Spotted Owl Sierran Province Interim Guidelines Environmental Assessment (USDA, 1993), nesting and roosting habitat typically includes a forest stand with greater than 70 percent canopy cover. Optimum habitat consists of dense, mature trees with multiple canopies and abundant snags and down woody material. Nesting habitat is characterized by dense canopy closure (greater than 70 percent) with medium to large trees, and usually at least two canopy layers are present. In addition, nest stands usually have some large snags and an accumulation of logs and limbs on the ground (USDA, 1993). Foraging habitat can include all medium to large tree stands with 50 percent or greater canopy closure. Proportion of the watershed or landscape in suitable habitat (greater than 50% canopy closure) appears to be important to northern spotted owl and is presumed to be important to California spotted owl as well. Northern spotted owl show declines when less than 80% of the landscape is suitable and appear to reach a critical threshold between 30% and 50% suitable habitat in the landscape.

Past reproduction has been highly variable. Highest reproduction occurred in 1992 and has declined until 2002. Current reports of reproductive success are at near 1992 levels. Studies of California spotted owls in the Sierra Nevada appear to indicate that the species is in decline.

Stand-replacing or catastrophic wildfire has been identified as one of the major threats to the spotted owl and its habitat. Approximately 11 spotted owl territories on the Sequoia National Forest have suffered substantial loss of habitat due to wildfire since 1980. Most of these territories, and one other affected by drought-related mortality of trees, are no longer considered to be viable. All other territories on the forest that previously had territorial males or pairs are still considered to be viable.

Northern Goshawk (USFS Sensitive, USFWS Species of Concern). There are 12 goshawk territories identified within the Monument. Biologists have conducted intermittent surveys for nesting goshawks in relation to projects or based on reported sightings for at least two decades in portions of the Monument. The location of the exact nests each year is unknown, as goshawks use alternate nest sites. Protected activity centers have been established for these territories.

Preferred habitat consists of older-age coniferous, mixed, and deciduous forest habitat. Habitat also consists of large trees for nesting, a closed canopy for protection and thermal cover, and open spaces allowing maneuverability below the canopy (Hargis, et al, 1991). Snags, downed logs, and high canopy cover are critical habitat features. The former two are also an important component used by numerous prey species. Many of the species that provide the prey base for goshawks are associated with open stands of trees or natural openings containing an understory of native shrubs and grass (Fowler, 1988).

Northern goshawk nesting habitat is characterized by dense canopy closure (50 to 90 percent) with mature timber. Nest trees for this species are commonly located on benches or basins surrounded by much steeper slopes (Hargis, et al, 1991). Mature trees serve as nest and perch sites, while plucking posts are frequently located in denser portions of the secondary canopy. The same nest might be used for several seasons, but alternate nests are common within a single territory. The chronology of nesting activity varies annually and by elevation. In general, nesting activities are initiated in February. Nest construction, egg laying, and incubation occur through May and June. Young birds hatch and begin fledging in late June and early July. They are independent by mid-September (USDA, 1992c).

Great Gray Owl (USFS Sensitive, California State Endangered). The CDFG's California Natural Diversity Database has records of many gray owls found throughout the Monument. Many large meadows contain suitable habitat for great gray owls. Protocol surveys in 2001 and 2002 did not detect presence and no nest stands have been found to date. Informal surveys through 2002 and anecdotal information indicate great gray owls are still present at several locations throughout the Monument.

Preferred habitat consists of mixed coniferous and hardwood forests, usually bordering small openings or meadows (USDA, 2001b). Optimal habitat consists of semi-open areas near dense coniferous forests, which the owls use for roosting and nesting. Breeding great gray owls are typically found between 4,000 and 8,000 feet elevation, but breeding has been documented as low as 2,500 feet in the Sierra Nevada. Courtship and nest site selection occur during late winter. Most nests are in broken-top snags, generally greater than 21 inches diameter and 20 feet tall (Winter, 1986). Nests are also found in debris platforms from dwarf mistletoe or in old stick nests of other raptors. Nests are generally located within 1,000 feet of the edges of wet meadows that range in size from 15 to 250 acres. Preferred canopy closure is greater than 70 percent, although owls use habitat with canopy closure as low as 40 percent (Zeiner, et al, 1990).

The owls prey primarily on voles and pocket gophers throughout the year (Zeiner, et al, 1990). High prey density, perch availability, and relatively open forest canopies have been identified as important factors in foraging habitats (Greene, 1995. In winter, the owls hunt in early morning and from late afternoon to dusk. During the breeding season, they hunt throughout the day and night. Great gray owls hunt by perching 2 to 20 feet high at the edges of meadows or grasslands and listening for prey in grass runways or underground burrows. The owls fly low over the ground and drop on their prey (Winter, 1981).

California Wolverine (USFS Sensitive). The wolverine occupies a variety of habitats, including mixed conifer, red fir, lodgepole pine, wet meadow, and montane riparian habitats, as well as alpine dwarf-shrub, montane chaparral, and Jeffrey pine. Wolverines prefer areas with low human disturbance (Zeiner, et al, 1990).

In summer, wolverines are typically opportunistic omnivores. Small mammals, such as marmots and ground squirrels, are the principal prey items. Carrion is an important component of the

wolverine's diet. In winter, wolverines are primarily scavengers, often feeding on large animal carrion such as deer, but will also prey on snowbound live prey (Ruggiero, et al, 1994).

Wolverines are primarily nocturnal but diurnal movements have been recorded. During the summer, long distance movements occur at night when temperatures are cooler (Hornocker and Hash, 1976). Studies indicate that wolverines have large home ranges, anywhere from 38 to 347 square miles; males have larger territories than females. Because of these factors, wolverines are rarely seen. Wolverines may move great distances on a daily basis; 15 to 30 miles a day is common for males, and some individuals have moved 60 to 70 miles in a single day (Ruggiero, et al, 1994).

The historic range of wolverines in California included much of the Sierra Nevada (Schempf and White, 1977). However, as a result of increased human activities, wolverines are believed to have become isolated within the Sierra Nevada ecoprovince of California. The known distribution is from Del Norte and Trinity Counties east through Siskiyou and Shasta Counties, and south through the Sierra Nevada to Tulare County. Most observations have been recorded between 4,300 and 7,300 feet in the northern Sierra Nevada, while in the southern Sierra Nevada sightings have been recorded between 3,900 and 10,800 feet (Zeiner, et al, 1990).

California wolverine populations are believed to have always been low and the current wolverine distribution is poorly known (Zeiner, et al, 1990). Remote-camera surveys conducted in 1993 throughout much of the Sierra Nevada did not detect any wolverines. Fifteen historical sightings of wolverines have been reported on the Sequoia National Forest dating from 1909 to 1988. These sightings were all in the Monument.

Marten (USFS Sensitive). Marten can be found in suitable habitat at elevations ranging from 4,000 to 13,100 feet (Freel, 1991). Preferred habitat is characterized by dense (60 to 100 percent canopy closure), multi-story, multi-species mature coniferous forests with a complex physical structure near the ground (Buskirk and Ruggiero, 1994). High numbers of large snags and downed logs are an important component of marten habitat, especially in winter when snow covers much of the ground. Snags and downed logs provide denning and resting sites for marten, access to subnivian (cavities below snow) areas that provide habitat for marten prey (Sherburne and Bissonette, 1994). Subnivian habitat is also important for resting and thermal regulation during winter (Buskirk and Ruggiero, 1994). In the winter, martens usually require forest with canopy closure of at least 50 percent (Sherburne and Bissonette, 1994).

High quality habitat includes close proximity to forested riparian corridors that are used as travelways and an interspersion of small (less than one acre) openings with good ground cover used for foraging (Freel, 1991). Martens forage at the edge of openings, especially natural meadows, but they avoid traveling across large openings.

The presence of roads and clearings may act as behavioral barriers to movement by martens (Freel, 1991). Martens generally avoid habitats that lack overhead cover, and various authors have reported complete or partial avoidance of non-forested habitats (Ruggiero, et al, 1994), although locally marten have been observed in large openings where there is adequate shrub cover.

Marten do use a variety of other habitat types, but depend on a well-connected expanse of late-seral forest. Variable sizes for home ranges within the Sierra Nevada are reported in the literature: male home ranges vary between 673 to 3,000 acres and female ranges vary from 427 to 1,075 acres (Hargis and Bissonette, 1995). Suitable marten habitat is thought to largely overlap with that of the Pacific fisher, although marten may also occur in subalpine forests at higher elevations.

Extensive fisher and marten surveys were conducted across the Forest by Sequoia National Forest wildlife biologists as part of a research project from 1991 through 1995. Radio telemetry studies of fisher and marten in the Tule River Basin ran from 1994 through 1999. Ten-kilometer grids of areas not previously surveyed were checked with track plates in 1999 and 2000. It is assumed that all unsurveyed suitable habitat is occupied by marten or fisher.

Fisher (USFS Sensitive). Preferred habitat for fishers include extensive, continuous canopies, such as dense lowland forests, or mature to old-growth spruce-fir forests with high canopy closure. Fishers use greater percentages of mid to early seral stages for foraging in summer months, but still appear to need and use mature or old growth stands for denning, especially in areas with high snowfall. Forest stands with no understory or with sparse coniferous understory appear to be used most often (Arthur, et al, 1989), although shrub cover appears to be important locally.

Suitable fisher habitat is thought to occur at elevations ranging from 4,000 to 8,000 feet. Recent studies of fisher and marten support past assumptions that fishers are found at lower

elevations than martens (Zielinski, et al, 1997). Fisher appear to be restricted by soft thick snow cover and seek out areas with relatively low snow accumulation, and sightings of fisher at high elevations appear to be confined to east slopes where the snow is less deep (Krohn, et al, 1997; Ruggiero, et al, 1994; Raine, 1981).

Besides maternal dens, fishers use temporary shelters such as hollow logs, brush, rock piles, tree nests, or burrows, for sleeping and shelter from bad weather (USDA, 1991a). Fisher home ranges are as large as ten square miles. Fishers are solitary except during the breeding season between March and May. Females usually give birth in tree dens located in high cavities of large trees. The fisher is primarily a predator, eating small mammals such as porcupines, snowshoe hares, squirrels, shrews, and mice.

Sequoia National Forest wildlife biologists have conducted extensive fisher and marten surveys as part of a research project, and many occurrences of fisher have been documented in the project area since 1991 using track plates and camera stations. Since marten and fishers have been located with these camera stations and all suitable habitat that has been surveyed is occupied by marten or fisher, it must be assumed that all unsurveyed suitable habitat in the Monument will be occupied by marten or fisher (Anderson, 2001, personal communication).

The Framework sets up a Southern Sierra Fisher Conservation Area that covers the Sequoia and Sierra National Forests above 3,500 feet elevation and north of the Kern River to Yosemite National Park. Guidelines for conservation of the species apply outside of wildland urban interface zones and defer to old forest plan standards where the allocations overlap. The primary guideline for the conservation of the fisher is the retention of 60% canopy closure in habitat over 60% of the landscape. Depending on how canopy closure is measured, this situation only occurs naturally within one watershed in the Monument.

Foothill yellow-legged frog (Rana boylii) (USFWS Species of Concern, California Species of Concern, Region 5 USFS Sensitive Species). Historically, foothill yellow-legged frogs occurred between sea level and 6,000 feet in most Pacific drainages west of the Sierra-Cascade Crest from the Santiam River, Marion County, Oregon to the San Gabriel Drainage, Los Angeles County, California (Jennings and Hayes, 1986). Its known elevation range in California extends from near sea level to 6300 feet at Snow Mountain in Trinity County (Hemphill, 1952).

Breeding occurs in shallow, slow-flowing water with at least some pebble and cobble substrate (Lind, 1996, personal communication) between March and June after high flows have receded. Little is known about the movement and dispersal of this species (Jennings and Hayes, 1994). During breeding and summer, foothill yellow-legged frogs are rarely encountered far from permanent water. During the winter, frogs have been observed in abandoned rodent burrows and under logs as far as 100 meters from a stream (Zeiner, et al, 1988).

There were numerous populations known from the Sequoia National Forest and the adjacent national parks during the mid 1980s. Currently, small populations are known from the Rincon area and the southern Sierra National Forest. No populations are known within the Monument. Based on presence of habitat and recent historical presence, it is presumed that foothill yellow-legged frogs may exist within the Monument.

Mountain yellow-legged frog (Rana muscosa) (USFWS Species of Concern, California Species of Special Concern, USFS Region 5 Sensitive Species, National Heritage Ranking of G3N3). Mountain yellow-legged frogs are native to California and occur primarily in the Sierra Nevada from 4,500 feet to over 12,000 feet elevation. This species also occurs in Nevada around Lake Tahoe. In southern California, isolated populations exist in the San Gabriel, San Bernardino, and San Jacinto Mountains. This species was known from many locations in the mid 1980s. Current known populations are limited to a few in the Golden Trout Wilderness. Surveys of high quality habitats have been contracted with the California Science Academy. Suitable breeding habitat for mountain yellow-legged frogs is considered to be low gradient (up to 4%) perennial streams and lakes. Streams in this category generally have the potential for deep pools and undercut banks that provide the habitat requirements of this frog.

Mountain yellow-legged frogs are seldom far from water and prefer well-illuminated, sloping banks of meadow streams, riverbanks, isolated pools, and lake borders with vegetation that is continuous to the water's edge (Martin, 1992; Zeiner, et al, 1988).

The decline of mountain yellow-legged frogs in the Sierra Nevada has been attributed to the introduction of salmonid fishes during the last century. As populations are lost, remaining populations become more isolated, which can indirectly result in extinctions of additional populations and reduce opportunities for recolonization of these sites (Bradford, et al, 1993). Garter snakes and introduced trout prey upon mountain yellow-legged frog tadpoles (Zeiner, etal, 1988). Due to the adults' over wintering underwater and the tadpoles' long metamorphosis, this species is very vulnerable to introduced fish (Knapp, 1994). Additional

reasons for the frog's disappearance that have been offered include: loss of habitat, altered habitat, grazing, and other environmental problems such as increased ultraviolet radiation, pesticides, viruses, and acid rain.

Terrestrial Land Birds. Terrestrial land birds, specifically neo-tropical migrants, are covered under the Migratory Bird Treaty Act. They are addressed here specifically due to the statutory requirement for their conservation and because, when addressed through habitat guilds, they are reasonable indicators of ecosystem health and function. The largest concerns for land birds are the conservation of habitats that provide for both early and late seral habitats and the effects of spring burning on nesting success.

Human Use

Heritage Resources

Heritage resources are in many instances tangible cultural resources. They may be structures, remains of structures, accumulated or deposited trash, physical evidence of mining, logging, livestock grazing, or agriculture. Physical resources are carefully recorded, explored, and excavated or preserved in place.

Another category of heritage resources is the intangible historic aspects of the environment. Within this category falls the general and particular history of the project area as expressed in social life, economic adaptations, and folk life. This information can contribute to the development of historic research and, like tangible resources, are subject to loss through modification of the environment.

Heritage resource surveys have been conducted on approximately 40 percent of the Monument. To date, over 1,200 prehistoric and historic sites have been located and recorded.

Ethnographic Groups Within the Study Area

Kings River Drainage. Five groups inhabited the Monument portion of the Kings River drainage: the Choinimne (Yokuts';), Michahai, Entimbits, Wobonuch, and Tuhukwaj (Mono';). The major Choinimne settlements were on the south side of the Kings River in the vicinity of Mill Creek and on Mill Creek.

The Entimbits held a territory to the east of the Choinimne, which extended to the north side of Mill Creek east and southeast to Samson Flat and Dunlap. Two important villages, Kudsowabi and Wojidu, were located in the Dunlap area. The Michahai ranged between Squaw Valley and the Drum Valley/ Badger area in the Kaweah River drainage.

The Wobunuch held the south Fork of the Kings River, east from its confluence with the North Fork of the Kings River. Eighteen hamlets have been identified in this area, including the major villages of Yumsanyu, Ko'onikwe, and Kadawinao along Mill Flat Creek.

Population figures for this area exist only as rough estimates since no village count or population census was taken. The Mono groups on the Upper Kings River are estimated at between 1,700 to 2,340 persons.

Kaweah River Drainage. Three groups in the Kaweah River drainage are important for the Monument: the Wukchumni, a Yokuts'; group, and the Waksachi and Patwisha, two Mono'; groups. The three main Wukchumni villages were located in nearby Sequoia and Kings Canyon National Parks.

The core range of the Wukchumni extended to Antelope Valley to the north, Rivers (a modern town) up the Kaweah River to the east, Yokol to the south, and as far west as Woodlake. The Waksachi were centered in Eshom Valley, where the main village was Chitatu, with about 25 houses. They ranged southwest to Gaines Flat, where their summer camp was called Atitrao. They also ranged southeast as far as Cactus Mountain and northeast to old Baldy Ridge (Gayton, 1948, pages 213-214). The Patwisha are a little known group whose range began just below the confluence of the North and Middle Forks of the Kaweah River, where their main village of the same name, Patwisha, was located. They also shared a village, Botnunyu, just downstream from the former, with the Wukchumni, but their range basically included the upper drainages of the Kaweah (Gayton, 1948, pages 55-59). Again, population figures for these groups are only rough estimates, as Gayton could not develop an adequate census during her 1925 fieldwork (Gayton, 1948, page 56). Nevertheless, Kunkel has some figures derived from a variety of sources. From the early (1819) account of Estudillo, the figure of 1,250 is given, which may

refer either to the single, major Wukchumni village or to the whole tribelet. Kunkel takes this as a possible minimum figure. Kunkel derives a density range of 7.35 to 10.0 persons per square mile from these population estimates (Kunkel, 1962, page 139). Clearly, Wukchumni villages were large (300-400), even if the minimum population estimate represents the whole group. The Waksachi and Patwisha population estimates range from 150-300 per tribelet. Kunkel derives a maximum density of 1.41 persons per square mile, although he acknowledges that this figure may be misleading (Kunkel, 1962, page 141).

Tule River, Deer Creek, White River, Poso Creek, And Lower Kern Drainages. Together these drainages held five Yokuts'; groups and one Tubatulabal or related group. The Yaudanchi residential core was focused on the North Middle Forks of the Tule River at the main winter village of Shawahtau (Springville). The Bokninuwad resided on the southern forks of the Tule and on Deer Creek. Their main settlements were Keyau towards the valley and Hoin Tinliu (California Hot Springs) in the foothills (Kroeber, 1925, pages 479-480).

The Bankalachi or Toloim (Uto-Aztecan speakers or mixed Yokuts/ Tubatulabal group) lived above the Bokninuwad on Deer Creek at Sototio on White River (Gayton, 1948, page 50; Kunkel, 1962, page 145). The group occupied the headwaters of Poso Creek at White River, with their main village of Hoschiu on the White River (Kroeber, 1925, page 479). They lived along Poso Creek, principally at Altau just south of the creek, also at Bekiu and Shikidapau at Poso Flat and Holmiu in Linn's Valley (Kroeber, Y925, page 479). These three ethnologically linguistic groups are not well documented ethnographically. The sixth group was the Yaulemani, who were basically a valley Yokuts'; group but who held the lower reaches of the Kern River. Their major settlement was Woilo at Bakersfield. Kroeber describes their range as extensive, reaching south to Tejon (Kroeber, 1925, page 482).

Population estimates for these groups are weak at best. Kunkel figures 400 minimum and 800 maximum for Yaudanchi, with a density of 1.6-3.2 persons per square mile, and a single figure for theYaudanchi of 200, with a density of 1.14 (Kunkel, 1962, page 144). He gives a combined for the remains of four tribelets (Bankalachi, Kumachisi, Paleuyami, Yauelmani) as 1,200 minimum and 2,700 maximum, resulting in densities to 3.38 (Kunkel, 1962, page 148).

Expected Areas of Archaeological Sensitivity

Prehistoric Resources (Entire Monument). Prehistoric archaeological sensitivity was determined primarily by consideration of research done in the Monument. In the adjacent Yosemite Valley Region, Bennyhoff (1956) was able to show that the frequency of sites occurred at various elevations. Large and small village sites were always found below 8,000 feet, while most of the large and small camps existed above this elevation. In his sample, 2% of the sites occurred in the Upper Sonoran Life Zone, 36% in the Transition Zone, and 61% in the Boreal Zone. Factors important to site location include availability of water and meadow edges, accessibility to boulders within the oak belt, sunny exposures, and relatively dry and well drained soil (Bennyhoff, 1956, page 14).

High Sensitivity Zones are those in which archaeological sites are most likely to be found and are characterized by the following:

Debris slopes, stream terraces, flat, or benches.

The foothill woodland community.

Perennial or intermittent streams.

Distance from water of 0 to 100 meters.

Open areas or a southern direction of exposure.

Slopes of 0 to 15%.

Moderately sensitive areas reflect a smaller degree of aboriginal use and are characterized by the following:

Slope crests.

Yellow pine forest community.

Springs and seeps.

Distance to water of 101 to 300 meters.

Western direction of exposure.

Slopes of 16 to 30%.

Elevations between 1,601 to 2,400 meters.

Zones of low sensitivity are those places where the occurrence of archaeological sites is least likely and are characterized by the following:

Escarpments and stream channels.

Valley grassland, red fir forest, lodge pole forest and sub-alpine forest.

Ephemeral streams, lakes and ponds.

Distance to water greater than 300 meters.

Northern and eastern directions of exposure.

Slopes greater than 31%.

Elevations between 401 to 1600 meters and above 2400 meters.

Historic Resources

Chronological Historic Site Typology. In historic times, a variety of mineral resources attracted miners, and meadows and forest resources brought ranchers and loggers. These and the major rivers continue today to be the focus of activities designed to extract and use the values of the area. In simplistic terms, the hydrology, flora, and fauna of the southern Sierra Nevada provided and continue to provide a number of natural resources of interest to human users. However, the interaction between culture and natural environment is complex; simple lists of available resources do not convey this complexity. Any discussion must artificially separate out some of the multiple interacting factors of the natural environment, which affected human use of the study area. For example, it is clear that the factors of elevation, latitude, climate, and biotic communities are all interrelated in the distribution of natural resources. But it is possible to isolate a single variable, such aselevation, to be used as an indicator for the associated factors. The elevation range of the area includes a number of biotic communities, which are either known or expected to have been used by human groups. At varying elevations, with thecorrespondingly varying climatic conditions and biotic communities, different types of cultural resources have been recorded and can be expected to be found. Likewise, variations in the patterns of site occurrence can be anticipated for settings at different elevations.

As early as 1776, the Spaniards, and later the Mexicans and Americans, explored areas in and adjacent to the study area. Connected with this was the struggle for land ownership between various countries and individuals. This often led to expeditions, battles, military patrols, and documented events. Although material manifestations of many of these do exist, it is difficult to locate them in the field. However, some features of these sites may still be observable. Roads and trails used by these people may sometimes be recorded on the ground. Other physical characteristics of this type of land use may include graves, carved or blazed trees, and trail markers. Forts, outlaw hideouts, battlefields, and campsites of soldiers and explorers are more difficult to discern. Some campsites received annual or extended use. It is possible that cans, bottles, flattened earthen pads, rock alignments, and perhaps bullet cartridges or other military occupational items might be visible on the ground. Most explorers were just passing through and left no material objects to mark their passage.

The documentary record discusses the location of a few of these sites, chiefly forts, trails, battlefields, and campsites. Other types of sites, such as hideouts, bootleggers' stills, trash pits or scatters, and graves, remain undocumented. Too few of such sites have been recorded in the Monument to allow us to generalize, based on associated environmental variables, the expected locations of these sites. The only guide is that buildings, regardless of associated activity, tend to be located near water, on gently sloping land, and near a transportation route.

Governmental Regulation. The government began to directly regulate the use of the Sierra Nevada by the 1860s. However, not until the 1890s, with the establishment of army camps, did governmental regulation create physical remains. Most recordable sites relate to U.S. Forest Service administration. It was not until the turn of the 20th century that funds were available to hire forest rangers and work began in national forests. Rangers and assistant rangers began constructing trails, buildings, bridges, camps, and other structures. Permanent winter stations were built at lower elevations or in valleys, and summer headquarters were constructed in the mountains, usually near meadows. Seasonal stations consisted of log or shake one-room cabins

with pitched, shake-covered roofs or tents constructed on a leveled and cleared area. These stations often had a developed spring and/or corral or fenced-in pasture, associated with the cabin.

More often than not, a forest ranger simply rolled up in his blanket and slept out in the woods. Bundles containing camping gear were often left at strategic places, eliminating the need for the ranger to carry supplies on his saddle. These temporary camps often consisted of a fire circle by a spring and were not used on a regular basis.

Along with the national forest came fire management. The government hired men to live in the mountains and look for smoke during fire season. First, heliographs (mirrors) were used to communicate from lookout to station, or from any high spot in the forest to any lookout. Later, telegraph and telephone lines were strung and dry-battery crank telephones were hung at campgrounds, lookouts, and stations for easier and quicker communication.

Lookouts were constructed in trees, on peaks, and on mountaintops, any place with good 360-degree visibility over a large area. Early lookouts were towers, small cabins, or one-room tree houses. These were equipped with beds, stoves, and fire sighting and fighting equipment. Caches of tools were also placed in meadows and along trails for emergency use by rangers, recreation users, cattlemen, and sheepherders.

Today, many of the original stations are gone or have been replaced by modern buildings. Scattered boards, square or round nails, developed water troughs, corral poles, trash pits, and perhaps a privy might be found in some combination at the sites of these first stations. The camps used by rangers may be more difficult to detect and identify. Fire hearths or rock circles and trash scatters may remain at camp locations. Larger camps may have telephone lines and insulators still present in trees, about 15 or more feet above the ground.

Fire management activities were incorporated as part of the job. Tool caches may occasionally be located in remote areas of the southern Sierra Nevada. These may contain shovels, picks, axes, and canned goods. Most of the fire structures are no longer standing, but some remnants (trash pits, telephone lines and insulators, boards, nails, water sources) may be in the immediate vicinity. Historic trails (usually indicated by blazed trees), bridges, and developed campsites might also be recorded.

The Civilian Conservation Corps (CCC) constructed many of the roads and foot trails currently in use throughout the study area in the early 1930s. The CCC also strung telephone lines in the mountains, cleared brush, cut trees, and constructed permanent bridges. In addition, from 1931 to 1938, the CCC constructed many of the currently used Forest Service administrative structures. They usually had permanent camps and spike camps. The permanent camps housed large numbers of men and may be marked by concrete foundations, boards, nails, equipment, bunkhouse remnants, and assorted historic debris. The spike camps were temporary in nature and consisted of tents with small groups of men. These may be identified in the field by earthen tent platforms, portable privies, trash pits or scatters, and abandoned equipment. These temporary CCC camps occurred throughout the mountains and can still be found today. The documentary record gives the locations of many Forest Service cabins.

Settlers. In the late nineteenth century, it was possible to homestead and/or receive government land under a variety of patents. Homesteaders were usually awarded up to 160 acres of land. Pre-emption claims were also awarded. Both of these types of patents were usually associated with the settler. However, not all settlers received title to their lands, and many sites called homesteads'; predate the official claim entry by many decades, or were never patented at all.

Basic improvements had to be made on the homestead. The settler probably fenced in all, or a portion of, his land to keep his stock protected. Perhaps a log or shake cabin was constructed, or an earthen platform was built. Later, this crude structure may have been replaced with a more permanent home. A few acres were usually cleared for growing grains, vegetables, and other crops. Some settlers planted orchards in addition to crops. Out- buildings, barns, corrals, sheds, and other structures were often added as time progressed. Most homesteaders also built trails and/or roads leading to and from their property.

Today, it is still possible to identify the physical remains of homesteads. Depending on the length of occupation and the level of improvements made, a variety of features may be observable. These can aid in establishing the historic use of the site. One of the more noticeable features in the field might be the remnant of a fireplace, chimney, or stone hearth. Surrounding this rock pile, boards, nails, historic debris (glass, cans, household goods), a stone or concrete house foundation, and a basement or cellar hole are likely to be scattered. Privies, barns, sheds, and other outbuildings might be identified by flattened earthen pads, board and nail scatters, foundations, abandoned equipment, and trash pits. A pole corral might be

situated away from the main complex or attached to the barn. The main area was often enclosed with a fence. Fallen or standing hand-hewn square posts with attached barbed wire can sometimes be located in the main complex area and/or within the 160-acre allotment. Ax-cut stumps, indicative of building and other settler activities, may also be present in the general vicinity.

Vegetation changes can indicate settler activity. Once thriving orchards, especially apple orchards, may still have a few isolated fruit trees growing within their confines. Locust, black walnut, and other decorative trees were often planted around the house and may still be alive. Trees native to the area may be blazed, testifying to a path or trail that marked the way to the homestead. Relatively few settler-related sites exist which can be recorded during field survey. The documentary record indicates far more settler-related sites exist in surveyed areas than are recorded, and the best sources for locating these sites are government land office survey plats and public land records. Many of the settler-related sites that are not located in the documentary record belonged to squatters. These, like documented settler-related sites, are most likely to be found in meadows or on broad flats.

Seasonal Grazing. Many of the large ranchers in the valleys, as well as smaller landowners, grazed their sheep and cattle in the mountains from May to October. The herders and cowboys who accompanied the stock usually established temporary camps. The camps were often established in high elevation mountain meadows with permanent springs or water sources. The meadows provided plenty of feed for horses and pack animals, and forage for stock.

A cabin, constructed of either logs and/or shakes, was often built on the edge of a meadow or in a clearing by a creek. The springs were sometimes developed and/or fenced to keep the stock out of the water supply. Other streams and springs were dammed to fill stock ponds. Log troughs were devices used to water the stock and saltboxes were placed in the mountains. After Forest Service oversight began, ranchers were assigned specific territories and required to build drift fences to keep their stock from wandering into another rancher's range.

Numerous features mark the passage of ranchers and sheepherders through the Monument. Foremost is the stockman's cabin, a one-room building made of shakes or logs with a pitched shake roof, usually located at the edge of a meadow near a water source. A small barn, a lean-to, or perhaps a privy may be associated with the cabin. Flattened and scattered boards and nails might be all that remains of this structure. It is possible that an associated trash scatter or pit, or debris, might be found near the cabin. Developed springs, dammed creeks, pole corrals, and log troughs or saltboxes might be virtually anywhere in the mountains. Sheep and cattle driveways'; are also associated with grazing, as are roads and blazed trails.

After the turn of the 20th century, permanent cow camps'; were established in the mountains. Cattlemen began transporting their entire families up to the cow camps for the entire season, or for one or two months. More permanent and larger cabins were built to accommodate wives, children, and visitors. A small garden may have been planted next to the cabin. Boards, nails, a developed water source, cleared land, corrals, privies, foundations, and chimney hearths might still be visible. The cattlemen worked out of these camps, but sometimes spent the night in the woods. These temporary stock camps may contain nothing more than a fire circle of rocks and a trash scatter, or may not even be noticeable. Most features relating to seasonal grazing which can be recorded in the field date from the twentieth century, by which time improvements were strictly regulated.

Nineteenth century features evidently have not survived to be recorded, with minor exceptions, such as Basque sheep carvings. Should others exist, they would probably be located with respect to water, slope and transportation as are twentieth century features. Government land office survey plats frequently show the routes of historic trails. It is logical that since these trails were used principally for livestock drives by seasonal grazers, most nineteenth century grazing-related sites will be located in close proximity. However, not enough nineteenth-century grazing-related sites have been recorded to test this hypothesis.

Logging. Some areas in the Monument were sites of logging activities from the mid-nineteenth century to the present. Early logging operations relied on skidways, oxen teams, and steam donkeys to transport lumber to the mill in the 1880s. The narrow gauge railroads (1889), steam engines, and rate flume systems came into use as a means of transporting lumber to the mill and marketplace.

The first mills were portable and were skidded from one location to next following the harvest. Later mills were often permanent and established in lower elevations or valleys. These later mills were elaborate with workshops, millponds and dams, workers housing, storage areas for cut and unprocessed lumber, and saws.

Early lumbering operations were usually very small and run by one or two men. Trees were

usually cut three or more feet from the ground by using bucksaws and springboards. The tree stumps are one indication of historically logged regions (modern methods cut trees less than 18 inches from the ground). Portable mill sites are hard to detect in the field, but sawdust piles, abandoned equipment, flattened earthen pads, boards, and nails may remain in the area. Flumes, developed water sources, and a small cabin or camp might be found in the vicinity of the mill. If so, square or round nails, boards, and historic debris would be evidence of man and mill.

Large-scale operators owned later mills. In the northern area, the activities of the Sanger Lumber Company in Converse Basin (ca. 1897 to 1905) and the Hume Bennett operations at Hume Lake (ca. 1909 to 1918) are well documented. The remains of these activities include mill locations, hoist machinery locations, work and living camps, and linear features such as chutes, hoist tramways, and railroad grades.

Brown and Elling (1981) proposed a classification system of historic resources based on functional complexity and temporal duration of the activity. The classes are isolated artifacts, locations, linear features, sites, and landscapes. Individual objects, which may be related to the activity area (e.g. sites or locations) but have no direct spatial association, would fall in the isolated artifact class. Broken saw blades, bottles, tin cans, or machinery parts are examples. Locations are areas where specific logging tasks of short duration took place';. The distinction of a location is that it would be designed for a single purpose activity that lasted a few hours, days, a week or perhaps a month'; (Brown and Elling, 1981, page 91). Linear features connect locations or activity areas (sites more or less represent an extension of the activity). Skid trails, pole chutes, tramways, or railroad grades are the most common examples of linear features. Sites are places where several interrelated activities occurred over a long period of time. The mill area or permanent hoist locations are examples. Landscapes are the collective physical remnants of logging. Stump Meadow or the Boole Tree area are examples.

Associated with these large operations were narrow gauge railroads, trestles, hoists, steam engines, and flumes. The railroads were a boon to large companies, making possible fast transport from harvest sites to mills for processing, and then to the market place. Tracks could be removed and transferred from one location to the next, reducing overall cost. Oxen teams were sometimes used to transport from the stump to the track, but more often a combination of steam donkeys and cables performed this task.

The greatest impact on the land came from the actual logging (mill sites and harvest areas). Companies logged giant sequoias, as well as smaller pines and firs. Most large giant sequoia trees were cut 5 to 25 feet above the ground and are good indicators of early 1900 logging activity. Abandoned equipment and trash scatters, privies, and small camps may be found in logged-over areas. Mill sites can be identified by structural remains (usually more than one cabin or building), stone foundations, sawdust piles, platforms, and a wide assortment of metal, glass, ceramic, and wooden objects. Cables (used to transport logs) may be found anywhere throughout a logging district, as well as trash debris and abandoned equipment.

The large-scale operators left scars on the physical landscape. Although narrow gauge rails were usually removed, some isolated railroad debris may remain. The tracks were usually laid out on cleared and leveled paths. Many of these old railroad grades now serve as Forest Service roads and are still visible. Abandoned railroad carts, cars, or flatbeds remain in the Monument. Flumes, trestles, and bridges may be in a dilapidated condition. Boards, nails, and abandoned equipment are indicators of these features.

Analysis of logging-related sites has shown that locations of certain types of sites can be anticipated in the documentary record. Maps give the locations of railroads, mills, towns, major lumber camps, and hoists. Isolated cabins, equipment pieces, trash deposits, and piles, along with stumps, are frequently recorded.

Recreation. After the mid-1880s, people began going to the mountains for summer recreation and to escape the valley heat. Some hot springs were developed in the southern Sierra Nevada, while other camping spots higher in the mountains became favorite retreats. Hunting, fishing, and hiking were common activities, especially in the summer and fall. Later, people obtained special use permits from the government for a nominal fee and moved their entire family into the mountains to the cabin'; (recreation residence) for vacation.

Many of the more developed resort sites are still in existence. Others are characterized by glass and can scatters or trash pits, stone or cement foundations, boards, nails, fencing remnants, telephone wire and ceramic insulators, and in some cases, bath house remains and developed hot springs. Earth tent platforms and/or fences, pastures, blazed trails, footpaths, roads, and log or shake one-room cabins may also be present.

Hunter camps and other camping sites are more difficult to discern and to differentiate from

forest, lumber, and temporary mining camps. The recreational user camps may consist of a fire hearth or rock circle, spent bullet cartridges, developed springs, and trash scatters or pits. Some hunter camps were used on an annual basis and may be more developed. In this case, it is possible that log benches, wood tables, tent platforms, privies, hunting blinds, and shelves or cupboards may be located in clearings or on the edges of meadows. A hunter camp will usually be characterized by a deer rack (pole) hanging between two trees.

Summer cabins, even when receiving minimal use, were often more elaborate and developed than other recreation sites. Usually a small house or cabin was built of logs or boards in a forest clearing or on the edge of a meadow or creek. The cabin housed a family and often had two or more rooms. These sites may be identified by structural remains (boards, nails), chimney or fire hearths, trash pits, privies, and associated pole corrals or fenced-in pasture areas. Blazed trails and/or wagon roads led to these summer homes. Tree stumps and developed water sources are good indicators of this type of camp, as are kitchen items and stove or oven fragments.

Resort sites are documented in the record. Since few other recreation-related sites have been either anticipated or recorded for the Monument, no generalization can be offered as to locations.

Hydroelectricity. The need for water to generate power for southern California, and for use in mining and lumbering operations, became overwhelming around the turn of the 20th century. Around 1900, several companies began to harness the energy from water flowing out of the southern Sierra Nevada. Dams, flumes, and powerhouses were constructed along major rivers and streams, all designed to get the most power out of the rushing water. Many of these dams, original flumes, and powerhouses are still in operation. However, some flumes have been abandoned and may be found in the field. These were usually constructed of wood or concrete. Associated worker camps, both temporary and permanent, may be recordable. Permanent camps may be identified by stone or cement foundations, abandoned equipment, roads, boards, and trash pits. Fire rings, privies, abandoned equipment, and trash scatters or pits may mark temporary camps, and developed water sources.

Recreation

The Sequoia National Forest and Giant Sequoia National Monument are unique in their juxtaposition to Los Angeles, San Bernardino, San Francisco, and San Diego, and the metropolitan areas of Fresno, Sacramento, Bakersfield, and Las Vegas, Nevada. Over 28 million people live within a half day's drive of the forest and Monument. The San Francisco Bay Area, Sacramento, San Diego, and Las Vegas are all located within a half day's drive. Approximately sixty percent of the forest's visitors are estimated to come from the Los Angeles Basin, which is within a three-hour drive. More than two million people live within an hour's drive from the forest. While all of these people are potential visitors to the Monument, numerous other recreation opportunities in these areas may also attract this population base.

Recreation use in the Monument was last estimated for the period of October 1996 through September 1997. The northern portion of the Monument was estimated to have 3.7 million visits and the southern portion had 2.4 million visits.

Group and family campground occupancy rates (percent of sites occupied) average 75 to 85% on peak weekends and about 25 to 30% on summer weekdays. For day use sites, percentages range from about 30% to 85%. For the northern portion of the Monument, most facilities have 100% occupancy on peak use days, which is partially a reflection of their proximity to Sequoia and Kings Canyon National Parks.

Once occupancy reaches 60%, campers are likely to find that adjacent campsites are occupied, and some people will begin to feel crowded. Crowding can affect how and when people visit an area. Some people do not mind crowds and, in fact, crowds can positively influence their recreation experiences. Many others, however, find that crowding adversely affects their experiences. Consequently, they may avoid visiting areas when they perceive the areas will be more crowded and shift their visits to other areas, other times of the week, or seasons of the year. If people perceive that areas are always crowded, they may simply avoid visiting them altogether.

Typically, the recreation facilities within the Monument were built 40 to 50 years ago. Many are outdated and are not equipped to handle today's visitors. Although an effort is being made to upgrade them, only a small portion can be reconstructed each year. The result is that many facilities cannot accommodate today's larger vehicles or larger family groups, nor can they meet the growing demands for universal accessibility to accommodate people of all abilities.

The Monument offers a rich and varied range of recreation, interpretation, and education opportunities that existed prior to its designation. Changes in some uses, most notably the exclusion of off-highway vehicles on trails, occurred as a result of the Proclamation that established the Monument.

The Forest Plan assigned Recreation Opportunity Spectrum (ROS) classes to all lands within the Sequoia National Forest (see Glossary in Appendix A for definitions of the ROS classes). Approximately 10% (32,600 acres) of the Monument is in the Semi-Primitive Non-Motorized class, 12% (39,200 acres) is in the Semi-Primitive Motorized class, 77% (251,300 acres) is in the Roaded Natural class, and 1% (3,300 acres) is in the Rural class. There are no areas in the Primitive or Urban classes in the Monument.

Developed recreation facilities in the Monument encompass about 222 acres and provide a variety of opportunities for the recreating public (for locations, see the Sequoia National Forest visitor map included with this DEIS). There are 21 family campgrounds with 502 campsites and 7 group campgrounds. The total capacity (also called persons at one time, or PAOT) of the family sites is 2,510, while the group sites have a PAOT of 450. Six picnic areas have 53 sites. There are 12 developed trailheads that offer parking, information, and rest rooms, as well as 10 other trailheads with only parking for trail users. Outside of wilderness, there are approximately 160 miles of system trails, including 12 miles of the Summit National Recreation Trail. Two pack stations provide outfitter guide services.

A number of recreation facilities are located within the current administrative boundaries of giant sequoia groves. These include four family campgrounds (Belknap, Redwood Meadow, Eshom, and Princess) with 144 campsites, one interpretive trail with 5 picnic sites and 15 parking spaces (Trail of 100 Giants), and about 23 miles of trail. Also located in groves are five trailheads (Chicago Stump, Boole Tree, Cherry Gap, Freeman Creek, and Needles), two recreation residence tracts (McIntyre and Soda Springs), one organization camp (Quaker Meadow Church Camp), and one recreation rental cabin (Mountain Home). One administrative site, the Sequoia Guard Station, is located within the Redwood Mountain Grove.

Concentrated use areas are scattered throughout the Monument. These are areas of various sizes, with little or no development, that visitors primarily use to recreate in a forest environment, often near streams, without the amenities of a campground. There are 43 concentrated use areas in the northern portion of the Monument, with an estimated 8,900 use days. The southern portion has 80 concentrated use areas, with about 17,700 use days.

In the northern part of the Monument, the greatest amount of water-oriented recreation occurs at Hume Lake. Non-motorized boating, fishing, and swimming are the primary uses. Recreation developments around the lake include campgrounds, a lakeside trail accessible to persons with disabilities, two beach areas, a picnic area, a boat launch, and two fishing piers. Hume Lake, which permits only non-motorized boats, is the only lake within the Monument that can be accessed by vehicle.

A number of campgrounds in the northern portion of the Monument are located near streams and provide opportunities for water-oriented recreation. These include Tenmile, Landslide, and Logger Flat Campgrounds along Tenmile Creek; Eshom Campground along Eshom Creek; Upper and Lower Stony Creek Campgrounds along Stony Creek; and Big Meadow Campground along Big Meadow Creek. Recreation facilities along the Main Fork and South Fork of the Kings River are Boyden Cavern with guided tours, Grizzly Falls Picnic Area with an interpretive trail, Mill Flat and Convict Flat Campgrounds, and several vista points. The Cedarbrook Picnic Area is along Mill Creek near Pinehurst.

In the southern part of the Monument, many campgrounds and picnic sites are located near streams and rivers that provide opportunities for water-oriented recreation. They include Upper and Lower Coffee Camp picnic areas along the Tule River, Wishon Campground along the North Fork of the Tule River, Belknap Campground at the confluence of Belknap Creek and the Middle Fork of the Tule River, Redwood Meadow and Long Meadow Campgrounds along Long Meadow Creek, Leavis Flat Campground along Deer Creek, White River Campground along White River, and Peppermint and Lower Peppermint Campgrounds along Peppermint Creek.

Boating, primarily whitewater rafting and/or kayaking, occurs mostly on the Kern River and the Kings River. Skilled kayakers also float Dry Meadow Creek. The Kings and Kern rivers are also popular fisheries.

Several congressionally-designated areas are found entirely or partially within the Monument: the Monarch Wilderness, the Golden Trout Wilderness, the Kings Wild and Scenic River, the South Fork Kings Wild and Scenic River, the North Fork Kern Wild and Scenic River, and the Kings River Special Management Area (see Figure III-10). Part or all of three giant sequoia groves are in the Monarch Wilderness: Agnew, Monarch, and Evans Complex Groves. The

Golden Trout Wilderness contains part of all of three other groves: Maggie Mountain, Upper Tule, and Middle Tule Groves. A botanical area exists at Slate Mountain, and the Sequoia National Forest Land Management Plan, Mediated Settlement Agreement proposed the Freeman Grove as another; however, no formal nomination has occurred to date.

About 24,000 acres of the Kings River Special Management Area are located within the northern portion of the Monument, adjacent to the Kings River. This special management area was created by Public Law 100-150 in 1987 to provide for public outdoor recreation use and enjoyment; protection of the natural, archeological, and scenic resources; and for fish and wildlife management. This public law permits off-highway vehicular use on trails to the same extent and in the same location as was permitted before enactment. This statute takes precedence over the Presidential Proclamation that created the Monument and prohibits off-highway vehicles from driving off of designated roads. Therefore, within that portion of the special management area located within the Monument, off-highway vehicle use may still occur on about 20 miles of trails.

Trails within the Kings River Special Management Area and designated roads in the rest of the Monument offer off-highway vehicle riding experiences. A total of approximately 150 miles of road are designated for off-highway vehicle use in the northern portion of the Monument, including about 20 miles of motorcycle routes, 25 miles of challenging 4-wheel drive road that is also available for motorcycles and all-terrain vehicles, and an additional 100 or more miles of high-clearance dirt road. The southern portion has off-highway vehicle recreation opportunities that offer approximately 300 miles of unpaved, designated roads.

The National Scenic Byway Program showcases outstanding national forest scenery and increases public awareness and understanding of all national forest activities. The Kings Canyon Scenic Byway, which is 50 miles long, is the only national forest scenic byway in the Monument and the Sequoia National Forest and is an eligible state scenic highway. The Scenic Byway Nomination Report states that this is an internationally significant travel corridor with two extraordinary features: towering giant sequoia trees and Kings Canyon (Scenic Byway Nomination Report, USDA, Forest Service, 1990).

Winter recreation activities are primarily snowmobiling, cross-country skiing, snow play, and some snowshoeing. In the northern portion of the Monument, there are 39 miles of marked over-snow vehicle routes, twenty-one of which are groomed, and an additional 50 miles of unmarked roadbeds that are open to snowmobiles. These offer opportunities for all levels of riding experience, from easy, groomed routes to very difficult, deep-powder routes. Existing facilities include four winter trailheads with parking; two have restrooms. Snow conditions in the Big Meadows area make this the center for winter use, with Quail Flat and Woodward as popular take-off points for both snowmobile users and skiers. In better snow years, the Cherry Gap site provides opportunities for both snowmobilers and skiers. A local resort offers 31 miles of groomed trails used exclusively by skiers. Snow play typically occurs near winter trailheads and road turnouts opened by plows. In the southern portion of the Monument, there are approximately 114 miles of primary groomed and marked roads, 68 miles of secondary groomed and marked roads, a warming hut located north of the junction of SH190 and the Western Divide Highway, and three trailheads. Cross-country skiing commonly occurs along the groomed snowmobile routes with some adventure trail breaking occurring off-road. Volunteers commonly mark approximately 4 miles of ungroomed ski trails in the Quaking Aspen-Ponderosa area and the Parker Pass area. Snow play typically occurs wherever there are winter trailheads and road turnouts opened by plows.

Three resorts and nine organization camps, operated under special use permits offer additional opportunities for forest visitors. One hundred eighty-nine recreation residences are authorized in the Monument under special use permit. Numerous temporary permits authorize recreation events such as hiking and climbing programs, snowmobile festivals, horseback riding and rodeo events, youth camping, running events, and American Indian gatherings. Three recreation rental cabins, owned by the Forest Service, are available for use by the public. The Sequoia and Kings Canyon National Parks border the northern portion of the Monument and visitors to these parks often use Monument facilities. Located on private land surrounded by the Monument, the Hume Lake Christian Camps are the largest Christian camps in the United States.

Education and Interpretation

The Hume Lake Ranger District in the northern part of the Monument has been actively involved in both indirect and direct face-to-face interpretation and education for the past decade. Delivery of these services follows the National Strategy for Interpretive Services and the National Conservation and Education Strategic Action Plan.

Interpretive and conservation education activities are based on an overall strategy for the district, with two general focuses: 1) create self-guided opportunities along the Kings Canyon

Scenic Byway; around Hume Lake; in the historically significant areas at Millwood, Converse, and Indian Basin; and around Big Meadows; and 2) create interpreter-based opportunities through guided hikes, campfire programs, and educational activities both on and off-forest.

Indirect interpretation and education are accomplished through a variety of recreation opportunity guides and signs at points of interest. Three recreation opportunity guides focus on items of interest in easily accessible giant sequoia groves and several others address a variety of commonly asked questions.

Interpretive signs are added as funding allows. Existing signs are placed along three trails and the Kings Canyon Scenic Byway. A trail around Hume Lake, which is fully accessible for persons with disabilities and has four interpretive signs, was recently completed. Additional signs are proposed in the Scenic Byway Interpretive Plan. Four major wilderness trailheads have wilderness ethic signs and six other areas have interpretive signs. Three overlooks on Highway 180 and one on the Generals Highway have interpretive signs. The Forest Service maintains two signs at the Grant Grove Visitor Center in the Sequoia and Kings Canyon National Parks.

Direct interpretation and education take several forms. Through a partnership with the National Park Service, Forest Service employees work at the Grant Grove Visitor Center each summer. Boyden Cavern, operated under special use permit, offers guided tours through the cave. Montecito Sequoia Resort, which is also operated under permit, has naturalists on staff during the summer season and focuses many activities on education and respect for the natural environment. These recreation service partners as well as others serve over 40,000 visitors each year.

Interpreters are trained each summer to provide traditional campfire interpretive programs as well as guided hikes, children's activities, and living histories. The venue for these programs varies between one of the three amphitheaters, Buck Rock Lookout, along streams, in organization camps, or along trails. Forest Service programs directly reach an average of 7,000 visitors each year. Forest Service personnel also offer programs to schools and service organizations at local schools, fairs, and other gatherings in surrounding communities.

For the past three summers, the Forest Service hosted a Celebrate Sequoias Festival. This event offered a variety of interpretive hikes through several giant sequoia groves, along with entertainment, children's activities, and vendors.

In the southern part of the Monument, ongoing education and interpretation are available at interpretive trails at Wishon Campground and the Trail of 100 Giants, wilderness ethics displays at Quaking Aspen Campground, and three developed wilderness trailheads. Quaking Aspen Campground has an amphitheater available for environmental education.

All Forest Service offices offer written guides to the public at no cost, covering a wide range of topics, including hiking and camping opportunities, safety messages, ecological education, outdoor ethics, visiting giant sequoia groves, hunting and fishing rules, fire safety, and much more.

Projections of Demand

Recreation use of the Sequoia National Forest has been estimated at 10 to 13 million visits a year, which is more than Sequoia, Kings Canyon, and Yosemite National Parks combined. Use within the Monument portion of the Sequoia National Forest was over 6 million visits, based on the latest estimate in 1997, and is estimated to be about 6.5 million in 2002. Activities with the greatest participation were automobile travel, camping, and a combination of viewing scenery, interpretive sites, wildlife, and works of mankind.

The National Visitor Use Monitoring methodology will be employed on the forest in 2003, which should yield more accurate visitation figures. This methodology is being implemented by the Forest Service nationwide and is designed to provide consistent, statistically valid visitation estimates and data regarding visitor preferences, and future demand for recreation opportunities.

A number of recreation surveys have been conducted over the past several years, all of which project increases in participation for most activities, at varying rates. Participation is expected to increase, at varying rates, across all demographic strata, for all ages and abilities, including persons with disabilities. All surveys seem to indicate a growing interest in viewing and learning activities (see Appendix J).

Several factors, relating to societal, lifestyle, and demographic trends, can affect recreation participation. The aging of the baby boomer generation, income changes, time constraints, changes in family structure, and immigration are examples.

The diversity of recreationists will continue to increase, as the American population becomes more diverse, and international visitors will increase.

The variety of activities is expected to continue to grow. Some will be determined to be suitable uses for national forest land, and some will not. As more recreation uses occur, they must compete with existing uses for a limited land base.

Participation in many activities that currently occur in the Monument is expected to grow in the future, so that the need will exist to create additional opportunities for them. Whatever additional opportunities are provided, they must be provided in such a way that lifestyle and demographic trends are taken into account, in facility design and recreation management, in order to truly serve the needs of the recreating public.

Return to top of page.

Scenic Environment

With the creation of the Giant Sequoia National Monument, recognition of the quality of its natural beauty was suddenly thrust into greater national and international significance. Language used in the Presidential Proclamation of April 15, 2000 described the rich and varied landscapes'; of the Monument. The Proclamation affirmed, Groves of towering giant sequoias, the world's largest trees, are interspersed within a great belt of coniferous forest, jeweled with mountain meadows. Bold granite domes, spires, and plunging gorges texture the landscape.'; This language describes the magnificent beauty that is experienced best by visiting these lands and viewing them firsthand.

Scenery is a critical resource within the Monument. The Scenic Management System (SMS) is an approach to determine the relative value and importance of scenery in the Monument (Landscape Aesthetics, A Handbook for Scenery Management, Agriculture Handbook Number 701, 12/95). The three primary elements identified in this approach are landscape character (scenic attractiveness), landscape visibility, and scenic integrity. Landscape character is the physical appearance of a landscape that gives it an identity and "sense of place"; and measures the scenic importance of the land. Landscape visibility is a measure of people's concern for aesthetics based on the context of the landscape being viewed, perceptual factors of people viewing those landscapes, and different visual characteristics of a landscape. Scenic integrity reflects the amount of human-caused deviation from the character valued by constituents for its aesthetic appeal.

Landscape Character and Scenic Attractiveness

The Monument offers a wide range of scenic features that include western Sierra Nevada foothills and mid to high elevation landscapes. Elevations vary from 1,240 feet to over 12,400 feet above sea level, an indication of the area's scenic diversity. Previous American Indian inhabitation and historic logging add cultural and educational value to the area. Vegetation, water and rock form, and cultural features combine to create a landscape unique to the southern Sierra Nevada.

Since the time of the Forest Plan, the Sierra Nevada Ecosystem Project was completed. Volume II of this report (Final Report to Congress, pages 839-853) discusses and maps significant natural areas. These areas contain outstanding features of unusual rarity, diversity, and representativeness on national forest system lands. The result is the recognition of more distinctive landscapes (Class A) than are identified in the old Visual Management System.

Examples of highly distinctive landscapes include giant sequoia groves, old-growth conifer forest, meadows with aspen groves alongside, and recognized botanical areas. Geologic features, such as the Needles, Dome Rock, Tobias Peak, Mule Peak, Moses Peak, Maggie Peak, Buck Rock, Mitchell Peak, and the Kern and Kings River Canyons provide high scenic value. Water features include the Kern, Tule, and Kings Rivers and their tributaries.

Landscape Visibility

With the creation of the Monument, expectations for a high quality landscape have increased, and the sensitivity of seen areas has risen. Travelways that access giant sequoia groves will take on added sensitivity.

Using the old visual management system, all roads and trails were assigned a sensitivity level. The highest level, Level 1, was assigned to Highway 190, Highway 180, and the Generals Highway. Short trail segments going into the Golden Trout Wilderness and Jennie Lake

Wilderness were also considered Level 1. This high sensitivity along travel corridors resulted in the retention visual quality objective of landscapes seen in the foreground. Low-use roads and trails were assigned Level 3, the lowest level of sensitivity, while others received a moderate sensitivity (Level 2).

Scenic Classes

All national forest landscapes have value as scenery, some more than others. The concept of scenic classes was developed to measure the relative importance, or value, of discrete landscape areas having similar characteristics of scenic attractiveness and landscape visibility. The lower the number of the scenic class, the more important it is to maintain the highest scenic value.

Scenic classes were mapped for the Monument by combining the three classes of scenic attractiveness with the distance zones and concern levels of landscape visibility. There are approximately 108,100 acres of Class 1 (the highest class), 127,500 acres of Class 2, 52,400 acres of Class 3, 2,400 acres of Class 4, and 36,000 acres of Class 5 (the lowest class).

Scenic Integrity Levels

Levels of scenic integrity range from very high to very low (USDA Forest Service, Pacific Southwest Region, 2001, Chapter 3, pages 501-503). These levels were mapped for the Monument based on a combination of landscape character, roadless status, slope, and past management practices. The giant sequoia groves and other distinctive landscapes were mapped as having a very high scenic integrity level. No areas in the Monument were found to have a very low scenic integrity level. There are approximately 800 acres of Low, 174,200 acres of Moderate, 91,200 acres of High, and 60,200 acres of Very High (see Figure III-11). Scenic integrity levels are roughly equivalent to the old Visual Management System's visual quality objectives: maximum modification = very low, modification = low, partial retention = moderate, retention = high, and preservation = very high. The Visual Quality Objectives assigned by the Forest Plan and specific to the Monument are approximately 24,500 acres of maximum modification, 124,000 acres of modification, 106,100 acres of partial retention, 42,400 acres of retention, and 29,400 acres of preservation.

The urban interface areas identified in the Forest Plan are Hume Lake, Pinehurst, Hartland, Camp Nelson, Sequoia Crest/Alpine, Ponderosa, Hot Springs, Sugarloaf, and Poso. The Forest Plan states that these areas within the conifer forest will continue to experience a dominantly natural landscape. Activities seen from these areas will remain subordinate (USDA Forest Service, Sequoia National Forest, 1988, page 4-10).

Socio-Economics

The San Joaquin Valley counties of Fresno, Tulare, and Kern are the areas of primary socio-economic effect of management decisions in the Monument. The Monument lies within Fresno, Tulare, and Kern Counties and is easily accessed by Highways 65, 155, 180 and 190, as well as by several less direct routes. While only a few acres of the Monument lie within Kern County, it is easily accessed via Highway 178 and the Kern River Valley. Since all three counties may experience some socio-economic effects from active management of forest vegetation and/or from tourism, primarily in levels of employment in the agricultural, manufacturing (woods work, mill), service (hotel/motel), and retail sectors, a short description of each is provided below. It is important to understand that in the San Joaquin Valley as a whole, unemployment is consistently higher then the statewide average, which reflects the seasonality of the agricultural economy and the excess growth rate of the labor force over job creation.

While all three counties enjoy some measure of tourist-related economic activity, much relating to national forests or parks, this is a relatively small proportion of the service and retail sectors. This activity is somewhat more important than the numbers would suggest because it is activity partially generated from outside these counties rather than inside. Similarly, the woods work and mill jobs, while relatively small in number (about 100 in Tulare County), are more significant economically because they are not related to the needs of local residents as much as to the demand for products elsewhere.

Fresno County

Situated in the heart of California's central valley, Fresno County covers a 6,000 square mile area, making it the fifth largest county in the state. It is among the nation's number one counties for agriculture production, with a gross crop value exceeding three billion dollars.

While agriculture supports the county's financial base, Fresno, with a population over 750,000, has diversified into a broad range of industries, which provide approximately 87 percent of the non-agricultural wage and salary jobs. Fresno County is the financial, trade, commercial, and educational center for the surrounding five-county region. It is also the hub for transportation facilities connecting central California to all parts of the state.

Table III-22: Fresno County Labor Force

Table III-23: Fresno County, Labor by Industry Sector

Tulare County

Tulare County lies south of Fresno County, spanning the Sierra Nevada and extending into the San Joaquin Valley. Almost half the entire county area is devoted to national parks and forests, including the Sequoia and Kings CanyonNational Parks, and the Inyo and Sequoia National Forests.

With a population of over 350,000, Tulare County ranks first as the most productive agricultural county in the nation. For years, Tulare County has held the distinction of leading the nation in milk, orange, grape, cattle, and cotton production.Recently, Tulare County has seen sizable employment gains in its manufacturing industries, with jobs in durable goods showing the largest jump. New small-to-midsize firms manufacturing electronic components, plastics, prefabricated buildings, construction related products, food processing and printing services have significantly increased anddiversified industrial activity.

Table III-24: Tulare County Labor Force

Table III-25: Tulare County, Labor by Industry Sector

Kern County

Kern is California's third largest county, covering 8,172 square miles at the south end of the San Joaquin Valley. Kern County's population of over 625,000 is centered in the San Joaquin and Antelope Valleys. Agriculture provides the backbone of Kern County's economy, providing employment to a large segment of the labor force and putting millions of dollars into the local economy. Kern County routinely ranks in the top three among the agricultural counties in the state. Cotton, grapes, carrots, and almonds are Kern County's most valued agricultural products. It is the nation's leading petroleum-producing county, yielding half the total California output of oil; the second largest cement-producing county in California; and the location of the largest flight test center in the world, Edwards Air Force Base.

Table III-26: Kern County Labor Force

Table III-27: Kern County, Labor by Industry Sector

Social Values Regarding Vegetation Treatments

Social analyses are conducted by the Forest Service to determine what effects the agency has on local communities and the people directly using natural resources. The social analysis also considers the effects of natural resource management on those that are not directly in contact with the area, but may have some concerns about it and/or hold values about its management. This includes sectors of the American public that may never visit Giant Sequoia National Monument but take satisfaction in knowing it is there. In order to understand how people and their values relate to management of the Monument, it is important to understand its history.

The newly created Giant Sequoia National Monument is part of a larger natural and social ecosystem that has a relatively long history of conflict over public land management goals and practices. This conflict on the Sequoia National Forest dates from at least the 1960s, when a U.S. Forest Service proposal to develop a high-density outdoor recreation site in the Mineral King Valley was challenged in the federal courts by the Sierra Club (Nienaber, 1972). Conflicts over timber production in the 1980s led to a mediated settlement agreement, which resolved some issues but not all.

In 1990, the National Forest System marked its centennial, and the anniversary sparked discussion regarding the future of the national forests. Through the 1990s, policy and social changes affected the types of management undertaken on national forests. Policy changes included the definition and adoption of an ecosystem management approach and the

implementation of environmental laws at regional and local levels. Simultaneously, outdoor recreation has increased throughout the country, and government agencies are responsible for much of the land that is still available for outdoor recreation activities (Cordell, et al, 1997).

In addition, there has been a significant change in timber supply characteristics throughout the western U.S. This was caused by a harvest policy shift on public forests. The Forest Service's traditional emphasis on timber production, road construction, and livestock grazing has shifted toward more recreation-based activities. Researchers have documented increases in recreational/visitor use on Sierra Nevada public lands over the past ten years (Daniels and Gimblett, 2001; Duane, 1996). Federal land managers have seen an increase in the numbers of constituency groups claiming an interest in, or use of, the public lands (Clarke and McCool, 1996). This social trend began about twenty years ago.

The uniqueness and limited range of giant sequoia trees only adds to the fervor with which people and groups have expressed their feelings. Those that feel the national forests must be managed for protection feel that the sequoias and their ecosystems are so unique and special that no harm should come to them, the trees must be preserved as they stand at a given time and place. Those that feel the sequoias should be managed for recreation amenities would like to see interpretive centers, historical sites marked and interpreted, and education on management policies and practices. The groups and individuals that feel the national forests should be managed for outputs see a need to preserve the giant sequoia species but want the forest to be managed through utilization.

This wide disparity in values surfaced again as a result of President Clinton's 2000 presidential proclamation creating the Giant Sequoia National Monument. In order to assess the degree to which these different values are redeemed through the range of alternatives in this Monument management plan, indicators are selected and analyzed in Chapter 4. These indicators include wood products available from protection and restoration treatments and acres where mechanical treatments would be prescribed.

Transportation

Roads

The Sequoia National Forest has approximately 1,640 miles of road, with approximately 900miles in the Monument. Not all of this mileage is open to public vehicular traffic (see Maintenance Level 1 definition below). A road is definedas a motor vehicle travelways over 50 inches wide that is not designated and managed as a trail. A road may be classified, unclassified, or temporary. Most of the forest roads within the Monument were built primarily for timber harvesting between 1950 and 1980. Timber harvest levels have declined significantly since 1993, when the California Spotted Owl Sierran Province Interim Guidelines were implemented. Since that time, however, public use of the roads has increased about three percent per year, and pleasure driving is the single largest recreational use of lands managed by the Forest Service. The higher standard roads were designed and constructed for multiple uses, including public access.

Most national forest visitors travel on the Forest Service road system. These roads have provided access to millions of national and international tourists. Forest Service roads serve such needs as recreation, fire protection, timber harvest, commercial use, grazing, research, private property use, and insect and disease control.

Access to the Forest Service road system is provided by state and county roads. Access to the vicinity of the northern portion of the Monument is available on a variety of highways and county roads, including State Highways (SH) 99 and 63 and Dry Creek Road. These roads eventually focus traffic on SH 180 or County Road 245, both of which enter the Monument. SH 180 out of Fresno serves the northern portion of the Monument, where it becomes the Kings Canyon Scenic Byway. County Road 245 through Pinehurst serves the west side of the northern portion of the Monument. The General's Highway provides access to this area from the south through Sequoia National Park (see the Sequoia National Forest visitor map included with this DEIS).

Access to the vicinity of the southern portion of the Monument is also provided by a variety of highways and county roads, including SH 65, 178, and 14, that eventually focus traffic on SH 190 and 155, or County Roads SM50, SM99, and SM107 that enter the Monument. SH 190 out of Porterville provides access to the north part of the southern portion of the Monument. SH 155 provides access from the east and west to the central part of the southern portion of the Monument. In addition to SH 155 from the east, County Road SM99 provides access to the Monument from the Kern Valley. County Road SM50 provides access through the south part of the southern portion of the Monument. The Western Divide Highway, SM107, provides north to

south access within the southern portion of the Monument and links SH 190 to SM50.

Some forest roads may be designated as public roads. All state and county roads are public roads. The Forest Service is developing a program that will designate most Maintenance Level 3-5 roads as Public Forest Service Roads. Currently, no Public Forest Service Roads are designated within the Monument.

The remaining Forest Service roads are not public roads. They are authorized for the administration and use of national forest system lands. Generally, they are open to public use, but at the discretion of the Secretary of Agriculture. The Forest Service may restrict or control the use of these roads to meet specific management direction (USDA Forest Service, 2001a, FSM 7731).

Road Definitions

Several terms regarding roads and road management need to be understood.

Forest Road. Any road wholly or partly within, adjacent to, and serving the National Forest System, which is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources (23 USC 101).

Public Roads. Roads that are under the jurisdiction of and maintained by a public authority, that are open to public travel (23 USC 101(a)).

National Forest System Roads. Forest roads under the jurisdiction of the Forest Service (23 USC 205).

Classified Roads. Roads wholly or partially within or adjacent to national forest system lands that are determined to be needed for motor vehicle access, such as state roads, county roads, privately owned roads, national forest system roads, and roads authorized by the Forest Service that are intended for long-term use (36 CFR 212.1).

Unclassified Roads. Roads on National Forest System lands that are not needed for, and not managed as part of, the forest transportation system, such as unplanned roads, abandoned travelways, off-road vehicle tracks which have not been designated and managed as trails, and those roads no longer under permit or authorization (36 CFR 212.1).

Forest Transportation Atlas. An inventory, description, display, and other associated information for those roads, trails, and airfields that are important to the management and use of national forest system lands or to the development and use of resources upon which communities within or adjacent to the national forests depend.

Maintained for Public Use. A Memorandum of Understanding with the Federal Highway Administration defines national forest system roads open to the public as those roads open to unrestricted use by the general public in standard passenger cars, including those roads open on a seasonal basis or for emergencies (Sierra Nevada Forest Plan Amendment, Final EIS, Chapter 3, page 444).

Deferred Maintenance. Maintenance activities that can be delayed without critical loss of facility serviceability, until the work can be economically or efficiently performed.

Road Decommissioning. Activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212). One method of decommissioning is to convert the road to a trail.

Maintenance Levels

Table III-28 displays the miles of road in the Monument by maintenance level. The maintenance level represents the maintenance required for a particular type of road and the level of service that the user can expect. Maintenance levels range from one, representing lower standard roads that are closed to vehicular traffic, to five, representing a higher standard, paved road.

Maintenance Level 1. These roads are closed, although some intermittent use may be authorized. Closures must be in place for one year or more. When closed, they are physically closed with barricades, berms, gates, or other closure devices. When closed to vehicular traffic, the road may be suitable and used for non-motorized uses, with custodial maintenance to protect adjacent resources. When open, the road may be maintained at any other level (USDA Forest Service, FSH 7709.58, 12.3 - Maintenance Levels).

Several roads in the Monument that have a Maintenance Level 1 objective are not physically closed to public use, which is an ongoing administrative issue. Most Maintenance Level 1 roads in the Monument do not have physical barriers that prevent public use.

Maintenance Level 2. These roads are open for use by high clearance vehicles. Passenger-car traffic is discouraged. Traffic is minor administrative, permitted, or for dispersed recreation. Non-traffic generated maintenance is minimal.

Maintenance Level 3. These roads are open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Typically, these roads are low-speed and single-lane, with turnouts and native or aggregate surfacing.

Maintenance Level 4. These roads provide a moderate degree of user comfort and convenience at moderate speeds. Most are double-lane and paved, although some roads may be single-lane.

Maintenance Level 5. These roads provide a high degree of user comfort and convenience. Normally these roads are double-lane and paved, or aggregate surface with dust abatement. This is the highest standard of Forest Service road maintenance.

Table III-28: Miles of Roads in the Monument by Maintenance Level

Functional Classes

A functional classification system is also used to categorize our national forest system roads. These classes are arterial, collector, and local (Table III-29). Arterial roads are the main roads, which traverse the forest and connect to major state highways or county roads. They are paved and designed for high-speed travel. Collector roads connect the arterials to local roads and balance access needs with mobility. Local roads are at the ends of collector roads, tend to be low standard, and serve a small land area.

Table III-29: Miles of Road in the Monument by Functional Class

The Forest Service has five different traffic management strategies: encourage, accept, discourage, eliminate, and prohibit. The encourage strategy directs forest visitors to important destinations via desirable routes. The discourage strategy informs potential users of road conditions that may detract from the experience they seek when visiting a national forest. The eliminate and prohibit strategies are used to closed roads with physical barriers or regulatory signs and orders (USDA Forest Service, FSH 7709.59-25.3; Sierra Nevada Forest Plan Amendment, Final EIS, Chapter 3, page 446).

The Monument has many routes or wheel tracks that are not included in the forest road system. These roads are defined as unclassified. They have evolved in different ways; some were constructed as temporary roads for past timber harvest projects and were not decommissioned at the end of the sale, while some are user-defined roads or paths and are considered a non-authorized use. These roads are not inventoried or maintained; they may be sources of environmental damage. According to the national roads policy, all unclassified roads will be inventoried through the Roads Analysis Process (RAP) during site-specific analysis. The forest will determine whether the route is causing resource damage and if there is an administrative or public access need that warrants adding it to the road or trail system. Once site-specific analysis is completed, the Forest Service is managing these roads using three methods: decommissioning, adding them to the trail system, or adding them to the forest transportation atlas and classified road system. Roads are added to the forest transportation atlas after appropriate RAP and NEPA analyses are completed.

The Sequoia National Forest decommissions about three to six miles of road per year in the Monument. Roads previously selected for decommissioning were identified through site-specific analyses of negative impacts to natural or cultural resources or lack of public and administrative use. The RAP will help determine potential roads to decommission for further analysis at the site-specific scale.

Annually, newly constructed or acquired roads are added to the forest transportation atlas. Some roads, if decommissioned, are removed from the atlas. Newly constructed roads are typically short, single-lane, of local designation, and related to a single need, such as access to new recreation developments or access to private property surrounded by national forest system land. Other existing roads may be acquired through land acquisitions. Annually, less than one mile of roadway is acquired or constructed within the Monument.

Costs and Funding for Road Construction, Maintenance, and Decommissioning

In recent years, the Forest Service has actively assessed the condition of its road network. The network is in a deteriorating condition, due to increased use and the continued deferral of maintenance and capital improvements. Roads are becoming unusable through lack of maintenance, may be causing resource damage, or are no longer needed or desired for administrative or public access. These roads are candidates for decommissioning after appropriate site-specific project planning.

National forest system roads must receive a certain minimal amount of yearly maintenance. If the minimal maintenance activities do not occur, these activities are termed deferred maintenance. Deferred maintenance can adversely affect the roads' functionality and impacts on the environment.

To properly maintain the entire forest road system, the roads must be maintained on a 20-year cycle. For example, each year 5% of Maintenance Level 1 roads must be fully maintained (5% of 360 miles equals 18 miles). The estimated cost figures per mile used in Table III-30 are from the electronic road log database, dated 2002. This table displays annual road maintenance costs, assuming all Monument roads were maintained to standard and on a scheduled cycle. Costs to adequately maintain the road system on a 20-year cycle exceed the 2002 budget by approximately $260,000 (see Table III-30).

The majority of the Monument road system mileage is rated as Maintenance Levels 1 and 2, but a few roads are rated as Maintenance Level 3 through 5. The annual maintenance budget does not cover the anticipated maintenance needs on the Maintenance Levels 3 through 5 roads. Only approximately 28% of the Monument road system was partially maintained in fiscal year 2001.

Table III-30: 2001 Road Work Activity Costs to Maintain Five Percent of Monument Roads

The existing road maintenance funding for the Monument is used to repair the most pressing safety-related road problems and unacceptable resource impacts. As a result, none of the roads are being maintained to standard or within the 20-year maintenance cycle. The backlog of needed road maintenance work is referred to as deferred maintenance (USDA Forest Service, Pacific Southwest Region, 2001, Chapter 3, page 447). In 2001, the deferred maintenance for the classified road system (including roads, bridges, and culverts) was estimated at $23,705,900, comprised of the following categories:

12% for health and safety (Maintenance Level 3 through 5 roads: clearing along roadsides, repairing potholes, replacing signs, etc.).

39% for resource protection (installing water bars, rolling dips, and over side drains to prevent or reduce sedimentation; installing larger culverts and open bottom arch culverts for aquatic species passage; closing roads to protect sensitive plant species and to encourage animal migration).

49% for the Forest Service mission (providing proper and safe access on Maintenance Level 1 and 2 roads for fire protection and vegetation management).

Return to top of page.

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF

· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Chapter IV Environmental Consequences

Environmental Consequences. IV-2 | Resource Management. IV-2 | Air Quality. IV-2 | Caves. IV-12 | Fire and Fuels. IV-12 | Giant Sequoia and Mixed Conifer. IV-20 | Range. IV-37 | Rare Plants. IV-38 | Watershed. IV-41 | Wildlife. IV-54 | Human Use. IV-61 | Heritage Resources. IV-61 | Recreation. IV-65 | Scenic Environment IV-79 | Socio-Economics. IV-81 | Transportation. IV-85 | Roads. IV-85 | Other Effects. IV-89 | Unavoidable Adverse Effects. IV-90 | Relationship Between Short-Term Uses and Long-Term Productivity. IV-91 | Irreversible and Irretrievable Commitments of Resources. IV-92 | Disclosures. IV-93

Environmental Consequences

This chapter describes the probable consequences or effects of each alternative on each resource. Three types of effects will be discussed by alternative: direct effects, indirect effects, and cumulative effects. The description of effects is the scientific and analytic basis for comparing the alternatives.

The resource components are divided into three categories, as follows:

Resource Management

- Air Quality
- Caves
- Fire and Fuels
- Geology and Soils
- Giant Sequoia and Mixed Conifer
- Range
- Rare Plants
- Watershed
- Wildlife

Human Use

- Heritage Resources
- Recreation
- Scenic Environment
- Socio-Economics
- Transportation
- Roads

Resource Management

Air Quality

Emissions From National Monument Activities. Smoke from prescribed burning and wildland fires could potentially affect air quality and is a concern because of its potential effect on human health and visibility. The smoke could potentially affect visitors to the Monument and residents in surrounding communities.

Prescribed Burning. When considering the use of prescribed burning to restore the natural role of fire in ecosystems and reduce fuels the effects of smoke from wildfire and prescribed burning must be considered. Fires emit large amounts of particulate matter (PM-10 and PM2.5) and carbon monoxide, as well as nitrous oxides (Nxand volatile organic compounds (VOCs, which are precursors to ozone. Other constituents of smoke (gases and chemicals) may also enter the lungs. Some components, such as benzo-apyrene and aldehydes, can be carcinogenic.

Wildfires result in greater emissions per acre when compared to prescribed burns, commonly exceeding ambient

air quality standards. They also often occur under conditions of high temperature and low humidity, when high concentrations of ozone are most likely. Prescribed burning reduces existing fuels, thus decreasing the fire hazard and the risk of high intensity wildfire, and decreasing the quantity of fuels available to be consumed in a wildfire. However, infrequent large-scale wildfire will still occur naturally in some vegetation types. There are concerns about the amount of smoke and how it will disperse and whether the prescribed burns would result in fewer impacts to air quality than would occur with a wildland fire.

The quantity of smoke emissions from fires and the impact of those emissions on local and regional air quality vary dramatically with the size and type of fire that occurs. The number of acres burned is the single most important factor in determining the total emissions within an airshed. Large fires, whether they originate as wildland fires or prescribed fires, produce more total emissions than small fires. Therefore, reducing the total acreage burned, regardless of the type of fire, is the most effective way to reduce the total emissions within an airshed.

The fire type also influences the quantity of emissions from fire. Prescribed fires typically produce lower per-acre emissions than wildland fires. Heading fires (a fire that burns with the wind) typically produce lower per-acre emissions but have higher emission rates than backing fires, and surface fires typically produce lower per-acre emissions than crown fires. The differences in emissions among the different fire types may be attributed to differences in the meteorological conditions that typically occur, differences in fuel properties, and differences in the resultant fire behavior and fuel consumption. Because prescribed fire generally produces fewer per-acre emissions than wildland fire, it is possible to burn more acres with prescribed fire than would normally occur with wildland fire and still maintain the same total emissions within an airshed.

The primary benefit of a prescribed fire program is in modifying the sizes and types of fires that occur within a particular geographic region. With prescribed fire, it is possible to replace large high- intensity wildland fires characterized by high fuel consumption and high total emissions with smaller, lower-intensity prescribed fires characterized by lower fuel consumption and lower total emissions. But this decrease in wildland fire emissions typically comes at the expense of higher prescribed fire emissions.

The higher the total emissions (wildland fire plus prescribed fire) within an airshed, the greater the air quality impacts. However, air quality impacts are measured in terms of air concentrations and not in terms of total emissions. Air concentrations are a function not only of the total emissions within the airshed, but also of the timing of the emissions, the locations of the fires relative to sensitive receptors, the meteorology of the area, and the physical characteristics of the smoke plume. Prescribed fires, while they generally produce lower total emissions than wildfires, are also lower in intensity than wildfires, with lower total heat production and lower plume rise. This difference can often lead to higher smoke concentrations at locations far from the source than from a wildland fire of the same size.

Evaluation Criteria The air quality impacts of the alternatives are evaluated on the basis of the following criteria:

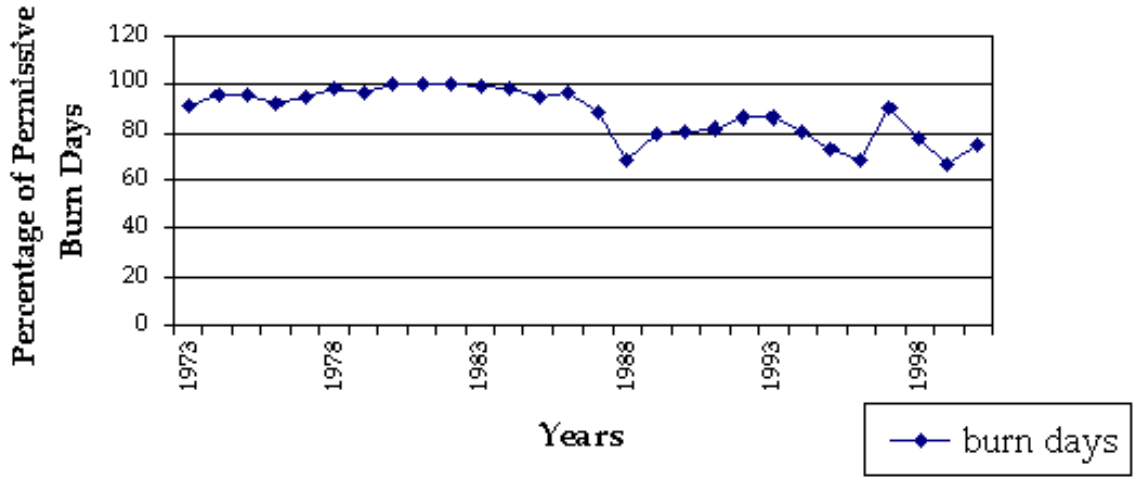
Capability to conduct prescribed fires in the regulatory environment. A retrospective analysis was completed using a 28-year record of annual burn day summaries and a 4 year record (1998 to 2001) of daily burn day designations. The annual summary record was used to establish trends. The daily record was used to examine monthly variation, establish multiple day burning opportunities, and compare burn day variation with typical prescribed fire prescriptions. Fuel moisture records for the same 4- year daily burn day record were examined to identify when prescribed fire prescriptions and allowable burn days coincide.

Total emissions of fine particulate matter less than 10 microns in aerodynamic diameter relative to the alternatives. Both wildland fire and prescribed fire emissions are displayed by annual average for the first decade.

Retrospective Analysis of Burn Days. Burn day designations within the Monument are currently designated by the San Joaquin Valley Air Pollution Control District (District). Until recently the California Air Resources Board (CARB) has provided this service. The data used for the retrospective analyses were based on burn day designations historically provided by CARB. Annual summaries were used to establish trends and daily records from 1998 to 2001 were used to look at monthly variations.

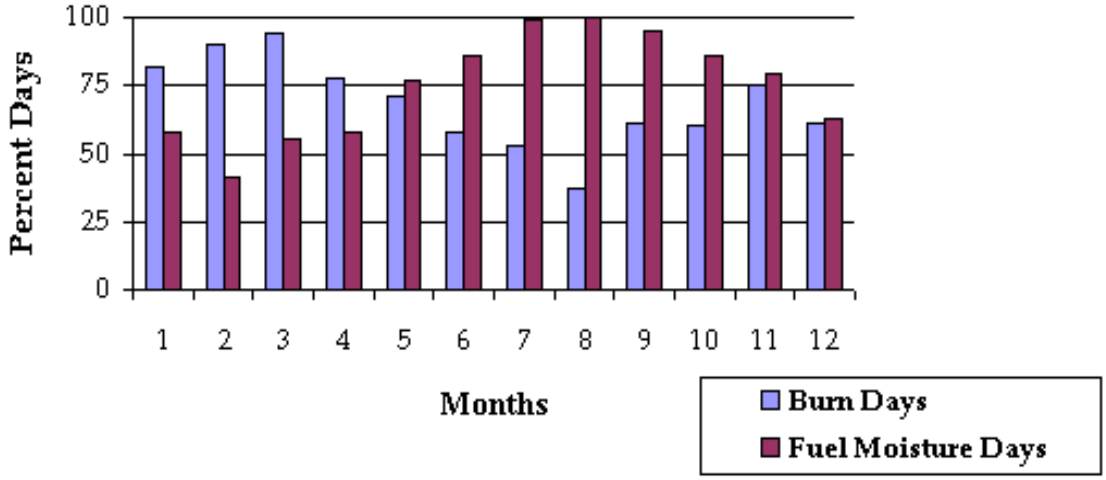
An examination of CARB burn day records from 1973 to 2000 suggests that designated burn days have declined in the Monument since 1973 (Figure IV-1). Up to about 1988, over 95% of the days each year were permissive burn days. From 1988 to 2000 , the number of permissive days has been just under 80%. Even though burn days have declined since 1973 a fairly high percentage of days remain available. The District is planning to develop a burn day designation process that will involve dividing the District up into zones. More refined meteorological data is expected to provide better forecasting and the ability to differentiate "burn" and "no burn" designations at a zone scale. This process could provide more burn day designations in the Monument.

Figure IV-1: Burn Days 1973 to 2000

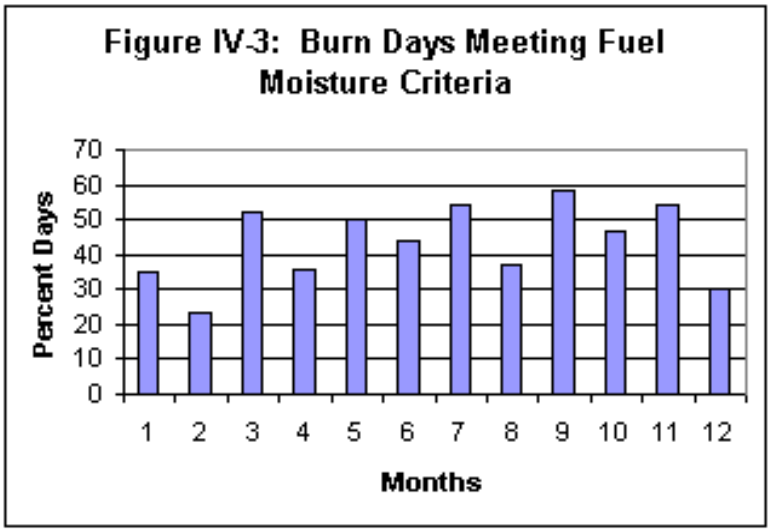


Available burn days only provide the information needed to minimize the potential for smoke impacts. The Forest Service has many other criteria that must be met prior to ignition of a prescribed burn project. One of the principal criteria is fuel moisture. Days meeting fuel moisture criteria and designated burn days for 1998 to 2001 were examined to better understand how they might constrain prescribed fire in the Monument (Figure IV- 2). The number of d designated burn days tends to start high in January and peak in March. There is a considerable drop from April to August and then a slight increase from September to December. The number of days when fuel m moisture criteria is suitable for prescribed burning is at its lowest in January and February and conversely picks up in the spring months. Conditions are normally too dry for burning after May and remain that way until about September. Generally the data suggest that in early spring fuel moisture is more constraining than permissive burn days and in the fall permissive burn days are more constraining than fuel moisture.

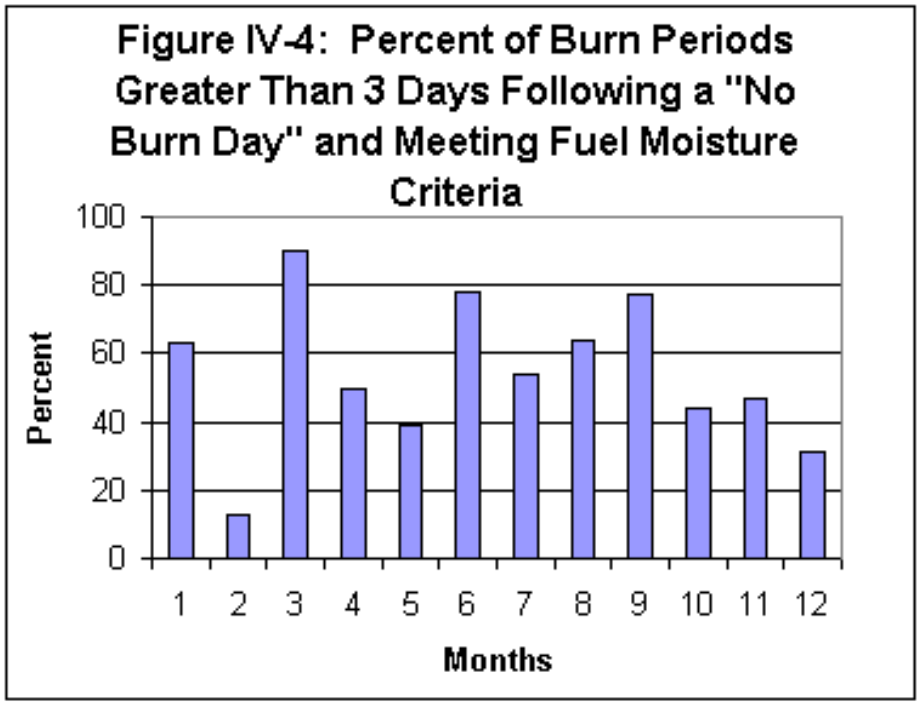
Figure IV-2: Burn Days vs. Days Meeting Fuel Moisture Criteria



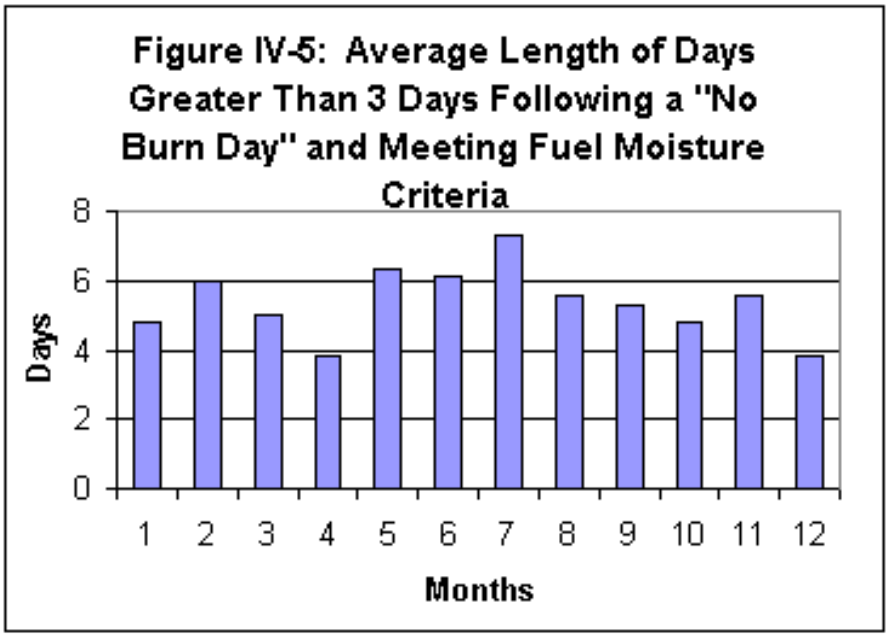
Both fuel moisture records and burn day designations for the 1998 to 2001 period were use d to examine monthly variation in permissive burn days that met fuel moisture criteria (Figure IV- 3). The data suggest slightly more days meeting both criteria in the fall burn period than in the spring period. The traditional burning period in the spring (March, April, May) averages about 45% of the days meeting criteria. The traditional burning period in the fall (September, October, November) averages over 50% of the days meeting criteria.



Another factor that could limit prescribed fire application would be the availability of consecutive burn days meeting a prescription for larger projects that might take multiple days to complete. The 1998 to 2001 data was examined to better understand the opportunities for multiple day projects. The frequency (%) of burn periods following a no burn period that would extend at least 3 days is displayed in Figure IV-4 . Fuel moisture criteria are integrated as well. Coordination with the San Joaquin Valley Air Pollution Control District staff might allow better predictions of these periods.



Of those periods that exceeded 3 days, the average length was 4½ days. The monthly variation in the average length of days exceeding 3 days is shown in Figure IV- 5. These data tend to indicate that sufficient opportunity exists to complete the prescribed fire objectives in each alternative. The more complex issue may be one of public acceptance of smoke, which is discussed in more detail in the section on Smoke and Public Nuisance below.



Air Quality Impact Assessment

Table IV-1 presents, by alternative, the predicted annual average PM-10 emissions for prescribed fire in the first decade and annual averages thereafter. Emissions are expressed in annual tons.

Table IV-1: Predicted PM-10 Emissions

Each alternative would have some pile burning in the first decade in anticipation of mechanical treatment in the urban defense zone. This would be an extremely important element in effectively spreading the emissions over more time since the pile burning could be accomplished during winter months. Alternatives 1, 2, 3, 5, and 6 could all remove some amount of commercial volume; that would represent an emissions savings. In Alternative 4, this material would be burned.

The ranking of each alternative in terms of PM- 10 produced in the first decade is shown in Table IV-2 . The ranking that displays underburns is important since this material is would be burned primarily in the more critical spring or fall burn periods. The material burned in piles would be a candidate for winter burning and therefore removed from the more constraining seasons. Alternatives 1, 2, 3, 5, and 6 could remove some commercial volume; this tonnage was removed from the fuel loadings in the PM-10 estimates. Alternatives 1 and 2 would result in the least PM-10 emissions in both the short and long term. Rankings of PM-10 emissions after the first decade are displayed in Table IV-3.

Table IV-2: Alternatives Ranked by PM-10 Produced

Table IV-3: PM-10 Emissions After the First Decade

Wildfire emissions are displayed in Table IV-4 . Emissions decrease over time as wildfire and prescribed fire projections begin to affect the potential.

Table IV-4 Wildfire Emissions

Smoke and Public Nuisance. The regulatory environment for smoke has shown an overall emphasis on accommodating prescribed fire out of recognition of the severe fuels risk in the western United States. In California the public nuisance rule provides an important protection measure for property, safety and health. However, this rule can have a very unpredictable impact on prescribed burn programs.

In response to the California Code of Regulations the District enacted Rule 4102. This is the Nuisance Rule which was adopted May 21, 1992 and amended December 17, 1992. This rule essentially requires the District to investigate and take action to remedy any air discharge which is causing injury, detriment, nuisance, or annoyance to any considerable number of persons.

Good smoke management techniques, improved burn day forecasts and public communication can mitigate some complaints. Public nuisance issues are more commonly associated with changing or unforeseen conditions in the burn day forecast or lower elevation projects where the smoke is not fully dispersed during daytime hours. Although difficult to predict, it is probably safe to assume that the impact of public nuisance calls on prescribed fire projects would increase, given growing populations in the foothill areas on the west side of the Monument . Alternatives 3, 4, 5, and 6 have the highest likelihood of triggering public nuisance complaints.

Return to top of page.

Caves

Alternative 1

All Action Alternatives

Under all alternatives, caves and their associated resources would be inventoried, protected, studied, and preserved. A ll of the alternatives include some form of vegetation management, prescribed burning, road maintenance, recreation use and management, and other management activities . The management strategies and goals for all the alternatives would limit the possible effects on cave resources from these activities to minimal or no effects.

Fire and Fuels

All Alternatives

Under all alternatives, the following direct effects would occur:

Treatments in the chaparral vegetation type would provide an increase in the variety of age classes of vegetation and begin moving this type towards desired conditions. Fire susceptibility would be reduced in the chaparral ecosystem.

Fire would be reintroduced in fire-dependent ecosystems.

Fuel loading and fire susceptibility would be reduced, leading to a decrease in the risk of loss from catastrophic fire across the landscape. There would be a reduction in surface and ladder fuels.

The density of ladder fuels would be reduced and surface fuel loadings would be reduced (USDI National Park Service, Sequoia and Kings National Park, 2001).

Under all alternatives, the following indirect effects would occur:

Vegetative heterogeneity would increase as different age classes and sizes are established, leading toward a condition that is more supportive of a low-intensity surface fire and a more frequent fire return interval.

Treatment in chaparral vegetation would reduce the ability of fires to move from the chaparral to the mixed conifer ecosystem.

Over time, large trees over 30 inches in diameter would increase, as thinning by prescribed burning or mechanical treatments begins to reduce stand densities. These trees can more easily survive the effects of wildfire than smaller trees.

Approximately 13% of the Monument contains protected habitat for wildlife species dependent on old forest conditions, such as the California spotted owl and furbearers. Fire susceptibility would be reduced in these areas, however not to the same extent as areas that do not have the constraints applied to these areas. For example, only 10% of protected activity centers can be treated per decade. Most treatments would be limited to treatment of surface fuels and very small trees. The effect is that wildfires would tend to remain as ground fires. However, a continuous overstory canopy contributes to severe crown fires, and these limited understory treatments would not reduce the canopy. Wildfires occurring within this wildlife habitat would be more likely to result in severe effects than in areas where more treatments are allowed. Outside of these key habitat areas, strategically located treatments would help reduce the extent and magnitude of wildfires before they reached these areas.

Fire susceptibility is an indicator of large severe fire or catastrophic fire. Areas of high and moderate fire susceptibility have higher potential under high fire danger weather conditions to result in catastrophic fire than areas of low susceptibility. Approximately 30 to 40 percent of each landscape within the Monument would need to be treated in strategic locations to move towards low fire susceptibility (Finney, 1999; USDA Forest Service, 2001). Table IV-5 summarizes the acreage in each class of fire susceptibility. During the first decade, all alternatives would reduce fire susceptibility, as shown in Table IV-6. The rate of accomplishing this would vary among alternatives.

Table IV-5: Fire Susceptibility Classes

Table IV-6: Acres of Moderate and High Susceptibility Treated by Alternative in First Decade

Table IV-6 shows that Alternatives 5 and 6 would reduce fire susceptibility the greatest during the first decade. Alternatives 3 and 4 would treat almost equal amounts and would be less than 5 and 6, while Alternatives 1 and 2 would treat the least acres of moderate and high susceptibility. This difference among alternatives is because Alternatives 1 and 2 do not have a protection or restoration strategy outside of the urban intermix areas. Alternatives 3 and 4 have a restoration strategy, however defense zones are very limited compared to other alternatives. Alternatives 5 and 6 have the same urban intermix strategy as Alternatives 1 and 2; however, they also treat areas for restoration, which also reduces fire susceptibility.

Fire as a natural process has been excluded from the Monument for almost 100 years, resulting in a change of density, configuration, and amount of fuels from historical levels. Table IV-7 shows the existing fire return interval departure in the Monument. "Departure" is a deviation from the historic fire return interval. The more intervals missed, the farther the current fire regime is from the historic fire regime. "Extreme" is greater than 5 departures from the historic fire interval; "High" is between 2 and 5 departures; "Moderate" is between 1 and 2 departures; "Low" is 1 or less and is within the historic fire return interval (see Figure III-6 in the Map Packet).

Table IV-7: Fire Return Interval Departure Classes

All alternatives reintroduce fire into the ecosystem; however, the rate at which it is accomplished varies by alternatives. The predicted numbers of acres that move toward historic fire return interval over a 10-year period are shown in Table IV-8.

Table IV-8: Acres Moving Toward Their Historic Fire Return Interval in the First Decade

Table IV-8 displays that Alternatives 1 and 2 would be the least effective in moving acres towards the desired condition, as no explicit restoration strategy is found in these alternatives and the effects would primarily be gained from the protection strategy. Alternatives 3 and 4 would be the second most effective, as they would combine a restoration strategy with a protection strategy. Alternatives 5 and 6 would be the most effective in restoring fire to the ecosystem based on their comprehensive protection strategy, their restoration strategy, and the increased number of treatment acres estimated that would be treated each year.

Alternatives 1, 2, and 5

These alternatives would be very similar in their effects because the management direction is similar, except that in Alternative 5, in the giant sequoia groves, greater flexibility is provided to manage vegetation. These alternatives would not have as much flexibility as Alternative 6 to create stands that are closer to the desired conditions, but are more likely to create stands closer to desired conditions than are Alternatives 3 and 4. This is because mechanical treatments, in conjunction with prescribed fire, would reduce the risk of undesirable effects from prescribed fires, such as impacts to wildlife habitat or reduced protection to communities or objects of interest. Alternatives 1, 2, and 5 provide for this combination of treatment methods, but not to the same degree as Alternative 6.

These alternatives would meet the goal of reducing risk from catastrophic fire and would also enhance fire suppression capabilities by modifying fire behavior inside the wildland urban intermix zone. Strategically placed area treatments would be completed within the threat zone to support firefighting efforts in the defense zone for protection of communities. Within the defense zone of the wildland urban intermix, areas would be treated to move toward or maintain the desired condition. In Alternative 5, where giant sequoia groves overlap the wildland urban intermix, more protection would be provided because of the greater flexibility to reduce canopy and shift the stand structure toward one that would support a low-intensity surface fire. Giant sequoia groves would be likely to receive greater protection from catastrophic fire in Alternative 5 than under Alternatives 1 or 2. Alternatives 1, 2, and 5 all have an extensive strategy for protection of communities. However, the mechanical and prescribed fire treatments would not provide the same degree of protection, as would Alternative 6, because Alternative 6 would provide greater flexibility in managing fuels and fuels outside the groves.

Within three decades of implementation, fire susceptibility would be reduced in the wildland urban intermix by strategically placing fuel treatments in the defense and threat zones. Most giant sequoia groves would meet the desired condition for the fire severity indicator and would be at reduced risk from catastrophic fire.

In forest vegetation types, mechanical treatments would reduce ladder fuels and intermediate crown fuels. These changes would result in reduced stand densities, increased crown base heights, and reduced surface fuel loads, which in turn would reduce the risk of severe wildfires. In mixed brush vegetation types, fuels would be treated mechanically and prescribed burned to reduce fire susceptibility. The direct effect would be that the outcomes in follow-up prescribed burning would be more unpredictable in Alternatives 1, 2, and 5 than in Alternative 6. The long-term effect would be a reduction in the risk of catastrophic fire in the wildland urban intermix zones. While the Framework allows for thinning in the wildland urban intermix zones to reduce fuels, the standards and guidelines for these three alternatives place limitations on where it can occur and what can be removed. Catastrophic fire potential would be reduced over the long term, but not as much as in Alternative 6.

Over a very long time period, Alternatives 1, 2, and 5 would promote a fairly continuous overstory canopy, which would meet the goal of maintaining wildlife habitat for species dependent upon old forest or late seral stage conditions. This is because the fuel treatments and the limited size and scope of gap development in the groves and the mixed conifer forest would tend to thin the understory and thus promote the development of very large trees in the overstory. Understory and surface fuels would be reduced, thereby reducing the risk of catastrophic fire. In the long term, the overstory could become more continuous as larger trees develop. Mechanical treatments would be limited in carnivore den sites, which would have the same effect on stand structure as described above.

Since the least amount of acres would be treated under Alternatives 1 and 2, initial attack efforts would be the least effective in controlling wildfires under these alternatives. Initial attack efforts would be the second-most effective under Alternative 5 (Alternative 6 would be the most effective in this regard).

Currently the Monument has 23 miles of viable fuelbreaks. Alternatives 1, 2, and 5 would continue to maintain

the majority of these fuelbreaks with mechanical treatments and/or prescribed fire.

Over the long term, strategically placed area treatments, which are primarily in the wildland urban intermix areas, would reduce fuel loadings, ladder fuels, and some canopy, and therefore move the treated areas toward a more historic fire return interval.

These three alternatives (except in the groves under Alternative 5) would be less likely to reduce fire susceptibility overall than would Alternatives 3 and 4. Using prescribed fire in conjunction with mechanical pre-treatment would create fewer gaps in the overstory and less of a variety of vegetation age, structure, and composition. Alternatives 3 and 4, with prescribed fire as the primary treatment, would create more variety in the forest due to more intense prescribed fire behavior. In Alternatives 1 and 2, there would be no priorities to treat fuels or restore ecosystems outside the urban intermix zone; consequently, it would do little to move this area toward an historic fire return interval. Alternative 5 would implement a restoration strategy over the whole Monument, thereby treating more acres to lower fire susceptibility and moving a larger area to a more frequent fire regime (see Tables IV-6 and IV-8). The groves would move toward historic levels more quickly than in Alternatives 1 and 2.

Alternatives 3 and 4

Alternatives 3 and 4 would treat the most acres with prescribed fire and the least amount of acres with mechanical treatments. The acres of high and moderate susceptibility acres that would be treated would be more than in Alternatives 1 and 2 and less than in Alternatives 5 and 6 (Table IV-6).

Under the defense zone strategy, both alternatives would create defensible space for firefighters. Alternative 3 would treat a wider zone around communities than Alternative 4. Overall, Alternatives 3 and 4 would provide less protection to communities than the other alternatives. Defensible space would be created around communities, but wildfire extent and magnitude would not be reduced before reaching the defense zone. The protection strategy in these alternatives would not enhance firefighter suppression capabilities as well as the other alternatives.

Fire susceptibility would be reduced in the defense zones and, as treatments for restoration are completed outside the defense zone, fire susceptibility would be reduced over the general Monument lands. However, the pace of meeting desired fuel conditions and a stand structure that supports a low-intensity surface fire would be slower than that proposed in Alternatives 1, 2, 5, or 6. Also, there would be a greater likelihood of not treating heavy fuel loadings adjacent to defense zones, due to the risk of escape (outside of the defense zone only prescribed fire would be permitted). As a result, fire susceptibility would not be reduced in those areas.

The direct effects of prescribed burning for restoration purposes outside the defense zones would be to reduce ladder fuels, surface fuels, and crown fuels in mixed conifer and pine stands. Torching of individual trees and parts of stands would occur in areas with high fuel loads. Alternatives 3 and 4 would not, in the short term, create stand structures that are similar to historic conditions. These alternatives emphasize the use of prescribed fire to meet desired conditions. While this method can meet desired conditions over the long term for providing stand heterogeneity, age, and species composition, the short-term effects on other resource values can be undesirable. The extensive use of prescribed burn in areas of moderate or high fuel loading would likely not meet desired outcomes such as flame length and crown base height.

Alternatives 3 and 4 would rely on prescribed burning for putting fire back into ecosystems. Treated areas would move toward a more frequent fire return interval. Desired conditions would be reached more slowly than in Alternatives 5 and 6 (see Table IV- 8) and faster than in Alternatives 1 and 2.

Under Alternative 3, approximately 145 miles of road would be decommissioned. This would affect suppression by limiting ground-vehicle access to wildland fires. Most of the roads proposed for decommissioning would be spur roads, which are not arterial or collector roads that take firefighters into general areas. However, some of these have provided access to wildland fires in the past. Some of these roads could also be used for fire lines or access to fuel treatment projects. Helicopters would be relied on more often to control fires. This could create the need to shift fire-fighting resources for some areas from engines to helicopters.

Under Alternative 4, approximately 25 miles of road would be decommissioned. This would affect suppression the same way as in Alternative 3, but to a lesser degree. This could create the need to shift fire-fighting resources for some areas from engines to helicopters.

There are currently 22 miles of viable fuelbreak outside of defense zones in Alternatives 3 and 4. Alternatives 3 and 4 would be limited to prescribed fire and hand treatments for maintenance of these fuelbreaks. Due to the increased risk to other resources with the use of prescribed fire alone, fuelbreaks that are in close proximity to but outside of community defense zones may be difficult to maintain.

Alternative 6

Alternative 6 is similar to Alternatives 1, 2, and 5 in that it would use wildland urban intermix defense and threat zones and strategically placed area treatments as part of its protection strategy. Alternative 6 would provide a greater degree of protection than the other alternatives due to increased flexibility in its standards and guidelines and the application of them to more acres of the Monument.

Firefighter suppression capabilities would be enhanced the most in this alternative. It would allow the most

flexibility in removal of specific stand components that can modify fire behavior. Mechanically reducing crown cover, raising crown base heights, and modifying tree spacing would create different patch dynamics and stand mosaics across the landscape. Fire susceptibility would be reduced on more acres (see Table IV-6) in the first decade than in any other alternative. The long-term effect would be a more discontinuous landscape of vegetation that would reduce the potential for catastrophic wildfire.

Alternative 6 is similar to Alternative 5 and different from Alternatives 1 and 2 in that restoration is addressed in the overall strategy to reintroduce fire. The same flexibility would be allowed in restoration treatments as in protection treatments, producing the same short-term and long-term effects.

Alternative 6 would return fire to the ecosystem on the most acres in the first decade and therefore move the most acres toward an historic fire return interval. Important effects on stand structure components would include an increased crown base height and the removal of ladder fuels, which would reduce the risks from wildfire to important wildlife elements such as large trees and canopy cover. Through a combination of mechanically-created gaps and the use of prescribed fire, this alternative would move closer to creating a mosaic of vegetation and a variety of fuel complexes by varying structure, age, and type.

The risk of escaped prescribed fire would be low in all alternatives. Since Alternative 6 would treat the most acres with fire (this includes acres treated with only prescribed fire and acres treated mechanically with follow-up fire treatments), it would have the greatest relative risk of escape.

In Alternative 6, existing fuelbreaks would be maintained with mechanical and/or prescribed fire treatments, with minor exceptions for specific wildlife habitat constraints.

Return to top of page.

Giant Sequoia and Mixed Conifer

Assumptions

This discussion of environmental effects reflects the following assumptions:

The large majority of implementation in the first two to three decades would focus on protection strategies for communities and other key values, a priority consistent with the Framework decision and supported by many members of the public, both nationally and locally. In approximately 25 years, all initial protection treatments would be complete.

Protection treatments would focus on areas of high susceptibility to catastrophic fire. Restoration treatments would initially focus on areas that show the greatest departure from a historic fire return interval. These areas commonly show high susceptibility to catastrophic fire.

As the initial treatments for protection are accomplished, emphasis would shift to restoration treatments and then to the re-treatment of areas with prescribed fire to maintain desired fuel conditions and to restore a frequent fire return interval.

Initial treatments in giant sequoia groves would begin gradually and at a modest scale. This gradual approach to treatment of giant sequoia groves reflects the Forest Service's commitment to establishing a foundation of trust and confidence between the public and the Forest Service regarding treatments that are ecologically effective and socially acceptable.

Wildfire would continue to burn portions of the Monument, with the projected annual rate based upon historical data and effective fuel treatments. The projected amounts are generated by landscape computer modeling.

All Alternatives

After an estimated two to three decades, the initial treatments for the protection strategy would be completed. Fire would have been reintroduced to approximately one-third to one-half of the Monument as areas are treated to protect communities and other resource values. During the first three decades, approximately 4,000 acres per year would be treated under Alternatives 1 and 2. Up to approximately 6,000 acres per year would be treated under Alternatives 3 and 4. Up to approximately 8,000 acres per year would be treated under Alternatives 5 and 6. The increases in Alternatives 3 through 6 are attributed to the implementation of the ecological restoration strategy. Each of the alternatives allows for the reintroduction of fire to the ecosystem. However, Alternatives 1 and 2 do not propose a specific strategy to do this in areas outside of the protection strategy areas (urban wildland intermix defense and threat zones and SPLATs), so specific long-term effects are unknown.

Under all alternatives, the following general direct effects would occur. Amounts would differ by alternative and are described below.

Prescribed burning in conifer stands would immediately reduce fuel loadings, density of vegetation, and canopies of overstory trees, depending on fire behavior.

Prescribed burning in chaparral and brush stands would create gaps and subsequent young vegetation.

Mechanical treatments would immediately create openings in the forest canopy, would modify fuel

characteristics, and would reduce the density of trees in the thinned areas. These effects would be very limited in Alternatives 3 and 4 because of the limited areas where mechanical treatments are allowed.

Repeated prescribed burns would create small gaps and holes in the forest canopy, would reduce fuel loadings, and would control the density of trees and other vegetation.

Gaps would be created in the forest by mechanical treatments, but they would be very limited in Alternatives 3 and 4. The size of these gaps would be no larger than two acres and the majority would be less than one acre in size. Prescribed fire would also create gaps, especially in areas where concentrated fuel loading would cause localized torching and hot spots that would burn holes in the forest canopy. These gaps would range in size from less than 1/10-acre to several acres in size. In areas where there is no mechanical pretreatment or thinning in the understory of ground fuels and/or ladder fuels, there would be a greater likelihood that gaps would be created that are larger than the desired size range (majority of gaps being less than ½-acre in size). In areas where gaps are created by mechanical methods, the amount of area in gaps would be within the recommended range to meet desired conditions, as results achieved through mechanical methods are more predictable and controlled. In areas where gaps are created primarily through prescribed fire, the amount of area would be more likely to be outside the recommended range, due to the variability associated with fuel loadings and burning or site conditions that influence fire behavior.

In areas where fire intensity is high, barren soil would be exposed which would provide for the establishment of young conifers and other vegetation (brush, forbs, etc.).

Stand density would be reduced immediately following treatment, and most of the reduction in density would be in the suppressed and intermediate trees that make up the understory. Lesser amounts of co-dominant and dominant trees would be killed or removed by prescribed fire and/or mechanical thinning. Some hardwoods would be killed along with the conifers. The degree of thinning occurring as a result of prescribed fire is less predictable than that resulting from mechanical vegetation treatments. Monitoring data from the Sequoia National Park indicates a 61% reduction in tree density in the mixed conifer-giant sequoia forest after prescribed fire treatment (Keifer, et al, 2000). A similar effect would be expected under the action alternatives, as site conditions are very similar in the Monument.

Fuel loading would be reduced after treatment. Monitoring data from the Sequoia and Kings Canyon Parks indicate that post-burn fuel loading levels in mixed conifer forests is reduced by approximately 70% to 80%, depending on species composition of the mixed conifer forest (Keifer, et al, 2000).

Under all alternatives, the following indirect effects would occur:

Prescribed burning in conifer stands would reduce the risk of catastrophic fire, would produce new patches of vegetation, and would improve health and vigor in residual trees (due to reduced competition for light, soil, moisture, and nutrients). There is an element of uncertainty as to the scope and amount of these effects. Repeated underburnings at regular intervals would reduce the buildup of fuels on the forest floor, as well as the accumulation of heavy understory vegetation that can help to carry ground fires up into the canopy of trees. In addition, frequent fire return intervals would allow for periodic pulses of nutrients to be returned to the soil profile and would help to create conditions for the establishment of young trees. Bare mineral soil would be exposed and openings would be created in the overstory canopy that would allow seedlings to become established. These conditions would favor the establishment of shade-intolerant species such as pines and giant sequoia, which do not survive or grow well under shady conditions. Conditions for shade-intolerant species would be more favorable in openings that are larger than ¼-acre, as there would be greater opportunity for them to grow in open conditions.

Prescribed burning in chaparral and brush would help establish young seral stages of vegetation, would increase the heterogeneity of the stand (including more variety of sizes, ages, and distribution of vegetation), and would reduce risk of catastrophic fire behavior. There would be an increase over time in large trees over 30 inches in diameter, as the prescribed burning and thinning begin to reduce stand densities and open up forest canopies. The use of prescribed fire on frequent return intervals would help to maintain lower stand densities, so surviving larger trees would continue to grow at a more rapid rate than under the current condition of high stand densities.

Mechanical treatments would reduce the risk of catastrophic fire, would improve growing conditions if new vegetation becomes established, and would improve growth rates in residual trees.

Repeated prescribed burning would help continued the introduction of new patches of vegetation, would reduce the risk of stand-replacing wildfires, and would continue the thinning of vegetation.

Potential natural vegetation would be more likely to continue to develop in vegetation types (see Affected Environment, Ecological Units) with more frequent fire return intervals. The establishment of potential natural vegetation would be highly dependent upon fire interacting with other biological and physical site characteristics.

Fire would be returned to the ecosystem at a more frequent interval. This effect would be consistent with the desired condition and is more reflective of pre-1875 conditions.

Patches of new vegetation would become established and there would be more of the shade-intolerant species such as giant sequoias, pines, and hardwoods as prescribed fire or thinning creates gaps in the canopy. Sprouting from the oak stumps (primarily black oak) would lead to new age classes of hardwoods. Gaps that are generally larger than ¼-acre are more likely to promote shade-intolerant species. In the short-term, openings would be re-vegetated from adjacent mature seed-bearing trees. However, over the long term, there would be greater

amounts of shade-intolerant species in gaps that are at least ¼-acre in size, as compared to gaps that are smaller than ¼-acre, due to the reduced competition on shade-intolerant species from adjacent established vegetation. The reintroduction of prescribed fire would begin to shift species composition in favor of shade-intolerant species as openings are created in the canopy of conifer forest types. This effect is confirmed by results from the Sequoia National Park (Sequoia National Park, 2001; Kiefer, et al, 2000). Specifically, giant sequoia regeneration would be expected to increase.

Under all alternatives, the following cumulative effects would occur:

Prescribed burning in chaparral and brush would be likely to reduce damage to vegetation that is in proximity to, and generally upslope of, the treated areas.

Mechanical treatments would reduce the amount of vegetation lost to catastrophic wildfire and would develop stand structures more consistent with the desired conditions, especially a mosaic of ages and size classes. Creating openings in the forest canopy (gaps) by the use of mechanized equipment (heavy machinery and/or chainsaws) would provide more precision in producing the desired stand structure changes. This precision would be possible because of the selective capacity of personnel to carefully identify the fuels that need some sort of treatment or the vegetation that needs to be managed or removed in order to meet protection and/or restoration objectives.

Repeated prescribed burning would continue the development of a mosaic of ages and size classes and would reduce the amount of vegetation lost to catastrophic wildfire.

The number of large trees would increase, leading to an increase in the quality of old forest habitat.

The pulses of new vegetation established from prescribed burning or mechanical thinning would increase the variety of age classes and tree sizes and promote an overall mosaic of vegetation both within stands and across the landscape.

The structure of the giant sequoia groves would shift towards the desired conditions as patches of young vegetation are established that include giant sequoias. Density of trees in the 20 to 150-year-old age class would be reduced, further helping to meet desired conditions.

In the short term (estimated at up to 50 years), hardwood density would increase after prescribed burning and/or thinning due to the opened stands. In the very long term, however, hardwood density might be reduced as the numbers of large trees increase and they begin to shade out the hardwoods, which generally do not grow to the average heights of conifer trees.

There would be a reduction in the amount of land that is burned by wildfire. Currently, approximately 25,000 acres per decade are burned by wildfire on the Sequoia National Forest. This figure is projected to drop to about 12,000 to 15,000 acres per decade, depending on the alternative, as protection strategies are fully implemented.

The capacity of giant sequoia groves to adapt to changing environmental conditions would increase as compared to existing conditions. This would be due to the restoration of conditions (more frequent fire return intervals, new gaps) that would allow young vegetation associated with giant sequoias to become established and develop over time under conditions more similar to those that existed prior to 1875.

Under all alternatives, gaps and associated patches of vegetation would move towards the desired conditions. The plant community indicator would begin to move toward desired conditions, both in the short term and in the long term. The creation of gaps would lead to the establishment of young mixed conifer vegetation. Initial treatments of prescribed burning for protection or restoration purposes would likely lead to a change in composition in both smaller diameter classes and larger diameter classes (Sequoia National Park, 2002; Kiefer, et al, 2001). The number of giant sequoia tripled, from 7% to 21%, ten years after initial burning, as seedlings became established in the understory. The recruitment of young giant sequoias in the first decade would be modest, given that sequoia seedlings typically regenerate naturally within very close proximity (100-200 feet) of cone-bearing trees.

The treatments that are designed to reduce the risk of catastrophic fire to the objects of interest would be completed within the first three decades of implementation. These protection treatments would be located in areas that are currently highly susceptible to catastrophic fire, or are in defense or threat zones around communities and other key resource values. After treatment, these areas would have reduced susceptibility, thereby reducing the risk of damage from catastrophic fire. Giant sequoia groves, in particular, would meet the desired condition for the fire susceptibility indicator, in which less than 25% of grove acres have a risk of high fire severity. Monitoring data from the Sequoia National Park indicates that prescribed fire activities in low to mid-elevation mixed conifer-giant sequoia vegetation led to a 60% to 80% total fuel reduction (measured in tons per acre) (Sequoia National Park, 2002; Kiefer, 2001).

Alternative 1

The effects of this alternative would be very similar to Alternative 2, as the activity-based management direction and standards and guidelines would be the same (see discussion of Alternative 2 below). The management direction under Alternative 3 acknowledges the need to restore fire to fire-dependent species, including giant sequoia, but the overriding purpose is to manage for the allocations set forth in the Framework. Giant sequoia groves would fall under several key allocations: wildland urban intermix defense and threat zones to protect communities, protected activity centers, and old forest emphasis areas. Under this alternative, there would be

no emphasis to restore ecological processes and conditions for the protection and long-term sustainability of giant sequoias or the other vegetation of the Monument. The fire severity indicator would meet the desired condition under Alternative 1 within the first three decades.

Alternative 2

This alternative would treat the Monument consistent with Framework direction, as well as establish desired conditions, management goals, and management areas with direction for giant sequoias and other vegetation. The need to initiate the establishment of young giant sequoia trees through the creation of gaps and openings would not be emphasized in the management direction. Management strategies would be focused on the protection of wildlife habitat for key species that are dependent upon old forest conditions, such as the California spotted owl and furbearers. The strategies are short term (20-30 years) and, although the Framework acknowledges that fire is an important component of ecological restoration, there is no specific proposed strategy to reintroduce fire on a long term and sustainable basis. Giant sequoia groves would fall under several key allocations: wildland urban intermix defense and threat zones to protect communities, protected activity centers, and old forest emphasis areas.

Under Alternative 2, approximately 17,600 acres of urban wildland intermix defense zone would be established for the primary purpose of protecting communities. Within these areas, gap creation and development would be less likely to occur, given that the primary objective would be protection from catastrophic fire, while restoration goals are secondary. These protection areas would represent slightly more than 5% of the monument acreage. Approximately 7,400 acres, or 28%, of the giant sequoia groves are within the wildland urban intermix defense zone, where restoration objectives are secondary to protection objectives.

Under Alternative 2, outside of the giant sequoia groves, the urban wildland intermix defense zone allocations, urban wildland intermix threat zones, and strategically placed fuel treatment areas (SPLATs) would be likely to receive continued maintenance by prescribed burning on an estimated 20 to 30-year re-entry cycle. The potential effect of this alternatives on restoring a more frequent fire return interval to areas outside of the defense zones, threat zones, and SPLATs is unknown, since there is no specific strategy proposed to restore fire in those areas. The fire severity indicator would meet the desired condition under Alternative 2 within the first three decades.

Within the boundaries of the giant sequoia groves, an estimated 6% of the area would be managed as wildland urban intermix defense zones, where openings in the forest canopy from fuel reduction activities would allow for the establishment of young vegetation. However, gaps larger than ¼-acre in size would not likely be created, given the desired fire outcomes. Shade-tolerant species would be favored over the long-term, both within groves and within the general mixed conifer forest, as the shaded canopy of the defense zone would not provide good growing conditions for shade-intolerant pines, giant sequoia, or hardwoods to develop once they become established. The use of underburning as the primary activity to maintain the defense zone would also tend to suppress young vegetation, so achieving the desired conditions of a mosaic of vegetation sizes and ages with gaps and patches would be slow to develop compared to other managed areas under this alternative, as well as compared to other alternatives.

In the wildland urban intermix threat zone allocation that is within giant sequoia groves (approximately 28% of the grove acreage), fuel reduction activities would emphasize the treatment of understory suppressed and intermediate trees and the retention of overstory CO-dominant and dominant trees. The giant sequoia groves are classified as California Wildlife Habitat Relationship classes 5M, 5D, 4M, and 4D, which means that they have canopy cover greater than 40%. In these classes, crown canopy reduction would be limited to no more than 10% through mechanical treatment. According to grove inventories, approximately 10% of most groves have existing gaps with little or no crown cover, so creating gaps and patches of new vegetation within these areas through either mechanical treatments or prescribed fire would be consistent with management direction (noting that canopy reductions are relatively unconstrained when created by prescribed fire and these reductions do not create unacceptable impacts to other values such as wildlife habitat). Emphasizing the establishment of new vegetation in approximately 10% of the existing gaps would be consistent with the desired condition for both gap size and frequency.

Approximately 45% of the groves are classified as having crown closures greater than 60%. These conditions would also allow for canopy reductions that would lead to the establishment of patches of new vegetation. Overall, there would be an opportunity to open up canopies through both mechanical thinning and prescribed underburning sufficient to encourage the establishment of young vegetation. Although in some areas the standards and guidelines limit the size of trees removed by mechanical methods to 12 inches in diameter, removing trees up to this size, in conjunction with additional canopy reductions from subsequent prescribed burning, would create gaps and reduced canopies sufficient to establish new vegetation. Gaps up to one acre in size and irregular in shape would be created for the purpose of introducing structural heterogeneity into stands with uniform tree sizes. This effect would be consistent with the desired condition for gap size and frequency. Given that the threat zones have high fuel loadings, the use of prescribed fire in these areas would likely create gaps in the canopy due to localized high-intensity fires and torching into the canopy. Mechanical treatments in strategically placed fuel treatment areas would also allow for the removal of trees up to 20 inches in diameter to meet fuels objectives. The initial treatments of mechanical thinning and/or prescribed burning would be most likely to create gaps, given the high fuel loadings and high tree densities.

The standards and guidelines would provide the opportunity to create gaps and these gaps would lead to the development of new patches of vegetation. Grove inventory data indicates that the majority of the sampled groves have existing gaps in the canopy that provide opportunities for patches of new vegetation through mechanical methods or prescribed fire, with less than a five percent reduction in canopy closure. Constraints on

vegetation removal for protected activity centers or for den sites would limit the opportunity to create gaps with mechanical methods or with prescribed burning. These constraints would be applied on approximately 20% of the grove acreage, which means that there is an estimated 80% where the opportunity exists to create gaps. In the wildland urban intermix threat zone; mechanical treatments could be designed to create openings to promote a mosaic of tree sizes and species. In the short term, the opportunity to create gaps mechanically would have a very minor effect on canopy cover. In addition, the use of prescribed fire would be likely to lead to additional gaps and patches of young vegetation.

In the longer term, the opportunity to create additional gaps and patches of new vegetation would be more limited after initial treatments are completed. The long term effects would be that continued new patches of vegetation might not occur on a frequent enough basis to develop the desired condition of a mosaic of age classes and sizes. Initial entries would emphasize the conversion of existing gaps to new patches of vegetation. The mechanical thinning or prescribed underburning of residual stands would also encourage new patches of vegetation, given that these burns would be more intense than subsequent burns due to the high initial fuel loadings. Subsequent entries would be less likely to create additional gaps, as fire intensities would be reduced, leading to less probability of localized torching and high fire intensities.

Alternative 3

This alternative would treat the majority of the giant sequoia groves and other mixed conifer or hardwood vegetation with a prescribed burning approach, using hand treatments (chainsaws) to help create acceptable burning conditions. The brush and chaparral vegetation would be treated with a combination of mechanical treatments (e.g., brush piling or shredding) and prescribed burning (in a mosaic pattern). The program emphasis would be to give priority to protection treatments near communities and high profile groves, and then shift the priority over time to restoration treatments. There would be an estimated 3,600 acres of protection, where stand conditions would be modified to meet fuels reduction objectives. In these areas, creating ecological conditions to meet restoration objectives would be secondary to meeting protection objectives. The potential use of chainsaws would be generally limited to areas within ¼-mile of roads or on slopes less than 35%, and would be focused on constructing fire lines and protecting resources of high value such as monarch giant sequoias, wildlife habitat, and communities. Hand cutting of extensive amounts of understory vegetation is not anticipated, so the large majority of the Monument would be treated using a prescribed burn with a four-foot flame length as a key desired outcome. Subsequent treatments would be based upon regular intervals of prescribed fire. The variability of fuel loading conditions and burning conditions (fuel moisture, localized climate, arrangement of fuel, slope, etc.) would lead to a variable burn pattern, and it is not expected that a prescribed burn would affect every acre. The effect would be to move towards the desired condition of a mosaic of vegetation age classes and sizes, as well as a regular fire return interval.

Alternative 3 is one of two alternatives (in addition to Alternative 4) more likely after initial treatments to create gap and patch sizes that are outside the range of recommended management variability. This is because, with the exception of very narrow (200') protection areas around communities, treatments would be done primarily by prescribed fire. The existing high fuel loadings in much of the Monument would lead to flare-ups and torching of the overstory canopy. Field observations of recent prescribed burns in the Monument and in the adjacent national parks indicate that openings larger than two acres would be infrequent but are to be expected. In the short term, the almost exclusive use of prescribed fire in these two alternatives would be expected to create gaps and patches that are more than 10% of the area within the groves, as well as in other mixed conifer forest. This would be due to the generally high fuel loadings and the possibility of locally intense fire behavior where fuels are concentrated. In the first decade, an estimated 35,000 acres would be treated with prescribed fire that is intended to be intense enough to create gaps and associated new vegetation in the mixed conifer forest.

In the short term under Alternative 3, approximately one-third to one-half of the acreage of the Monument would have fire re-introduced as part of initial treatments under the protection strategy or the restoration strategy within the first three decades of implementation. It is anticipated that a return interval of 30 to 40 years would be established, which is substantially closer to conditions prior to 1875. Most of the Monument has had no fire for nearly 100 years. Over the long term, treated areas would continue to receive treatments to move stand conditions and processes toward desired future conditions. Prescribed burns would be used again in the same areas to maintain desired conditions after they are initially met. Under Alternative 3, the fire severity indicator would meet the desired condition at a slower pace than in Alternatives 1, 2, 5, and 6. This pace would be dependent upon the location of restoration treatment areas, since the only focused protection strategy is within a 200-foot defense zone.

Alternative 3 (and Alternative 4) would have the greatest short-term and long-term effects on stand density as compared to Alternatives 1, 2, 5, and 6. Alternative 3 would also lead to the creation of gaps and subsequent young vegetation as prescribed fire activities are accomplished, leading to trends toward the desired conditions. However, it is anticipated that average gap size and frequency might be outside the recommended management variability of the desired condition. Prescribed fire, in addition to consuming ground fuels, would also burn small trees and other ladder fuels, leading to occasional torching and flare-ups into the canopy of overstory trees. The prescribed fire and associated flare-ups would kill vegetation and provide better growing conditions for the surviving vegetation in the form of increased availability of sunlight, moisture, and nutrients. This kind of fire behavior (understory burning with flare-ups and torching) would be most likely in areas of high fuel loading that are highly susceptible to damage from catastrophic fire. Since the majority of the mixed conifer stands and the giant sequoia groves have very high fuel loadings, the anticipated fire behavior would create gaps that are outside the recommended management variability in both size and frequency. The fires would also likely thin out large amounts of trees in the understory and occasionally some in the overstory.

A long-term effect of reduced tree density from fire (both from initial treatments and follow-up burning) would

be the increased opportunity for larger trees that escape damage to grow more rapidly than they would under more dense stand conditions. Over time, there would be larger trees than under Alternatives 1, 2, 5, and 6 because of the greater and more sustained thinning effects from the prescribed fire. Based on monitoring of prescribed fire activities in the Sequoia National Park, Kiefer (2000) states that the reduced tree density falls within the range that may have been present prior to Euro-American settlement, based on forest structural targets developed with input from research, historic photos, and written accounts…" High fuel loadings combined with the very limited opportunity to pre-treat fuels with chainsaws or other mechanical methods would lead to the creation of some gap sizes and frequencies that are outside the recommended management variability of the desired condition. This would seem likely, based upon field observation of past prescribed fire projects within the Monument, as well as observations of prescribed fire results in the Sequoia National Park. This effect would be less likely within the protection areas (1% of the Monument), where the manipulation of fuel conditions by mechanical methods would be allowed, than in the rest of the Monument, where prescribed burning would be the primary treatment.

Species composition would begin to shift over time as gaps are created and vegetation becomes established. In gaps or holes created in the forest canopy, seedlings would become established in a mix similar to that of the surrounding seed-bearing trees. In openings in close proximity to seed-bearing giant sequoias, giant sequoia seedlings would become established, along with other naturally occurring species (Demetry and Duriscoe, 1996). Although seedlings would become established in openings in the forest canopy, long-term survival and growth of shade-intolerant species (giant sequoia, ponderosa pine, sugar pine, black oak) would be more reliable in openings that are larger than ¼-acre, due to the more open conditions close to the middle of openings (away from the edge effect of the adjacent larger trees). These effects are common to the other alternatives.

Areas of concentrated human use might be removed from within giant sequoia groves if, based on landscape analysis, they are creating unacceptable impacts to the objects of interest and these impacts cannot be mitigated. If removed, these facilities would most likely be relocated in nearby mixed conifer forest. There are an estimated 25 acres of developed recreation sites and facilities authorized under special use permit that are located in different groves. The primary short-term effect of removing these facilities would be reduced compaction associated with permanently surfaced or heavily compacted areas. The long-term effects would be that, in these localized areas, growing conditions and the overall health of giant sequoias and associated mixed conifer vegetation would improve due to better soil health conditions (increased soil aeration, nutrient cycling, water-holding capacity). In addition, areas where compacted surfaces are removed (paved areas and other areas of concentrated use), young vegetation would have the opportunity to become established, helping the groves to move towards the desired condition of a mosaic of age classes and tree sizes. The campgrounds that might be moved out of the perimeter of the groves would be relocated, most likely to adjacent mixed conifer forest areas. These areas would incur localized negative impacts to stand structure, as vegetation would be permanently removed to allow for the development of access roads and structures. There would be an increase in paved areas and compacted soils. There would be a reduction in overall vegetation as areas are committed to permanent structures. The total area impacted within the groves and within the mixed conifer forests is estimated at 20 acres.

Based on the Roads Analysis Process (Appendix D), an estimated 140 miles of road would be decommissioned. There would be minimal short or long-term effects, as they were identified in the Roads Analysis Process analysis to not be of high value for access to meet ecological restoration and protection goals. The specific scope and extent of these actions will not be known until landscape-level analyses are completed and roads are proposed for decommissioning based on site-specific information.

Alternative 4

The effects of Alternative 4 would be very similar to those of Alternative 3, as the general treatment strategy of the vegetation is the same. Prescribed burning would be emphasized as the primary management tool. Approximately 6,000 acres per year would be burned. A difference between Alternatives 3 and 4 is that most of the current road system would remain in place in Alternative 4. This would provide good access for implementation of protection projects and ecological restoration projects, both for initial treatments in the short term and maintenance treatments in the long term.

Alternative 4 is one of two alternatives (in addition to Alternative 3) that would be the least likely to create gap and patch sizes through initial treatments that are within the recommended management variability ranges. This is because, with the exception of very narrow (200') protection areas around communities, treatments would be done primarily by prescribed fire. The existing high fuel loadings in much of the Monument would lead to flare-ups and torching of the overstory canopy. Field observations of recent prescribed burns on the Monument indicate that openings larger than 2 acres are infrequent but are to be expected. In the short term, the almost exclusive use of prescribed fire in these two alternatives would be expected to create gaps and patches that are more than 10% of the area within the groves, as well as in other mixed conifer forest. This would be due to the generally high fuel loadings and the possibility of locally intense fire behavior where fuels are concentrated. In the first decade, an estimated 35,000 acres would be treated with prescribed fire that is intended to be intense enough to create gaps and associated new vegetation in the mixed conifer forest.

Alternative 4 would be more likely to create gaps and patches that are outside the range of recommended management variability. In the short term, the almost exclusive use of prescribed fire in these two alternatives would be expected to create gaps and patches that are more than 10% of the area within the groves, as well as in other mixed conifer forest. This would be due to the generally high fuel loadings and the possibility of locally intense fire behavior where fuels are concentrated.

In the short term under Alternative 4, approximately one-third to one-half of the acreage of the Monument would

have fire reintroduced as part of initial treatments under the protection strategy or the restoration strategy. It is anticipated that a return interval of 30 to 40 years would be established, which is substantially closer to conditions prior to 1875. Most of the Monument has had no fire for nearly 100 years. Over the long term, treated areas would continue to receive treatments to move stand conditions and processes toward desired future conditions. Prescribed burns would be used again in the same areas to maintain desired conditions after they are initially met. Under Alternative 4, the fire severity indicator would meet the desired condition at a slower pace than in Alternatives 1, 2, 5, and 6. This pace would be dependent upon the location of restoration treatment areas, since the only focused protection strategy is within the human influence zone.

Alternative 5

The effects of Alternative 5 are similar to those of Alternative 2. This is because the same management direction would apply to the all of the Monument except the giant sequoia groves (approximately 27,000 acres). In the groves, effects would be similar to those of Alternative 6, as the same standards and guidelines would apply there. This mixture of treatment methods and flexible standards and guidelines in the groves is responsive to and acknowledges the fact that site conditions and resource objectives would vary (see discussion for effects of Alternative 6). Restoration of stand structure, particularly creation of gaps and patches of new vegetation in giant sequoia groves, would be emphasized in Management Area GSG1, where there has been no major disturbance for over 100 years. New patches of vegetation would be initiated primarily in gaps that currently exist in the groves. Other gaps and patches would be established where prescribed fire creates additional holes in the canopy. Additional fire-caused gaps would be most likely created in the forest matrix between the gaps on slopes over 35%, where substantial mechanical thinning would not be expected due to slope limitations. Approximately 60% of the acreage in the groves is on slopes less than 35%. In these areas, mechanical methods would provide for greater precision and predictability as new patches of vegetation are initiated in already-existing gaps. The areas between these gaps would be mechanically treated to reduce tree densities and improve burning conditions. The availability of mechanical treatment on 60% of the acreage in the giant sequoia groves would help ensure that the size and frequency of gaps are created which are consistent with the desired condition.

Approximately 40% of the giant sequoia grove acreage is on slopes greater than 35%, where prescribed burning would be the primary treatment. There would be greater likelihood of creating gaps that are outside the desired conditions, as heavy fuel loadings might lead to occasional pockets of mortality. Although gap creation and establishment of vegetation might not be within the recommended management variability, the removal of substantial amounts of understory trees and reduced stand densities would move the stands toward desired conditions. These results would be consistent with outcomes documented by the National Park Service, where stand densities were reduced by 61% in the mixed conifer-giant sequoia forest five years after prescribed burning. On slopes less than 35%, where mechanical methods would be available to create gaps and thin the forest matrix between the gaps, gap creation and patch development would be much more predictable.

Under Alternative 5, approximately 17,600 acres of urban wildland intermix defense zone would be established for the primary purpose of protecting communities. Within these areas, gap creation and development would be less likely to occur, given that the primary objective would be protection from catastrophic fire, while restoration goals are secondary. These protection areas would represent slightly more than 5% of the monument acreage. The fire severity indicator would meet the desired condition under Alternative 5 within the first three decades.

Under Alternative 5, meeting the gap and patch frequency indicators would be more likely than in Alternatives 3 and 4, as this alternative would provide for the use of mechanical methods such as thinning to help pre-treat areas prior to prescribed burning. Gaps would be created that would be more likely to be within the recommended management variability as described in the affected environment and desired condition. This is because the standards and guidelines and use of mechanical methods would provide more control of fuel arrangements in giant sequoia groves, thereby helping to ensure that created gaps would be the desired sizes consistent with the recommended management variability (typically less than one acre in size). In these gaps and in areas where canopy cover allows for adequate light, there would be an increase in other shade-in tolerant species over time, particularly in gaps larger than ¼-acre, where the growth of the vegetation established in the middle of the openings would be less likely to be suppressed by adjacent larger trees. In the first decade, an estimated 575 acres would be treated in giant sequoia groves with a combination of methods (mechanical thinning, prescribed fire) to create gaps and patches of new vegetation.

In the short term (within 30 to 40 years), within the giant sequoia groves under Alternative 5 (Management Areas GSG1, GSG2, and GSG3), approximately one-third to one-half of the acreage of the Monument would have fire reintroduced as part of initial treatments under the protection strategy or the restoration strategy. It is anticipated that a return interval of 30 to 40 years would be established, which is substantially closer to conditions prior to 1875. Most of the Monument has had no fire for nearly 100 years. Over the long term, treated areas would continue to receive treatments to move stand conditions and processes toward desired future conditions. Prescribed burns would be used again in the same areas to maintain desired conditions after they are initially met. Outside of the giant sequoia groves, the urban wildland intermix defense zone allocations, urban wildland intermix threat zones, and strategically placed fuel treatment areas (SPLATs) would be likely to receive continued maintenance by prescribed burning.

In the short term, groves in Management Area GSG1 would have relatively more gaps and patches of new vegetation than other groves because the management direction emphasizes practices to restore forest structure, including an increased mosaic of age classes and tree sizes. Activities in groves that are within Management Areas GSG2 and GSG3 would focus on reducing the risk of catastrophic fire in the short term. However, as the groves meet desired conditions for reduced susceptibility from catastrophic fire, emphasis would shift to creating new gaps in these stands as well. Over the long term, groves in all management areas would move toward the desired

condition as gaps are created by mechanical methods or by prescribed fire, new patches of vegetation are established in these gaps, and the groves are at a reduced risk of catastrophic fire.

Alternative 6

In Alternative 6, the overall landscape would be managed with standards and guidelines that provide the most flexibility to local decision-makers by tailoring project proposals to site-specific conditions with the landscape analysis process. Approximately 8,000 acres a year would be treated through a variety of methods, including mechanical methods and prescribed burning. This mixture of treatment methods and flexible standards and guidelines is most responsive to and acknowledges the fact that site conditions and resource objectives will vary. Advisory III from the Scientific Advisory Board states, "Fire often is a useful tool for restoring giant sequoia groves and other fire-adapted ecosystems (Hardy and Amo, 1996; Stephenson, 1996, 1999). However, issues such as human safety, air quality, water quality, endangered species, cumulative impacts with other management actions, current and desired forest structure, and current fuel loads mean that fire alone cannot always be used to achieve desired forest conditions, (Weatherspoon, 1996; Fule, et al, 1997; Piirto and Rogers, 1999). In areas where fire alone cannot be used to achieve desired conditions, mechanical thinning often proves to be a useful alternative (Weatherspoon, 1996)." This alternative proposes to treat approximately 5% of the grove acreage annually. It is assumed that prescribed burning is imprecise, leaving certain areas unburned and burning with varying intensities in other areas, so effects would vary within specific burn locations. Management direction for giant sequoia groves in Management Area GSG1 would encourage the establishment of young cohorts of mixed conifer vegetation, especially in areas of groves where there is currently little or no vegetation. During the first two to three decades of implementation, short-term effects would include the creation of gaps and patches of new vegetation in Management Area GSG1, with the emphasis on establishing this new vegetation where gaps already exist in the canopy. Gaps would also be created in Management Areas GSG2 and GSG3 (also giant sequoia groves), but these would be a result of activities that are primarily for protection purposes. Since the majority of the conifer vegetation is on slopes less than 35%, the use of mechanical treatment followed by prescribed fire would help ensure that gap creation and subsequent patches of new vegetation would be more consistent with desired conditions. This is because prescribed fire behavior would be less likely to create unexpected torching and localized high-intensity burns that may create gaps that are larger or more frequent than desired conditions. The opportunity to more precisely meet protection and restoration objectives is greater than with the use of prescribed fire as the primary treatment method (as is the case with Alternatives 3 and 4). These effects would be similar for the conifer vegetation that is outside of the groves.

In Alternative 6, the gaps created would be more likely to be within the recommended management variability than in any other alternative. This is because the standards and guidelines and use of mechanical methods would apply to most of the Monument, and would provide more control of fuel arrangements in giant sequoia groves. This would help ensure that created gaps would be the desired sizes (typically less than one acre in size). In these gaps and in areas where canopy cover would allow for adequate light, there would be an increase in other shade-intolerant species over time. This would occur particularly in gaps larger than ¼-acre, where the growth of vegetation established in the middle of the openings would be less likely to be suppressed by adjacent larger trees. In addition, the standards and guidelines would allow the greatest flexibility and most effective combination of treatments on the most acres. This would help meet forest structural restoration goals. In the first decade, an estimated 1,800 acres would be treated in giant sequoia groves through a combination of methods (mechanical thinning, prescribed fire) to create gaps and patches of new vegetation

Under Alternative 6, approximately 17,600 acres of urban wildland intermix defense zone would be established for the primary purpose of protecting communities. Within these areas, gap creation and development would be less likely to occur, given that the primary objective would be protection from catastrophic fire, while restoration goals are secondary. These protection areas would represent slightly more than 5% of the monument acreage. The fire severity indicator would meet the desired condition under Alternative 6 within the first three decades.

The majority of the grove acres would be treated within 20 to 30 years. This would lead to a reduction in fire susceptibility for all of the groves. Stand density would be reduced by thinning areas between the created gaps, improving stand and tree health due to improved growing conditions. Over the long term, the numbers of large trees (more than 30 inches in diameter) would be slightly less than Alternatives 3 and 4. This effect is more consistent with the desired condition, where an estimated 10 to 20% of giant sequoia groves is recommended to be in trees over 150 years in age. This effect would be due to the more selective and more controlled nature of the thinning that is done on slopes less than 35% using mechanical methods. Amounts of vegetation will increase over the short term and long term, as mechanical or prescribed fire treatments would develop gaps and patches of new vegetation. There would also be a shift towards the desired condition for vegetation that is from 10 to 150 years old, as new patches of vegetation continue to mature and the reduction in density in the existing age classes improve growth rates and vigor of the residual trees.

Most of the vegetation in the rest of the Monument (outside of the groves) would also be treated for either protection or restoration objectives within 20 to 30 years. The effects on gap creation, patches of new vegetation, re-introduction of fire into the ecosystem, and reduction of fire susceptibility would be similar to those described within the giant sequoia groves. Species composition would begin to shift toward desired conditions as, in the short term, new patches of vegetation would be established that include shade-intolerant species, especially giant sequoia. Over the long term, the amounts of these species would increase over existing levels.

Return to top of page.

Range

All Alternatives

All alternatives, except Alternative 3, would apply Framework guidelines. Changes made under the Framework would be implemented over the next several years. Some Framework decisions are to be implemented within a short timeframe, such as limited operating seasons for the willow flycatcher, while other decisions, such as meeting age class and range of natural diversity in riparian vegetation, will require additional analysis and project level environmental analysis. Cumulatively, these changes would be expected to result in grazing reductions of 20-30% from grazing levels prior to the Framework. These reductions in grazing might be offset to a small amount by additional feed made available through additional burning and fuels treatment. Most fuels treatments would be focused around communities, where grazing is already minimized to avoid conflicts. No additional reductions would be anticipated due to the status of the Monument, except as noted under Alternative 3.

Alternative 3

Alternative 3 would eliminate grazing in high profile sequoia groves. This would directly affect three grazing permits, to the extent that the permits would be eliminated or may not be economically viable. Two other permits would be affected to a lesser extent. Grazing use would be reduced by approximately 1,135 animals and 5,300 animal units per month (AUMs), or approximately 10% of the current grazing program within the Sequoia National Forest.

Loss of substantial forage resources would be difficult to replace. Many small ranches have been subdivided when grazing is no longer able to support the base ranch. Resultant subdivision reduces the ability of the local community to absorb reductions in federal grazing permits, as well as increased encroachment and disturbance to wildlife habitat in the foothill belt surrounding the national forest. The lower Westside hardwood belt is an area of concern identified in the Framework due to the increased impacts and development adjacent to national forests. It is likely that reductions in federal grazing permits would contribute to that off-forest impact over time.

The grazing program on the Sequoia National Forest has declined from approximately 68,000 AUMs in the early 1980s to approximately 55,000 AUMs currently. Loss of jobs and economic return is small compared to the overall economy of the counties but can be locally significant in small rural settings. Rate of loss of lower Westside hardwood ecotypes is documented in the Framework.

Return to top of page.

Rare Plants

All Alternatives

Under all alternatives, species at risk would be protected. The Forest Service is mandated to maintain the viability of such species. Effects on species listed under the protection of the Endangered Species Act, both adverse and beneficial, are regulated by the USDI Fish and Wildlife Service. As such, effects on these species would range from minimal to no effect. Most of the discussion of potential effects to plant species at risk in this document is directed toward effects on future habitat potential rather than direct effects on existing populations. Effects are addressed only where proposed management actions would result in an outcome that may **

The Framework documented a detailed effort to aggregate plants for the purpose of addressing risk by vulnerability of both habitat (ecological guilds) and the species itself. Because there are fewer plants to address in this smaller portion of the Framework planning area, the ecological guilds were reduced to aquatic/riparian and terrestrial species. Threats and proposed actions under this planning effort would be similar to and within the range of activities proposed under that planning effort. Background on the risk ratings is provided in greater detail in the Biological Resources working documents for this document and Volume Three of the Framework.

Most terrestrial plant species at risk within the Monument are at risk due to limited distribution and low population levels rather than proposed management. Most of the terrestrial species occupy rock outcrops, cliffs, or unique habitats related to poor soils (edaphic guilds) with little competing vegetation. Treatments designed to reduce fuels are unlikely to target these areas for fuels reduction. Some species might be adversely affected by avoiding management treatments that maintain openings within the forest, since they depend on these natural gaps created by fire, disease, and other factors.

Riparian guilds are divided into meadow species and meadow edge/riparian/streambank species. Species in the meadow, bog, and fen guild are unlikely to be affected by changes in management proposed in this plan. Provisions for protection of these species are provided in the Framework riparian conservation strategy that is carried through the Monument alternatives.

Riparian/meadow edge/streambank species would be most likely to suffer under alternatives that strongly constrain opportunities for gap creation within riparian conservation areas (streamside management zones). The Framework set guidelines to address areas where grazing may eliminate younger age classes within riparian forests, but did not address the need for gaps and openings to sustain riparian forest other than through

landscape analysis. This places an emphasis on the need for landscape analysis to address and evaluate the condition of riparian forests

All alternatives would provide benefits due to the reduced potential for stand-replacing wildfires and the creation of small openings or more open forests that can support an herbaceous understory.

Alternatives 1, 2, and 5

Species in the temporally defined guilds that benefit from general openings would be likely to benefit under these alternatives. However, benefits would be offset by the strong preference for creating openings adjacent to communities, where increased disturbance may offset gains in potential habitat.

Alternatives 3 and 4

These alternatives would have the greatest effect on canopy reduction in the short term. The expectation of more intense prescribed burns in the absence of mechanical pretreatment of fuels would be a large benefit for gap species such as *Clarkia springvillensis*, *Calochortus westonii*, *Monardella linoides*, and possibly *Oreonana purpurascens*, *hulsea brevifolia*, and *Railardiopsis muirii*. Gaps would likely be a little larger, but still fine-grained disturbances within the forest. The larger openings and greater reduction in canopy closure would be likely to favor the above; however, the benefit would be offset slightly by a greater chance of escaped fires, with larger openings and higher intensity.

Alternative 3 reduces or eliminates grazing in high profile groves. None of the identified species at risk are known to inhabit the areas around the high profile groves; however, unknown populations and/or potential habitat for *Meesia uliginosa*, *M. triquetra*, *Hydrotheria venosa,* and *Bruchia bolanderi* might benefit from reduced trampling in meadows, fens, and stream banks.

Alternatives 5 and 6

The establishment of gaps in canopy closure and general openings would be more conservative than under Alternatives 3 and 4. Created openings and thinning would benefit gap phase species such as *Calochortus westonii* and *Clarkia springvillensis,* but not as much as the more aggressive burning program. Both species appear to benefit from disturbance, including mechanical treatments, although under current guidelines occupied habitat of either species would not be treated mechanically intentionally. *Calochortus* appears to colonize old skid roads and roadbeds, and *Clarkia springvillensis* populates road cut banks and other areas of mechanical disturbance. Most of the gaps or openings would be limited to lower gradient slopes available for mechanical treatments and adjacent to communities where greater human disturbance may offset habitat improvement for species at risk. Use of mechanical treatment gives greater control to avoid known populations but increases the potential for compaction of soil in potential habitat.

Riparian species that use gaps might lose habitat since mechanical equipment would be excluded from the riparian conservation areas and fire is likely to be more limited and less intense under these alternatives.

Return to top of page.

Watershed

All Alternatives

All alternatives would embrace the aquatic management strategy and the ecosystem management strategy of the Framework.

Aquatic Management Strategy (AMS). "The fundamental principle of the AMS is to retain, restore, and protect the processes and landforms that provide habitat for aquatic and riparian-dependent organisms, and produce and deliver high-quality waters for which the national forests were established (USDA Forest Service, Pacific Southwest Region, 2001, Record of Decision, Appendix A, page A-5)." The AMS includes the designation of riparian conservation areas (RCAs) along streams and around water bodies and critical aquatic refuges (CARs). RCAs focus on preserving, enhancing, and restoring habitat for riparian and aquatic-dependent species, ensuring that water quality is maintained or restored, enhancing habitat conservation for species associated with the transition zone between upslope and riparian areas, and providing greater connectivity within watersheds.

The AMS has four components, three of which are applicable to the Monument. The following summary of the AMS is incorporated into this statement by reference. The fourth strategy is direction for the Lassen National Forest pertaining to anadromous fish.

AMS goals focus on "end points" which provide a broad framework for establishing desired future conditions for ecosystem analysis at other scales. These goals are consistent with existing mandates such as the National Forest Management Act, the Endangered Species Act, the Organic Act, the Clean Water Act, etc. These acts and mandates include direction on Best Management Practice BMP implementation and monitoring for reduction of non-point source pollution, soil and water quality standards, plant and animal diversity, special habitats, and other specific goals documented in the Framework.

CAR 's have been designated in small sub -watersheds that contain known locations of threatened, endangered, or sensitive species; highly vulnerable populations of native plant or animal species; or localized populations of rare native aquatic or riparian-dependent plant or animal species. CAR 's provide habitat for native fish, amphibian , and aquatic invertebrate populations. Streams in meadows, lower elevation grasslands, and hardwood ecosystems have vegetation and channel bank conditions that approach historic potential (see the Framework for a discussion of historic potential).

There are two CA R's in the Monument. The southeastern edge of the Little Kern River CAR on the Tule River Ranger District , just overlaps the Monument boundary. Discussion of this area has been discussed as part of the Kern River Basis in section discussion in the Affected Environment. The other CAR is located in the Mill Flat Creek Drainage on the Hume Lake Ranger District in the Mill Flat Creek Drainage. This area has been discussed in the Upper Kings River Basin section of the Affected Environment.

The designation of RCAs follows those guidelines provided in the Framework. Modeling of all treatments and effects follow the direction in the standards and guidelines for RCAs in Appendix A of the Framework Record of Decision (ROD). RCAs are land allocations that are managed to maintain or restore the structure and function of streams and wetlands.

Widths are as follows:

Stream Type	Width of Conservation Area
Perennial Stream	300 feet on each side
Seasonally Flowing Streams	150 feet on each side
Meadows or Streams with Special Features	300 feet on each side
Other Topographic Depressions	Determined at the project level

The designation of RCAs follows those guidelines provided in the Framework. Modeling of all treatments and effects follow the direction in the standards and guidelines in Appendix A of the Framework Record of Decision (ROD) Development of Riparian Conservation Areas (RCAs) and Critical Aquatic Refuges (Cars). RCAs are land allocations that are managed to maintain or restore the structure and function of streams and wetlands; widths are as follows

The location and size of Cars and RCAs in the Monument will would remain as defined in the Sierra Nevada Forest Plan Amendment until such time that a landscape analysis provides the Forest with additional information in keeping with the Ecosystem Analysis Strategy direction contained in the Sierra Nevada Forest Plan Amendment.

There are six Riparian Conservation Objectifies (RCO 's) . All have associated Standards and Guidelines, that are discussed and may be found in Appendix A of Framework ROD. The Record of Decision for the Sierra Nevada Plan Amendment).

RCO #1. Ensure that identified beneficial uses are adequately protected and state water quality goals are implemented.

Roads, trails, etc. do not result in soil compaction to 5% in RCAs or 10% in Cars

Avoid pesticide application within 500 feet of known sites for special amphibians.

Implementation and monitoring of BMPs.

Managing toward Total Minimum Daily Load requirements for water quality limited stream segments.

Identify existing and potential sources of sediment and reduction in non-point source pollution.

Prohibit storage of fuels and toxics except at designated administrative sites.

RCO #2. Maintain or restore geomorphic and biological characteristics of special aquatic features to provide for aquatic dependent species.

Identify roads and trails that disrupt natural surface and subsurface water flow paths.

Where possible restore timing, flow, and water table in riparian areas.

Prevent resource damage to stream banks from exceeding 20% of stream reach or lake.

In stream reaches identified as essential habitat for Little Kern golden trout, Piute cutthroat trout, and Lahontan cutthroat trout, limit stream bank disturbance from livestock to 10% of the occupied stream reach.

Ensure culverts and stream crossings do not create migration barriers>.

Locate drafting sites to avoid adverse effects.

Evaluate Range of Variability using Stream Condition Inventory attributes for activities that could affect streams.

During Federal Energy Regulatory Commission re-licensing, evaluate modifications of the project's natural hydrograph and effects on all life stages of native aquatic species.

Maintain riparian resources, channel integrity, and fish passage.

RCO #3. Ensure a renewable supply of large down logs, applicable in both streams and plantations.

RCO #4. Ensure that management activities, including fuels treatments, within RCAs and Cars enhance or maintain physical and biological characteristics associated with aquatic and riparian dependent species.

Avoid direct lighting in riparian areas and minimize the spread of fire into riparian vegetation.

Use screening devices for water drafting pumps, fire suppression exempt; use low velocity pumps.

When possible locate fire suppression facilities (camps, etc.) outside of RCAs or Cars

For mining, require solid waste facilities to be located outside riparian conservation areas.

Allow activities within RCAs and Cars when consistent with RCOs.

Prior to implementing ground disturbing activities within suitable habitat for the California red-legged frog, the foothill yellow-legged frog, and the mountain yellow-legged frog , assess conditions using Stream Condition Inventory protocols and develop mitigation measures.

Assess existing uses during landscape analysis and identify conditions that degrade water quality or habitat for aquatic and riparian species.

RCO #5. Preserve, restore, and enhance special aquatic features (meadows, springs, bogs, etc.) to provide the ecological conditions and processes for the species that use them.

Ensure hydrologic function of meadows and riparian areas are at a minimum at Proper Functioning Condition for range management analysis.

Prior to re-issuing grazing permits, assess the capability of livestock management facilities located in riparian conservation areas with RCOs.

Changes in allowable use: Early Seral Stage equals 30 % utilization. Late Seral Stage equals 40 % utilization.

Degraded meadows (e.g., >10% bare soil and active erosion) require total rest from grazing until they have recovered and moved to mid to late seral status.

Grazing standards may be modified to assess the effects of grazing on willow flycatcher. Must be part of a study developed in cooperation with Pacific Southwest Experiment Station.

Limit browsing to no more than 20% of the annual leader growth of mature riparian shrubs and no more than 20 percent of individual seedlings.

Remove livestock from any area of an allotment when browsing indicates a change in preference from herbaceous to woody riparian vegetation.

RCO #6. Identify and implement restoration for water quality, riparian and aquatic species. Recommend and establish priorities for watershed restoration.

Ecosystem Analysis. The ecosystem analysis strategy as stated in the Framework, "Establishes a consistent, landscape-wide approach and context for maintaining or restoring ecological conditions that provide the desired levels of resources, such as clean water, clean air, plant and animal community diversity, and species viability, consistent with regulatory requirements and ongoing policies (USDA Forest Service, Pacific Southwest Region, 2001, Appendix T, page T-1)."

The ecosystem analysis strategy provides opportunities to perform assessments that are tailored to local conditions, capabilities, and restoration needs. The information assembled during landscape analysis would provide the basis for the identification of opportunities at the project scale to move the landscape towards desired condition. Ecosystem analysis is a prerequisite for determining which processes and parts of the landscape would most affect fish and riparian habitat, and would be essential for defining watershed-specific boundaries for RCAs, Cars, and riparian management objectives. Ecosystem analysis would form the basis for evaluating cumulative watershed effects, defining watershed restoration needs, goals, and objectives; implementing restoration strategies; and monitoring the effectiveness of watershed protection measures. Site-specific analysis would be done at the landscape level to address resource needs and potential effects of individual project alternatives on riparian health and soil and water resources.

Direct Effects to Riparian Health and Soil and Water Resources. The direct effects of alternatives are their potential to affect riparian health and soil and water quality. Intensity, timing, and extent of vegetation management; location, density, and connectivity of campgrounds, facilities, other recreation sites and roads; and grazing are all management activities that have the potential to affect riparian health, and soil and water

quality. Riparian health and soil and water quality are very closely connected and independently have the potential to affect the flow and timing of water.

The consequences of fuels and vegetation management would include compaction and decreased infiltration leading to overland flow and potential flooding. Translation of sediment to the drainage would have the potential to affect stream bank stability. Sedimentation and increased flow along with the decreased delivery time would have the potential to negatively affect water quality. The full extent of effects would be evident in the health of the riparian areas.

Riparian health is key to how a riparian area responds to stress. Healthy riparian areas are able to respond to increases in sediment and flood flows and maintain stability. Riparian ecotype health is dependent upon channel type. Specific indicators included vegetative bank protection, sediment deposition, cutting, percent stable material, bottom scour, and deposition. Stream bank stability and compaction/infiltration/runoff relationships are important to determine increases in flow and timing of water. Riparian health is covered in detail in the Hydrologic Zone of Influence for Surface Water flow, Sequoia National Forest (USDA Forest Service, Sequoia National Forest, 2001).

Soil quality and soil productivity are affected by the amount of organic material in and on the soil and the depth and extent of compaction within watersheds. Most compacted areas in the Monument are located in high use areas around urbanized areas, in close proximity to streams or meadows, or are connected to riparian areas via drainage structures. Management of vegetation has the potential to affect soil quality through compaction and reduction of organic material. Reduction in organic material and compaction negatively affect soil quality and soil productivity and can have negative affects on stream bank stability. Soil compaction and organic material affect the ability of soil to absorb water and affects infiltration rates. A soil's inability to absorb rainwater or snowmelt results in increased runoff and overland flow. Increases in runoff rate can affect the flooding potential of a watershed. Soil infiltration and compaction affect the timing of water. Water that is the result of overland flow resulting from disturbance to soil quality decreases the residence time of water in the watershed. Water quality is affected by the transport of soil to the stream system where it becomes sediment. Results of sedimentation in the stream system are increasing mid-channel deposition, filling of pools, widening of streams and deposition of fines on gravels. Indicators of potential erosion would be evident by the loss of ground cover, compaction, and erosion, as identified with soil transects

Implementation of soil quality standards would minimize the risk of sediment delivery to aquatic systems from management activities. Activities including road and trail construction and maintenance , recreation, prescribed burning, and fuels and vegetation management, in addition to other activities, should not result in detrimental soil compaction that exceeds soil quality standards. Soil quality standards are incorporated into the AMS and are documented in Appendix F of the Framework. As long as soil compaction from past, present, or reasonably foreseeable management activity does not exceed more than five percent of the RCA or ten percent of the area in CARs it would be expected that effects to riparian dependent species, riparian habitat, and soil and water resources would be minimized. Identification of existing and potential sources of sediment delivery to aquatic systems in the Forest Watershed Improvement Needs database and scheduling soil and watershed restoration along with prescribed vegetation management would implement the non-point source pollution strategy and reduce the potential for increased sedimentation to water quality. At the project level, implementation of preventive and restoration measures such as modifying management activities, increasing ground cover, reducing the extent of compacted surfaces, or re-vegetating disturbed sites to reduce or eliminate sediment delivery would be considered where necessary to meet the AMS.

The road network , along with urbanization, would have the highest impacts on soil and water quality. Roads and urbanization act as compacted sites and affect the flow and timing of water. These effects are widespread throughout the Monument and cause a disturbance that effectively expands the natural stream drainage network over entire watersheds as well as all of the watersheds that contain the Monument. Expanding the drainage system occurs because the road system is designed to function like a stream and carries water along road drainage systems for delivery into streams. Indicators include miles of extended drainage network and number of drainage structures that discharge directly to a stream course or drainage. The effects to water quality would be identical to those identified with other impervious or compacted areas discussed above. Grazing would have the same effect on water as facilities, roads, campgrounds, and other hardened surfaces.

Potential Indirect Effects to Riparian Health and Soil and Water Resources. The potential for wildfire defines circumstances that have not yet occurred. The wildfire threat to the watershed is high. The potential for wildfires is measured using departure from a normal fire interval. Fire susceptibility provides the information on how likely an area is to burn and provides a measure of risk. When wildfires burn at high intensity and over large areas water quality is affected by sedimentation, channel stability, and riparian area health. The removal of vegetation and decreased water holding capacity of soil, along with hydrophobic soils, would increase flow rates and decrease the residence time of the water in a watershed. The result of this could be reduced soil quality from erosion, flooding, and impacts to riparian vegetation, stream stability, and riparian habitat.

Cumulative Watershed Effects . Cumulative watershed effects will be evaluated at the subwatershed level during landscape analysis. This direction is commensurate with the direction on page A-21 of Appendix A of the Framework ROD. On page A-53, under Standards and Guidelines Associated with RCO #1, we are instructed to "Conduct project-specific cumulative watershed effects analysis following Regional procedures or other appropriate scientific methodology to meet NEPA requirements."

The hierarchical framework of ecosystem analysis will facilitate cumulative effects analysis by providing information across multiple scales. Specific direction for ecosystem management is in Appendix A of the Framework ROD and Appendix T of the Framework FEIS. Table IV-9 below displays the relative percentage of

treatment proposed in each alternative in this statement by the fifth field hydrologic unit or watershed.

The percentages displayed in Table IV-9 indicate a similar extent of treatmentswatershed-wide and for the total treatment percentages in all the watersheds affected by the Monumentacross the alternatives(for the acres of watersheds in the Monument, see Table III-18 in Chapter III). Nine of the fifteen watersheds vary in percentage of treatment by alternatives by less than two percent. Those watersheds that do vary by treatment do so by less than eight percent of the treatment area by alternative. Treatment acres affect between 35.3% and 35.8%of the total watershed acres that contain the Monument. Negative numbers in parenthesis indicate that there are subwatersheds within that watershed that arecurrently over threshold and that a treatment has been prescribed within the subwatersheds. The number represents the percent of the treatment area that is over threshold. These local sites are specific concerns that will be evaluated at the landscape level where prescriptions may be more tailor-suited to local conditions and concerns. A more detailed display of the percent of treatment by prescription by watershed may be found in Table IV-10 .

Table IV-9 : Relative Percentage of Treatment Proposed by Fifth Field Watershed

Table IV-10: Relative Percentage of Treatments Proposed in Watersheds by Alternative

Applying the principle that the more acres are treated by mechanical methods, the higher the risk of cumulative watershed effects, Alternatives 3 and 4 would have the least effect on the aquatic and riparian community and Alternatives 1, 2, 5, and 6 would have the greatest effect. However this principle ignores many factors that are related to negative watershed effects. Three factors are key to the examination of cumulative effects: the nearness of the impact to the watercourse (McGurk and Fong, 1995), the amount and size of material removed (Erman and Erman, 2000), and the presence of roads (Furniss, et al, 1991). Using these criteria, all alternatives except Alternative 3 and 4 would probably have similar consequences. Alternatives 3 and 4 would have higher consequences since they would exert less control over the size and amount of material removed and the intensity of the fires during initial treatments. However, as discussed above, the effects of mechanical treatment need to be weighed against the risk of catastrophic wildfire.

Table IV-11 displays the estimated road miles by fifth field watersheds. Alternatives 1, 2, 5, and 6 propose no changes to the road system. Alternatives 3 and 4 would include closing some of the existing road system to the public, maintaining the use of some of it for administrative use, and decommissioning a portion of it. The closure of roads would help maintain the drainage system that can be affected by use, especially during wet conditions. A reduction in the road system reduces the potential for cumulative watershed effects by reducing the potential for sedimentation from compacted surfaces and by reducing the extended drainage network created through the road drainage system. A cumulative watershed effects analysis, along with road treatments, would be conducted at the landscape level and provide a more site-specific analysis for project-level management.

Table IV-11 : Road Miles Proposed by Fifth Field Watershed

Clean Water Act. Commensurate with the Sierra Nevada Forest Plan Amendment, all alternatives are expected to maintain and improve water quality and satisfy all State water quality requirements. This finding is based on the standards and guidelines, the application of State approved Best Management Practices specifically designed to protect water quality, and the discussion of water quality and beneficial uses. Examples include (1) stream-type flexible width riparian areas, (2) critical aquatic refuges, (3) comprehensive landscape level analysis including existing uses, (4) Conservation Assessments of threatened and endangered species, and (5) incorporation of established recovery plans. Additionally, project-level analyses for activities subsequent to the decision will be required to demonstrate compliance with Clean Water Act and State water quality standards.

Flood Plains And Wetlands (Executive Orders 11988 and 11990). These Executive Orders require Federal agencies to avoid, to the extent possible, short- and long-term effects resulting from the occupancy and modification of flood plains, and the modification or destruction of wetlands. Standards and guidelines are provided for soil, water, wetlands, and riparian areas to minimize effects to flood plains and wetlands. They incorporate the Best Management Practices of the Soil and Water Conservation Handbook. The standards and guidelines apply to all floodplains and wetlands where less restrictive management might otherwise occur.

Consistency with Framework Riparian Conservation Strategy. Alternatives 1 and 2 are alternatives that closely follow those strategies outlined in the Framework and, based on those findings, would not have detrimental effects on riparian health and soil quality. It is therefore inferred that, since all of the alternatives evaluated in this statement propose similar levels of treatment in each watershed, they would all have similar levels of effects at the programmatic level. And, as expected in the Framework, analysis of site-specific treatments at the landscape level would be necessary to identify any potential impacts to soil and water resources at the project level. The level of treatment at the watershed level is displayed in the discussion of cumulative effects in this section.

Alternatives 1, 2, 5, and 6

Management actions that have the potential to effect soil and water resources are considered to be highest in those alternatives with the highest potential for ground disturbing activity. Mechanical treatment such as those described in Alternatives 1, 2,5, and 6 would have the highest potential to affect soil and water resources.

Alternatives 1, 2, 5, and 6 would provide more protection to soil and water resources due to the likelihood of reduced wildfire severity.

Ground disturbing activity under Alternatives 1, 2, 5, and 6 would produce the greatest amount of short-term

effects to soil and water quality while providing the greatest long-term benefits in terms of prevention of and protection from wildfire.

Alternatives 3 and 4

Alternatives 3 and 4 would have the highest potential to affect soil and water quality due to the reduced control of broadcast burning in stream buffers at close proximity to drainage areas. Conversely, these alternatives have the least potential to affect soil and water resources on slopes due to reduced amounts of ground disturbing activity.

The potential for effects from wildfire to the riparian ecosystem, soil quality, and water quality from Alternatives 3 and 4 is higher because of our reduced ability to control the type of materials removed and fire intensity. Therefore Alternatives 3 and 4 would provide a reduced level of soil and water quality protection, primarily due to the likelihood of high severity wildfire.

Reductions in road miles, reduction in grazing pressure, and decreases in wildfire would both contribute to soil and water quality protection. Alternatives 3 and 4 identify roads most likely to be considered for decommissioning and therefore would have a greater potential to maintain water quality. This would occur as a result of reducing compacted surfaces, decreasing the drainage network, reducing overland flow to riparian and wetland areas, and reducing connection of the road drainage system with the stream system. Alternative 3 identifies significantly more roads for decommissioning and closure than Alternative 4, while Alternatives 1, 2, 5, and 6 do not identify any increases. Alternative 3 also considers the removal of grazing from the groves. The effects of removing grazing from grove areas and decommissioning roads would need to be more closely evaluated at the landscape level to determine effects.

Return to top of page.

Wildlife

Habitats of Special Interest and Management Indicator Species

Aquatic and Riparian

A ll Alternatives. Effects on aquatic habitats are covered in general under the watershed/hydrology section. The primary potential effects on rainbow trout would be from increased sediment due to roads and wildfire, trampling and loss of habitat from recreation and grazing, and increased water temperature from activities that create wide shallow areas or remove excessive vegetation and shade along streams.

*A*lternatives 1, 2, and 5. Alternatives 1, 2, and 5 would improve habitat conditions by decommissioning roads, particularly those identified that impact riparian habitats. Increased burning and fuels treatments would improve flows and reduce the potential for stand-replacing wildfire. Wildfires pose the greatest threat of causing damaging increases in flows, sedimentation, and water temperatures. Habitat for rainbow trout would improve and benefit from avoiding more severe adverse impacts. In the absence of a landscape analysis, there would be little actual treatment within riparian conservation zones, causing conifers to overtop riparian deciduous vegetation. Shading and loss of riparian deciduous habitats would continue, which might lead to a loss of species richness in monitored avian guilds.

Alternatives 3 and 4. Alternatives 3 and 4 depend heavily on the use of fire without mechanical treatment. This would result in a temporary reduction in canopy and a loss of large conifers. The reduction in tree density would result in increased and prolonged water flow over time, due to the need for a more intense fire to meet fuel reduction objectives in the absence of mechanical pre-treatment. Sediment would increase in the short term as roads are obliterated and hotter prescribed fire conditions exist. Long-term results would be a reduction in sedimentation over current levels. The hotter prescribed fires and greater likelihood of hotter burns within the RCAs might result in increased openings that support riparian deciduous vegetation such as alders or aspen. This would provide for greater diversity at a landscape scale. Alternative 3 would provide for the greatest reduction in road miles and would eliminate grazing in high profile groves. The reduction in grazing might lead to improved habitat for trout in a limited area. A reduction in the miles of road would reduce sediment and slow runoff, both of which would be beneficial to riparian dependent species.

Alternative 6. Alternative 6 would treat the most acres by mechanical means. This would provide greater certainty that treatments would occur. The additional flexibility in treatment options would result in fewer air quality restrictions and the ability to implement treatments during different times of the year. Using mechanical methods prior to prescribed burning would allow greater control over the amount and placement of down woody debris, pockets of young trees or shrubs, and impacts to riparian areas. There would be greater potential for compaction and inadvertent harm to small, relatively immobile species such as the relictual salamander due to the operation of heavy equipment. Greater precision in fuel treatments and the ability to remove ladder fuels would reduce disturbance within RCAs. One side effect would be the potential loss of riparian deciduous hardwoods such as alders and aspen. In the absence of disturbance by natural processes or management, these species would be shaded out and lost.

Early Seral

All Alternatives. Modeled habitat types showed very little difference between alternatives. All alternatives show greater emphasis on late seral stage habitat, but do not capture early seral stage habitat well, except in chaparral. Early seral stage habitat could be supported in forested areas with light underburns where there are small openings or areas with less than 40% canopy closure, or small gaps less than five acres where shrubs and herbaceous plants have enough light to grow. Fine-grained mosaics such as this do not show in habitat modeling. Larger openings of 10 to 20 acres tend to benefit larger species such as deer, while smaller species such as quail appear to benefit from smaller openings.

In a ll alternatives, there would be an increase in early seral stage habitat over current levels. This would result from the release of stagnant mid seral stage stands that currently do not provide good habitat for early or late seral stage species, providing a better mix of late seral habitat with large trees and an herbaceous layer based on disturbance from fire or mechanical means.

Alternatives 1, 2 and 5. All three of these alternatives would have a similar outcome. Early seral stage habitat would be created but would be focused in the urban wildland intermix . Habitat use in this area might belimited by conflicts with human use. Alternative 5 would apply a gap thin prescription to giant sequoia groves. The gap thin prescription would be applied to existing openings and would be unlikely to create new early seral habitat. Thinning prescriptions would create mosaics with additional early seral habitat. In general ,the thinning prescriptions would be unlikely to open canopies to the extent necessary for the development of shrub and herbaceous undergrowth.

Alternatives 3 and 4. Greater use of fire without mechanical pretreatment of fuels under Alternatives 3 and 4 would create larger gaps or openings in the forest. Broadcast use of fire would promote growth of early seral species such as whitethorn and deerbrush. The larger openings, reduced canopy,and germination of more fire-dependent shrubs would result in the most early seral stage habitat of any of the alternatives.

Alternative 6. The mix of mechanical and fire treatments would leave more down woody debris, pockets of slash,and ground cover that would limit growth of herbaceous and shrub species. Habitat effectiveness might be greater due to having greater control of and the ability to leave hiding cover with mechanical treatments. Previous mechanical thinnings near Highway 245, followed by jackpot burning, resulted in significant increases in herbaceous undergrowth and maintained 40% or greater canopy closure, down logs, and snags.

Late Seral

All Alternatives. Mature forest and large-tree-dominated habitats (California Wildlife Habitat Relationship habitat types 5M, 5D, and 6), late seral stage habitat, and the number of large snags, would increase under all alternatives.

Modeling indicators used are late seral old growth (LSOG) ranking, the number of large trees over 30 inches in diameter per acre, changes in spotted owl habitat, and the number of snags over 15 inches in diameter per acre. Another area of concern for late seral stage species is the projection of acres likely to burn with stand -replacing intensity.

Alternatives 1, 2 and 5. These alternatives would result in a gradual increase in late seral habitat.

They would result in a modest decline of acres per decade lost due to stand-replacing wildfire. Area modeled as meeting late seral old growth (LSOG) characteristics would increase from nearly 70,000 acres to approximately 140,000 acres. Area modeled as meeting LSOG ranks 4 and 5 would increase from nearly 70,000 acres to approximately 16 0,000 acres for Alternative 5 and over 180,000 acres for Alternatives 1 and 2 (when projected out to 150 years). Large trees would increase from approximately five per acre to ten per acre over the next 100 years. Spotted owl nesting habitat would increase from approximately 48,500 acres currently to about 86,000, or 95,000 acres over the next 140 years. The projected level of snags over 15 inches in diameter would increase from three per acre to approximately seven per acre over the next eight decades.

Alternatives 3 and 4. Alternatives 3 and 4 would be more aggressive in thinning stands of smaller suppressed trees due to the fire intensity of the prescribed burns without mechanical pre- treatment. The result would be a steady increase over time in spotted owl habitat, large trees per acre,and snags Acres of LSOG ranks 4 and 5 are projected to peak at just over 160,000 in 150 years. The higher loss of large trees to fire in the short term would increase available nest trees for pileated woodpeckers and other cavity nesters. It is likely that spotted owl nesting habitat would suffer in the short term from increased openings and loss of larger trees>,but would improve over the long term. This predicted result is consistent with observations of prescribed burns in adjacent national parks. The burns within the national parks have not been shown to reduce spotted owl reproduction.

Alternative 6. Alternative 6 would improve LSOG habitat at a faster rate than Alternatives 1, 2>,and 5>,but not as rapidly as Alternatives 3 and 4. The greater flexibility in fuels management would result in fewer acres lost to stand-replacing wildfire, so the long-term loss of LSOG habitat would decrease. LSOG rank 4 and 5 acres are projected at 199,000 in 150 years. Mechanical pre-treatment prior to prescribed burns would increase the opportunity to protect habitat elements such as down logs, decaying snags, ground cover,canopy cover, and litter. This would result in less short-term loss of habitat than in Alternatives 3 and 4. Results would be consistent with the intent of the Framework to provide higher levels of protection to important fisher habitat elements.

Lower Westside Hardwoods

All Alternatives. All alternatives would follow Framework direction to specifically favor hardwoods where they naturally exist. Modeling shows gains of 30% to 40% in the number of hardwoods 15 inches in diameter per acre through the 7th decade. Although, after seven decades, modeling shows a decline in hardwoods over 15 inches in diameter, it is likely that hardwoods would increase under all alternatives and that this increase would be sustained over time. This would be due to a more open canopy, which would help to maintain and improve growth on existing oaks.

Alternatives 1, 2 and 5. Treatments would be primarily limited to urban wildland intermix and might not target areas where hardwoods are becoming shaded and lost. The more open character of the urban wildland intermix would favor retention of hardwoods where they naturally exist. This might limit use by gray squirrels, if not carefully planned,since they prefer interconnected crowns for travel and to avoid predation.

Alternatives 3 and 4. The use of fire alone in these alternatives would limit the ability to selectively treat stands to improve hardwood retention. More intense fire without pretreatment would kill oaks and could remove large legacy oaks with cavities that are important denning sites,unless individual oaks are identified and lined prior to burning. Modeling indicates this alternative would result in a net loss of hardwoods over the next 150 years, due to the more intense fire regime. Openings c lose to existing seed-bearing oaks might increase recruitment and would be likely to increase the numbers of oaks over time.

Alternative 6. Mechanical pretreatment of ladder and surface fuels in this alternative would allow more flexibility to selectively thin to favor oak retention and protect existing large oaks. Mechanical treatment would also allow for removal of conifers encroaching in aspen stands or shading out alders or other riparian deciduous trees to maintain diversity. Fire alone,in many cases,would have to be intense to kill the encroaching conifers and would result in loss of existing hardwoods. Due to greater control of leave trees, down woody debris,and ground cover, there would be greater opportunity to group leave trees to maintain overlapping canopies necessary for gray squirrels and other species,without compromising the integrity of fuels reduction treatments. Modeling indicates this alternative would show the greatest increase in the retention and recruitment of hardwoods over 15 inches in diameter over the next 150 years.

Wildlife Species At Risk

All Alternatives. Effects would vary greatly by species' habitat requirements, mobility, and sensitivity to human disturbance. Each of these species are conserved under Forest Service regulation and policy or fully protected by the Endangered Species Act. The issues of protection and maintenance of viability are addressed at the programmatic level and would again be addressed during each project-level decision. Not all species at risk found or potentially found within the Monument are addressed here. They are addressed only if there are specific consequences to the species as a result of proposed management actions. All species are addressed in greater detail in the biological resources working papers for this statement.

Valley elderberry long-horned beetle. This beetle would likely benefit from activities that restore the role of fire to chaparral ecosystems. Elderberries sprout after fires and may benefit from reduced competition after prescribed burns. The shrubs are not highly flammable and can generally be protected to varying degrees by timing and pattern of ignition. Complete loss under prescribed conditions is unlikely, whereas under wildfire conditions complete loss is likely. All alternatives would have a beneficial effect on this beetle;however, limitations on the use of mechanical pre-treatment in chaparral in Alternative 3 might limit options for the protection of elderberries. Project-level mitigation would be needed to offset or minimize loss of elderberry shrubs. Due to the low incidence of valley elderberry beetles within the Monument, efforts to protect elderberry during project implementation, and the potential beneficial effects of the proposed management, it is unlikely that any of the alternatives presented would have an adverse effect in the long term. Timing and other management tools, including reasonable and prudent measures provided by the Fish and Wildlife Service, would be used at the project level to minimize or eliminate short-term harm or species take.

California condor. Chaparral burning and treatment of fuels in the oak belt would increase deer habitat. They would result in better availability of food, as well as increase openings and large snags necessary for foraging and roost sites for the condor. A limited operating period would apply to grove activities in all alternatives if condors are in the area and are likely to be selecting a nest tree. The small openings and thinning proposed in groves in Alternatives 5 and 6 would be unlikely to adversely affect quality of nesting habitat for condors and might improve foraging in the area surrounding potential nest trees. Consultation on the Framework indicated there was a potential for adverse effects due to the potential to burn roost trees. Project-level consultation has resulted in provisions for protecting roost trees. Larger openings in the chaparral/oak woodland belt would be beneficial to the condor for foraging and creating new roost trees. With the protection of roost trees and limitations on activities near potential roost trees, it is unlikely that there would be adverse effects on condors. The Sequoia National Forest and Monument will continue to follow reasonable and prudent measures for conservation of this species identified during the consultation process.

California spotted owl, Pacific fisher, and American marten. These species have slightly different habitat requirements, but also have several elements in common. Common elements that would be affected by the alternatives include numbers of large trees, down logs, canopy closure, and proportion of the landscape with canopy closure over 40%.

Outcomes for Alternatives 1, 2, and 5 would not vary significantly from the Framework. Alternatives 3 and 4 would reduce the impact of the urban wildland intermix zones, but would increase the effects of canopy and large tree reduction over a larger area in the short term. Overall nesting habitat and large trees would increase

under all alternatives, increasing the most under Alternative 6. Large snags and down wood would also increase the most under Alternative 6 . Suitable spotted owl habitat after 140 years would be approximately 113,000 acres for Alternative 6 and approximately 95,000 acres for Alternatives 1 through 4. Alternative 5 would result in approximately 86,000 acres of suitable habitat in 140 years. Current suitable habitat is 48,500 acres.

Alternative 6 would apply the most mechanical treatment. The proposed gaps would focus on areas that are already open and of low suitability for spotted owls. Promoting regeneration in existing openings would reduce fragmentation over time. Thinning prescriptions associated with gap/thin treatments would increase growth and reduce the risk of stand-replacing fires at a faster rate than in other alternatives. This alternative would also give more protection to existing snags, large trees, down logs, and oaks than would Alternatives 3 and 4. By piling and burning fuels, more ground cover would be left for prey habitat. Thinning from below, under all alternatives, would be likely to improve flight paths and increase the resilience of stands to disease, pests, and fire.

Alternative 6 would not follow the Framework guideline for 60% canopy closure over 60% of the watershed in trees greater than 11 inches in diameter. Analysis indicates that this requirement is currently not met in most watersheds where fishers are present. Many of the stands in excess of 60% canopy closure are second growth, dominated by small trees with a dense understory and high fuel loadings. These stands are highly susceptible to loss from a wildfire and are a threat to adjacent communities, giant sequoia groves, and high quality LSOG habitat. Thinning within these stands would have the greatest potential to reduce risk to existing habitat and to increase the size and development of multiple-layered canopies. These stands may be used by fisher as den sites where adequate LSOG elements exist. Release of the Framework guideline shifts some of the burden of habitat protection to site-specific project analysis and therefore increases the risk of inadvertent disturbance. This is outweighed by the potential for expansion of suitable habitat and the reduction of threat to known existing habitat.

Return to top of page.

Human Use

Heritage Resources

All Alternatives

In all alternatives, the cultural resource program would provide support to all resource projects, as required by Section 106 of the National Historic Preservation Act. The program would include inventory, analysis, stabilization, and public interpretation.

Despite inventories, the potential exists for undiscovered sites to be exposed and/or damaged by surface disturbance or other events. These sites may or may not be noticed in time to allow mitigation. This damage represents an unavoidable adverse effect, present in all alternatives.

All alternatives will have some irreversible commitments of heritage resources. Examples are inadvertently damaged or destroyed sites, vandalized or looted sites, and sites that have not been inventoried and recorded and are undergoing loss from natural processes. Every alternative seeks to minimize this loss through inventory and evaluation, monitoring, and improved project implementation to ensure that this loss is kept to an absolute minimum.

There is a direct relationship between the numbers of acres disturbed through project implementation and the number of acres surveyed for heritage sites. This relationship also exists for the number of heritage sites located and evaluated. Alternatives that result in more acres of planned management activities could reduce adverse effects, because more inventory and evaluation would be required under these alternatives. Eligible sites would be avoided or mitigation of effects would occur during project implementation.

Direct effects could result both from natural events and human activities that could damage heritage resources or alter their settings such as surface disturbance, soil compaction, erosion, heating and freezing, wildfire, prescribed burning, livestock trampling, alteration of a heritage resource setting (including introduction of atmospheric or audible intrusions), and potential loss of protection for undiscovered heritage resources if land is transferred from federal to non-federal ownership. Indirect effects could result from improved access that brings more visitors, potentially resulting in increased vandalism, removal of materials, inadvertent damage or fires, or scenic and auditory changes from adjacent or nearby activities.

Cumulative effects over time could include loss of sites, loss of interpretive values, and incremental loss of the heritage resource base. Management activities could cause surface disturbance, bring additional people in contact with heritage resources, or affect the fabric of historic structures. The difference in cumulative effects to heritage resources under the different alternatives should be limited due to the protection and mitigation measures that would be implemented.

Cumulative effects could also occur to heritage resources as a result of unplanned activities such as vandalism or illegal excavation. Efforts to control and monitor these activities would be similar in all alternatives and would result in an extremely low level of cumulative adverse effects to heritage resources.

Alternatives that result in more acres of planned management activities could reduce adverse cumulative effects.

This is because more inventory and evaluation would be required under these alternatives. Additional inventory and evaluation would lead to the location of more heritage resources and a reduction of adverse cumulative effects caused by natural processes.

A growing emphasis on American Indian input to the management of the Monument has the possibility of broadening our understanding and awareness. The oral histories and lore of the American Indians would be complimentary to scientific information, providing a more in-depth and rich interpretation of the broader cultural landscape.

The National Historic Preservation Act defines effects to heritage resources as including those resulting from transfer from federal ownership. Potential effects include loss of federal protection for heritage resources on lands transferred to other ownership, which could result in damage or destruction of heritage sites. However, prior to landownership transfer, inventories would be conducted and mitigation applied, if needed. As a result of these inventories there would be the potential to locate eligible sites. That potential would be the same under all alternatives.

Heritage resources on lands acquired from other ownerships are accorded protection under federal law. Potential effects on heritage resources would depend on activities subsequently planned for the land.

Effects from Recreation Management

Direct effects could occur from construction or reconstruction of campgrounds and trampling of heritage resources by people and vehicles. For planned recreation developments, most of the potential direct effects can be eliminated or mitigated. However, indirect effects, such as the potential for increased vandalism, trampling, loss of integrity and increased erosion cannot be completely mitigated, because inventories are not usually conducted outside the limits of the developed sites.

An increase in dispersed camping could damage or destroy vegetation, inorganic surface crusts, and natural ground litter. Increased looting and vandalism might occur. In addition, driving over heritage sites could cause extensive direct damage with the compaction of soils, alteration of soil stratigraphy and reduced water-infiltration rates. These effects could occur under any alternative, but in Alternative 3, the potential for this type of negative effect would be greatly reduced, since access would be reduced. The number of sites potentially affected is not quantifiable at this time.

Effects from Fire and Fuels Management

Prescribed burning and wildfires would have the potential to directly affect heritage sites by burning historic structures and damaging or destroying artifacts and features of archeological sites. Activities carried out in emergency situations to control a wildfire, including construction of fire lines, could also directly damage heritage resources. Indirect effects of fire would include erosion losses resulting from burned vegetation cover; extreme temperatures, or changes in the landscape adjacent to sites that are initially damaged by deterioration and weathering that alter the matrix of artifacts and features.

Fuels management activities could affect heritage resources through surface disturbance caused by machinery and vehicles, by felling trees on certain types of sites, by theft or vandalism caused by workers, or by erosion caused by vegetation removal or damage. In addition, fuels and oils used by heavy equipment could be spilled or dumped on heritage sites. Construction or reconstruction of permanent or temporary roads would have the potential to affect heritage resources through damage or destruction. However, eligible sites would be avoided, or mitigation of effects would occur. Effects to heritage sites would be mitigated.

Effects to heritage resources would tend to be greater in wildfire situations because of extreme temperatures, an inability to control the effects, and because it is almost impossible to plan inventories in advance. Some inventories might be conducted on fire lines. Fire effects could be determined and appropriate mitigation carried out if a complete inventory of the burned area is conducted shortly after the fire is controlled, but this is not always possible. Therefore, potentially significant effects from wildfire could go undetermined under all alternatives. The number of heritage resources affected by wildfire on an annual basis cannot be predicted.

Effects from Grazing

Range-related management activities would have the potential to alter or destroy heritage resources. These activities include fence construction, spring developments, wells, stock tanks, pumps, pipelines, water storage and cattle guards, and non-structural projects such as noxious weed treatments, forage improvement and livestock grazing. Livestock grazing, especially where animals congregate or use trails, creates impacts to heritage resources. Sites exposed by grazing might be more prone to removal, collecting, or vandalism by people. These effects would be direct, indirect and cumulative. The stratigraphic layers, so important to defining cultural chronologies, could be churned and distorted by livestock digging, movements, and congregation. These same effects could be caused by wild herbivores and small mammals that use areas that may be heritage sites. This type of wildlife could increase in numbers due to range improvements such as wells. These heritage sites are often located near springs, drainages, and forest edges. Under any alternative, a cultural inventory would be necessary to prevent further damage, mitigate unforeseen damage, and prevent future impacts to sites.

Return to top of page.

Recreation

All Alternatives

In the Proclamation, providing access for persons with disabilities is exempted from the restriction of motorized vehicles to designated roads only and non-motorized mechanized vehicles to designated roads and trails. This exemption does not mean that persons with disabilities are allowed to travel wherever they desire with whatever mode of transportation they desire. Federal laws, regulations, and policies do not require areas that restrict off-highway and all-terrain vehicle use to make exceptions to such use just because a person has a disability. While using an off-highway or all-terrain vehicle off of designated roads would not be allowed, a person with a disability would be able to use a wheelchair, either mechanical or electric, on roads that are not designated for motorized use or on roads and trails that are not designated for mechanized use. A wheelchair is defined as a device that is designed solely for use by a mobility-impaired individual for locomotion that is suitable for use in an indoor pedestrian area (Americans with Disabilities Act, 1990). A device powered by an internal combustion engine would not fit that definition.

Beginning in fiscal year 2003, the Sequoia National Forest will conduct a survey of recreation users through the National Visitor Use Monitoring Project, using statistically valid sampling methodology. This will provide more reliable use figures than previously recorded and assist with information to guide the provision of recreation opportunities in the future.

Alternative 1

Alternative 1 continues with current direction and would not fully address the Recreation issue as stated in Chapter I. Use of the National Visitor Use Monitoring data would help guide the provision of recreation opportunities in the future.

Existing campgrounds and picnic areas may be reconstructed, or new facilities may be constructed to help meet the demand for developed sites. New developed recreation sites would add more roads to the forest road system, mainly in the form of short access roads and roads within the developed sites. Additional developed recreation sites would meet a portion of the expected increase in public demand for recreation opportunities.

Overnight facilities in the Hume Lake Basin, in accordance with the 1988 Forest Plan, would not be expanded. Only projects that enhance dispersed day-use recreation would occur (Forest Plan, page 4-21).

The Recreation Opportunity Spectrum (ROS) classifications would not change from those developed for the Forest Plan and the 1990 Mediated Settlement Agreement. Approximately 10% (32,600 acres) of the Monument would be in the Semi-Primitive Non-Motorized class, 12% (39,200 acres) would be in the Semi-Primitive Motorized class, 77% (251,300 acres) would be in the Roaded Natural class, and 1% (3,300 acres) would be in the Rural class. There are no areas in the Primitive or Urban classes in the Monument.

Under this alternative, the winter recreation program would continue providing groomed roads for over-snow vehicles at existing locations. The snow park areas would continue to be maintained as well. No new winter recreation trails or snow park areas are currently under consideration or are reasonably foreseeable, and winter use of the Monument would not be expected to increase significantly.

The current road system is expected to be maintained under this alternative and would continue to provide access to existing developed and dispersed recreation sites, for viewing the magnificent scenery of the southern Sierra Nevada, for opportunities to view wildlife in their natural habitat, and the ability to drive to special places for solitude and personal gratification. The Highway 190, Western Divide, and Parker Pass corridors would be studied for possible inclusion in the Forest Service scenic byway system. Off-highway and over-snow vehicle use would be maintained as is currently described in the Proclamation.

Designation of the Highway 190, Western Divide, and Parker Pass road corridors as Forest Service scenic byways might create an additional demand in driving for pleasure on these road corridors and might add more traffic and congestion to the road system. There would also be a greater demand for interpretive stops along the route. A larger tourism base might provide more business throughout the year to local communities and businesses.

The Sequoia Guard Station in Redwood Mountain Grove would be evaluated as a recreation rental or conservation education center.

Alternative 1 would not meet the demands of the recreating public. Overcrowding would likely occur more frequently. This alternative would not be expected to change PAOT capacity in the next decade. As use is expected to increase during this time period, campground occupancy rates would increase (increased frequency of 60% or greater). The resulting sense of "feeling crowded" by campers would also increase.

The expected increase in dispersed use within the Monument might heighten congestion and increase compaction problems in areas currently overcrowded or overused and expand the need for law enforcement and resource protection efforts.

Existing recreation facilities would continue to deteriorate until funds are allocated to reconstruct them. The currently outdated facilities would fall further into disrepair due to overuse. Many of the existing facilities would not meet visitors' changing needs in terms of larger family groups, larger vehicles, and universal accessibility.

Consequently, the ability to meet visitor expectations would continue in an ever-steeper downward trend, as demand outstrips the facilities' abilities to accommodate them.

All Action Alternatives

As described in Chapter II, potential recreation opportunity areas have been identified for all action alternatives and are mapped in Figures II-3 and II-4. These potential recreation opportunity areas are not the only areas where recreation opportunities could be developed. These areas are identified for illustrative purposes, as areas that have high potential for development of future recreation facilities or opportunities. Decisions on the location and type of recreation development would be made at the project level, in site-specific analyses. As new needs become known and trends change, other facilities or opportunities might be developed. Private development is encouraged in all alternatives.

Forest Plan guidance (no expansion of overnight facilities in the Hume Lake Basin and only site-specific projects that enhance dispersed day-use recreation [USDA Forest Service, Sequoia National Forest, 1988, page 4-21]) would be superceded by the following: the Hume Lake Basin Recreation Action Plan would be completed and include increased overnight facilities, more day use facilities, and more conservation education and/or interpretive opportunities, specifically focused on the historic and cultural resources surrounding the creation and use of Hume Lake. The specific location and amount of increased development would be determined by the action plan.

An analysis of the potential for visitor centers on government or private property would be completed.

The Recreation Opportunity Spectrum classes would be the same for all action alternatives. The overall effect would be to add area to the lesser-developed classes and provide greater opportunities for non-motorized activities. The approximate acres would be as follows: Semi-Primitive Non-Motorized - 58,700, Semi-Primitive Motorized - 45,700, Roaded Natural - 218,700, and Rural - 3,300. These acreages represent an addition of 26,100 acres in Semi-Primitive Non-Motorized, an addition of 6,500 acres in Semi-Primitive Motorized, a reduction of 32,600 acres in Roaded Natural, and no change in the Rural class.

The transportation system would be designed to maintain access to the primary concentrated use areas identified in the affected environment (Chapter III). Mountain bikes would be allowed on roads and most trails throughout the Monument. Trails closed to mountain bikes would be signed. Trail opportunities and mileage are likely to increase in all alternatives.

Designation of the Highway 190, Western Divide, and Parker Pass road corridors as Forest Service scenic byways might create additional demand in driving for pleasure on these road corridors and add more traffic and congestion to the road system. There would be a greater demand for interpretive stops along the route. A larger tourism base might provide more business throughout the year to local communities and businesses.

Existing recreation facilities would continue to deteriorate until funds are allocated to reconstruct them. The currently outdated facilities would fall further into disrepair, due to overuse. Many of the existing facilities would not meet visitors' changing needs, in terms of larger family groups, larger vehicles, and universal accessibility. Consequently, the ability to meet visitor expectations would continue in an ever steeper downward trend, as demand outstrips the facilities' ability to accommodate them. As funding is available, existing facilities could be reconstructed to help meet expected demands. New facilities would be constructed after site-specific project evaluation and NEPA documentation.

Enhanced conservation education, and interpretive services would assist resource management efforts by educating the visiting public about natural processes and management activities and goals.

Alternative 2

This alternative is generally responsive to the projected increase in demand for more and varied recreation, interpretation, and educational opportunities. However, Alternative 2 would still not meet the projected demands of the recreating public, although it has the potential to accommodate demand better than Alternative 1, but not as well as Alternatives 5 and 6. Alternative 2 would better accommodate demand than either Alternative 3 or 4. This alternative would encourage development of new and reconstruction of existing campgrounds, day use areas, and other appropriate recreation facilities and opportunities. This alternative would provide a wide range of trail opportunities, including accessible trails for persons with disabilities for hiking, horseback riding, bicycling, and cross-country skiing.

Overall, visits for developed recreation would be expected to increase by an estimated 15%to 16% throughout the Monument over the next ten years.

Additional developed recreation sites would increase PAOT capacity and would meet a portion of the expected increase in public demand for recreation opportunities within the Monument. To help meet this demand, opportunities for new construction and reconstruction of existing campgrounds and day use areas are emphasized. In the northern portion of the Monument, priority would be given to the Hume Lake Historic Area; the Tenmile, Highway 180, and Big Meadow road corridors; the Stony Creek area; and the Eshom area. In the southern portion, recreation opportunity areas in the Highway 190, Western Divide, and Lloyd Meadows road corridors, along with the Camp Wishon area, would receive priority.

This alternative is more likely to result in fewer days of reaching occupancy rates of 60% or greater in

campgrounds. The resulting sense of "feeling crowded" by campers would decrease and might result in greater visitor satisfaction.

Dispersed recreation activities such as trail use, camping in sites with minimum (or no) facilities, sightseeing, nature study, and non-consumptive wildlife activities would be accommodated in a number of places. In the northern portion, emphasis would be given to dispersed activities and camping with few amenities at recreation opportunity areas in the Millwood area, the Buck Rock area, and the Rowell/Horse Corral area. Highway 180 and the Generals Highway would receive priority for sightseeing, wildlife viewing, and nature interpretation. Winter uses would be emphasized along the Generals Highway, in the Big Meadows area, and in the vicinity of Cherry Gap. New winter recreation routes and/or snow park areas would be constructed in association with the Hume Lake Historic Area. Road grooming for over-snow vehicles would continue. (A permittee grooms trails for cross-country skiing).

In the southern portion, emphasis for dispersed recreation opportunities would be placed on the Wishon area to include trail opportunities to join with Mountain Home State Forest and to reach the Needles and Dome Rock areas from the Western Divide. Opportunities for wildlife viewing, camping with few amenities, and trails would be a focus along the Lloyd Meadows road corridor. Providing groomed winter roads would accommodate winter activities. Parking and facilities in the Sugarloaf area, at the intersection of the North Road with Highway 190, at Quaking Aspen Campground, and along the Western Divide Highway would likely be improved.

Opportunities for trailheads and trails in the vicinity of Red Hill, Peyrone, and South Peyrone Groves would be evaluated and proposed, if feasible.

The expected increase in dispersed use within the Monument might heighten congestion, increase compaction problems in areas currently overcrowded, or cause compaction in areas not currently impacted. The need for law enforcement and resource protection efforts would be likely to increase. With more visitation, more people would be interested in visiting the groves, which might affect grove management objectives.

New and reconstructed areas would help meet the need for diverse recreation opportunities and year-round access to Monument resources. It would boost local businesses and community economies and could create demand for overnight facilities in the foothill communities adjacent to the Monument.

The current road system is expected to be maintained at about 900 miles and would continue to provide access to the existing developed and dispersed recreation sites throughout the Monument. By retaining this system, opportunities similar to those currently available would continue. Vehicular access to popular dispersed sites, for viewing the magnificent scenery of the Southern Sierra Nevada, for opportunities to view wildlife in their natural habitat, and the ability to drive to special places for solitude and personal gratification would be retained. New facilities would add to the road system, mainly in the form of short access roads and roads within the developed sites. Some existing roads might not be useful for recreation or management activities proposed for the Monument. These roads would be available for conversion to trails or for decommissioning.

The Sequoia Guard Station in Redwood Mountain Grove would be evaluated for use as a recreation rental cabin or conservation education center, which would broaden conservation education opportunities in the Monument. It would make use of an historic facility at a potentially significant location. The site is close to the U.C. Berkeley Whittaker Forest and the National Park Service facilities in Redwood Mountain Grove.

Alternative 3

This alternative is generally responsive to the expected increases in demand for more primitive experiences and isolation from motorized use within the Monument. This alternative would concentrate human use and recreation in the high profile groves and encourage interpretation and education within these groves and the Hume Lake Historic Area. It would expand day use opportunities, maintain the status quo of developed overnight facilities, and reduce dispersed overnight use. The range of recreation opportunities in this alternative would be narrower than in the other alternatives. Alternative 3 would not be expected to meet the demands of the recreating public, but it may better meet the demand for some primitive kinds of recreation experiences than the other alternatives.

This alternative would reduce dispersed camping and eliminate roads for driving and all motorcycling and snowmobile use, which could theoretically result in an 8% reduction in visits, overall, as enthusiasts for these activities go elsewhere. However, as population increases and interest in almost all activities is expected to increase, visitation to the Monument is also be expected to increase. As people desiring certain experiences that are no longer available are forced out, others who will be interested in the Monument's opportunities would replace them. Capacities of developed sites would be maintained, yet use could be expected to increase by 6%, which would result in an increased frequency of reaching occupancy rates of 60 percent or greater in developed campgrounds. The resulting sense of "feeling crowded" by campers would also increase.

The reduction in access within the Monument would reduce areas available for overnight, dispersed camping. People who are displaced by the reduced availability may choose to go elsewhere for dispersed recreation experiences. Some people could opt to use developed sites instead, which could worsen congestion problems in them. The reduction in access for dispersed use and the lack of increase in campground capacity would have cumulative impacts, particularly in the northern portion of the Monument, as people visiting both the national parks and the Monument seek a place to stay. The need for law enforcement and resource protection efforts are likely to increase as use patterns change.

The highest priorities for providing recreation opportunities would be in the Hume Lake Historic Area and the

natural settings within the Monument. The Hume Lake Historic Area and surrounding high profile groves would provide a range of recreation, education, and interpretation opportunities, through new and improved developed sites, loop trails, interpretive signs and exhibits, as well as presentations by interpreters. The emphasis would be to build new trails and maintain existing trails to allow access into the more natural settings of the Monument. Relocation of trails and trailheads outside streamside zones would be the preferred treatment where terrain allows. Trailheads would be improved, and interpretive and education signs would be installed.

New developed recreation sites would add more roads to the forest road system, mainly in the form of short access roads and roads within the developed sites. Additional developed recreation sites would meet a portion of the expected increase in public demand for recreation opportunities within the Monument. The added sites would be balanced by the closure of other sites that do not meet the requirements of this alternative.

Overall, visits for developed recreation could be expected to increase by an estimated 6% throughout the Monument over the next ten years. To help meet increased demand for developed sites, reconstruction of existing campgrounds and picnic areas would be emphasized. Recreation facilities (e.g., campgrounds, picnic areas) located within the high profile giant sequoia groves, as well as trails and trailheads, would be improved and expanded where they would not have significant negative impacts on the groves or objects of interest. PAOT capacity would be lower in this alternative than in any of the other action alternatives.

Emphasis would be given to the analysis and, if necessary, subsequent relocation of part or all of developed and dispersed sites from streamside zones. These sites are Tenmile, Landslide, and Logger Flat Campgrounds along Tenmile Creek; Eshom Campground along Eshom Creek; Upper Stony and Stony Creek Campgrounds along Stony Creek; and Big Meadow Campground along Big Meadow Creek on the Hume Lake Ranger District. Boyden Cavern facilities, Grizzly Falls Picnic Area, and Mill Flat Campground are others on the same district. Upper and Lower Coffee Camp picnic areas along the Tule River, Wishon Campground along the North Fork of the Tule River, Belknap Campground at the confluence of Belknap Creek and the Middle Fork of the Tule River, Redwood Meadow and Long Meadow Campgrounds along Long Meadow Creek, Leavis Flat Campground along Deer Creek, White River Campground along White River, and Peppermint and Lower Peppermint Campgrounds along Peppermint Creek are found on the Tule River and Hot Springs Ranger Districts.

Priorities in the northern portion of the Monument would include loop trails that join Princess Campground with features within the Converse Basin and Indian Basin Groves. Signs and other educational opportunities would be available at places like Stump Meadow, Chicago Stump, and the Boole Tree, and along remnant features from the railroad-logging era. In the southern portion of the Monument, potential trail improvement and construction projects would include those at the Needles and Dome Rock areas, those that join the Monument with Mountain Home State Demonstration Forest, those in the Camp Nelson area, and ones that would join the Deer Creek area with Frog Meadow. Among other trail possibilities are a loop system tied in with the Poso cabin and the Sandy Creek Fire Road in the Poso-Panorama area, as well as one that would provide access into the Slate Mountain area.

Winter use would be encouraged with an emphasis on non-mechanized activities like snow play, cross-country skiing, and snowshoeing. Snow park areas would continue to be maintained at current locations. No new winter recreation trails or snow park areas are currently under consideration or are reasonably foreseeable, and winter use of the Monument would not be expected to increase significantly. Snowmobile use would be eliminated and snow grooming on roads would no longer be provided.

Roads open to the public would be reduced by approximately 400 miles, which would result in the smallest road system in any alternative. About 150 miles would be decommissioned and approximately 250 miles would be closed to public use but available for administrative use. This road system would reduce opportunities for vehicular access to dispersed use areas, for viewing the magnificent scenery of the Southern Sierra Nevada, for opportunities to view wildlife in their natural habitat, and the ability to drive to special places for personal gratification.

The Sequoia Guard Station in Redwood Mountain Grove would be evaluated for use as a conservation education center. This would broaden the range of conservation education opportunities available in the Monument. It would also make use of a historic facility at a potentially significant location. The site is in close proximity to the U.C. Berkeley Whittaker Forest and the National Park Service facilities in Redwood Mountain Grove.

Alternative 4

This alternative is generally responsive to the expected increases in demand for more recreation opportunities. However, Alternative 4 would not meet the demands of the recreating public. It has the potential to accommodate demand better than Alternatives 1 and 3, but less than Alternatives 2, 5, and 6. This alternative would encourage development of new and reconstruction of existing campgrounds and picnic areas. The focus of interpretation would be on historic areas in the northern portion of the Monument and on natural settings in the southern portion. Winter recreation opportunities would also be expanded.

The highest priorities for providing recreation opportunities would be given to the Hume Lake Historic Area and the natural settings within the Monument. The Hume Lake Historic Area and surrounding giant sequoia groves would provide a range of recreation, education, and interpretation opportunities, through new and improved developed sites, loop trails, interpretive signs and exhibits, as well as presentations by interpreters. The emphasis would be to build new trails and maintain existing trails to allow access into the more natural settings of the Monument. Trailheads would be improved, and interpretive and education signs would be installed.

Under this alternative, visits for developed recreation could be expected to increase by an estimated 15% to 16%

throughout the Monument over the next ten years.

Additional developed recreation sites would increase PAOT capacity and would meet a portion of the expected increase in demand for recreation opportunities within the Monument. To help meet this demand for developed sites, priority would be given to recreation opportunity areas. Examples would include the Hume Lake Area, Tenmile, Highway 180, and the Big Meadow road corridors, the Stony Creek area, and the Eshom area in the northern portion of the Monument. In the southern portion, examples would include Highway 190, the Western Divide, and the Lloyd Meadows road corridors, along with the Camp Wishon Area.

This alternative may result in fewer days of reaching occupancy rates of 60 percent or greater in campgrounds. The resulting sense of "feeling crowded" by campers may decrease and may result in greater visitor satisfaction.

Dispersed recreation activities, such as trail use, camping in sites with minimum or no facilities, sightseeing, nature study, and non-consumptive wildlife activities would be accommodated in a number of places. In the northern portion of the Monument, emphasis for dispersed recreation would be given to recreation opportunity areas in the Millwood area, the Buck Rock area, and the Rowell/Horse Corral area for camping with few amenities and other dispersed activities. Highway 180 and the Generals Highway would receive priority for sightseeing, wildlife viewing, and nature interpretation. Winter uses would be emphasized along the Generals Highway, the Big Meadows area, the Quail Flat to Weston area, and in the vicinity of Cherry Gap; facilities to accommodate users would be constructed, and grooming of roads would be increased.

In the southern portion of the Monument, emphasis for dispersed recreation opportunities would be placed on the Wishon area, for example, to include trail opportunities to join with Mountain Home State Forest and to the Needles and Dome Rock areas from the Western Divide Highway. Opportunities for wildlife viewing, camping with few amenities, and trails would be featured along the Lloyd Meadows Road corridor. Providing additional groomed roads would increase winter opportunities. Parking and facilities in the Sugarloaf area, at the intersection of the North Road with Highway 190, at Quaking Aspen Campground, and along the Western Divide Highway would likely be improved.

The winter recreation program would provide groomed road opportunities for over-snow vehicles. Snow park areas would continue to be maintained at current locations. New winter recreation routes and/or snow park areas would be constructed in association with the Hume Lake Historic Area and with new campgrounds. Opportunities for non-mechanized winter activities, like snow play, cross-country skiing, and snowshoeing, would be expanded.

The expected increase in dispersed use within the Monument would heighten congestion, increase compaction problems in areas currently overcrowded, or cause compaction in areas not currently impacted. The need for law enforcement and resource protection efforts is likely to increase. With more visitation, more people would be interested in visiting the groves, which might affect grove management objectives.

New and reconstructed areas would help meet the need for diverse recreation opportunities and year-round access to the Monument resources. It would boost local businesses and community economies and could create a demand for overnight facilities in the foothill communities adjacent to the Monument.

Under this alternative, the existing road system would be reduced by approximately 25 miles. This road system would have fewer miles than in Alternatives 2, 5, and 6, but substantially more mileage would be available to the public than in Alternative 3. The system would continue to provide access to existing developed and dispersed recreation sites throughout the Monument. The proposed new facilities would add to the road system mainly in the form of short access roads and roads within the developed sites. Some existing roads would not be useful for recreation or the expected management activities proposed for the Monument. These roads would be available for conversion to trails or decommissioning.

Alternatives 5 and 6

These alternatives are generally responsive to the expected increases in demand for a wide range of recreation opportunities. However, Alternatives 5 and 6 would still not meet the demands of the recreating public, although these alternatives are more likely to accommodate more of the projected demand than any of the other alternatives. These alternatives would encourage development of new and reconstruction of existing campgrounds, day use areas, and other appropriate recreation facilities and opportunities. These alternatives would encourage expansion of overnight camping opportunities, including facilities near and in giant sequoia groves. The focus of interpretation would be on historic areas in the northern portion of the Monument and on natural settings in the southern portion.

Under these alternatives, visits for developed recreation could be expected to increase by an estimated 15% to 16% throughout the Monument over the next ten years.

Additional developed recreation sites would increase PAOT capacity and would meet a portion of the expected increase in demand for recreation opportunities within the Monument. To help meet this demand, the highest priorities for providing recreation opportunities would be in the Hume Lake Historic Area and natural settings in the southern portion of the Monument. The Hume Lake Historic Area would accommodate a wide range of recreation, education, and interpretation opportunities, through new and improved developed sites, loop trail systems, interpretive signs, and exhibits, as well as presentations by interpreters. In the southern portion of the Monument, special emphasis would be placed on building new trails and maintaining existing trails to allow access into the natural settings. Trailheads would be improved, and interpretive and education signs would be installed.

Among possible locations for new recreation development are recreation opportunity areas in the Tenmile, Highway 180, and Big Meadow road corridors; the Stony Creek area; and the Eshom area in the northern portion of the Monument. In the southern portion, recreation opportunity areas in the Highway 190, Western Divide, and Lloyd Meadows road corridors would be possibilities.

These alternatives would encourage expansion of PAOT capacity and overnight camping opportunities near and in groves. Opportunities for development in or near Red Hill, Peyrone, and South Peyrone Groves, in particular, would be evaluated. Developed recreation facilities (campgrounds, day use areas) located within the current administrative boundaries of giant sequoia groves, as well as about 23 miles of trail and five trailheads, would be analyzed at the project level and improved and/or expanded where feasible. Added human use and recreation in and near the groves could impact the grove resources.

This alternative might result in fewer days of reaching occupancy rates of 60% or greater in developed campgrounds. The resulting sense of campers "feeling crowded" by campers might decrease and might result in greater visitor satisfaction.

Dispersed recreation activities, such as trail use, camping in sites with minimum or no facilities, sightseeing, nature study, and non-consumptive wildlife activities, would be accommodated in a number of places. In the northern portion, emphasis would be given to dispersed activities and camping with few amenities at recreation opportunity areas in the Millwood area, the Buck Rock area, and the Rowell/Horse Corral area. Highway 180 and the Generals Highway would receive priority for sightseeing, wildlife viewing, and nature interpretation. Winter uses would be emphasized along the Generals Highway, in the Big Meadows area, and in the vicinity of Cherry Gap. New winter recreation routes and/or snow park areas would be constructed in association with the Hume Lake Historic Area. Road grooming for over-snow vehicles would continue. (A permittee grooms trails for cross-country skiing.)

In the southern portion, emphasis for dispersed recreation opportunities would be placed on the Wishon area to include trail opportunities to join with Mountain Home State Forest and to reach the Needles and Dome Rock areas from the Western Divide Highway. Opportunities for wildlife viewing, camping with few amenities, and trails would be featured along the Lloyd Meadows Road corridor. Providing groomed roads would provide for winter opportunities. Parking and facilities in the Sugarloaf area, at the intersection of the North Road with Highway 190, at Quaking Aspen Campground, and along the Western Divide Highway would likely be improved.

The expected increase in dispersed use within the Monument would heighten congestion, increase compaction problems in areas currently overcrowded, or cause compaction in areas not currently impacted. The need for law enforcement and resource protection efforts is likely to increase. With more visitation, more people will be interested in visiting the groves, which might affect grove management objectives.

New and reconstructed areas would help meet the need for diverse recreation demand and year-round access to the Monument resources. It would boost local businesses and community economies and could create a need for overnight facilities in the foothill communities adjacent to the Monument.

The current road system is expected to be maintained at 900 miles under these alternatives, and it would continue to provide access to existing developed and dispersed recreation areas throughout the Monument. The proposed new facilities would add to the road system mainly in the form of short access roads and roads within the developed sites. Some existing roads may not be useful for recreation or the expected management activities proposed for the Monument. These roads would be available for conversion to trails or decommissioning.

The Sequoia Guard Station in Redwood Mountain Grove would be evaluated for use as a recreation rental cabin or conservation education center, which would broaden conservation education opportunities in the Monument. It would make use of an historic facility at a potentially significant location. The site is in proximity to the UC Berkeley Whittaker Forest and the National Park Service facilities in Redwood Mountain Grove.

Return to top of page.

Scenic Environment

Alternative 1

This alternative would retain the visual quality objectives assigned by the Forest Plan, although they would be converted to scenic integrity objectives used in the Scenery Management System. For the Monument, they consist of approximately 9% (29,400 acres) of very high, 13% (42,400 acres) of high, 32.5% (106,100 acres) of moderate, 38% (124, 000 acres) of low, and 7.5% (24,500 acres) of very low.

All Action Alternatives

With the creation of the Monument, the natural beauty of the land gained greater significance as a national treasure. The scenic resource is an integral part of landscape management in all alternatives. The Scenic Integrity Objectives (SIOs) for all alternatives are approximately 18% (60,200 acres) of very high, 28% (91,200 acres) of high, 53.5% (174,200 acres) of moderate, and 0.5% (800 acres) of low.

Since the goal of all action alternatives is to reach the same scenic integrity objectives throughout the Monument, techniques to help meet these objectives are discussed. Fuel management techniques are proposed in

varying degrees and offer the greatest potential for distractions to scenic quality. A paper titled, "Vegetative Management through Fuel Treatment and the Scenery Management System" is included in part and provides guidance to meet the objectives.

The management of vegetation, and its residues, within the Monument is a critical element of ecosystem management. One result of the continual quest to improve the techniques of managing vegetation is the Scenic Management System. Through this system, the relative importance of aesthetics has been identified and quantified on all national forest system lands.

The Monument Management Plan assigns very high and high scenic integrity objectives to the landscapes of highest visual sensitivity. Distances up to ¼-mile from the observer are the most critical zones. Managing these lands to retain the dominance of a natural landscape is the objective.

The dilemma is that many conifer stands are in an unnaturally dense state, or contain ground fuels or "ladder fuels" that create an extremely high fire hazard. A similar situation is found in the chaparral where the shrubs are decadent and highly flammable. The challenge, then, is to treat the fuels and reduce the fire danger within the very high, high, and moderate zones without management activities appearing to be the dominant element. By understanding some of the positive and negative effects of the specific techniques being considered and describing the desired scenic condition for the vegetation, we can then plan, design, and implement a fuels treatment project incorporating the Scenery Management System.

The selective removal of trees and prescribed burning (of vegetative residues and related flammable materials) can have a positive effect on the scenic values of the national forest. Plantings of more fire-resistant species, such as ponderosa and Jeffrey pines, giant sequoia, and incense cedar, in fire-prone areas can have a similarly positive effect. The potential positive effects of fuels treatment by selective removal of vegetation and prescribed burning are:

Increased visual penetration into the forest

Opening vistas that allow views of spectacular forest scenes

Allowing fresh exposures to scenes previously covered by dense understory

Rejuvenating decadent, over-mature shrubs, with resulting new growth and bright new colors

Giving a "park-like" appearance to the forest floor

Reducing the likelihood of a major wildfire

Creating a mosaic of different plant species, age classes, or successional stages

Resulting in greater numbers of large trees and lesser numbers of small and medium-sized trees (but still a mix)

The potential negative effects of fuels treatment by selective timber removal and prescribed burning are:

Removal of gnarled, entwined snags that make picturesque, even grotesque, shapes for scenic views and photographs

Scorched tree crown, blackened tree trunks, dead understory vegetation, and a blackened forest floor

Stumps and disturbed soils

Loss of a sequence of views and frames for vistas by losing understory, regeneration, and intertwining crowns

Short-term loss of low ground covers

Public information that addresses the temporary nature of adverse effects to scenery associated with prescribed burning can help to reduce the potential for negative public reaction after a fuels treatment project.

Return to top of page.

Socio-Economics

In assessing socio-economic effects of the alternatives, the selected indicator is the number of jobs for the three county area comprising Fresno, Tulare, and Kern Counties. Potential effects on the service and retail sectors are aggregated to the three-county area because there is no information regarding the location of recreation visitation over the next ten years. In contrast, change in the manufacturing sector, due to change in the availability of wood products, is assumed to be in Tulare County. There is only one industrially scaled lumber mill in the three-county region that bids on timber from the Sequoia National Forest timber and it is located in Tulare County.

Visitation: The Service and Retail Sectors

All Alternatives. Over the next ten years, visitation to the Monument is expected to increase from 6.5 million visits to 7.5 million visits under all alternatives except Alternative 3. For the latter, visitation is expected to rise to 6.9 million visits, or about 8% fewer visits than is projected for the other alternatives. The difference would be largely due to the closure to public use of about 400 miles of road and a simultaneous reduction in dispersed camping and other dispersed recreation activities throughout the Monument.

Because the volume of visitation is expected to increase gradually over ten years by the same 1,000,000 visits per year for all alternatives except Alternative 3, activities proposed for the Monument would have no effect on visitation. Thus there is no projected effect on the tourist-related employment in the service and retail sectors. In contrast, since Alternative 3 would produce a lower projected rate of growth in visitation over the next ten years, one of two things could happen in the service and retail sectors of the three affected counties. Either demand for goods and services could rise in relation to the other alternatives because visitors, who might have camped, now seek motel rooms and restaurant meals, or demand could fall relatively, as the overall volume of visitation increases at a slower rate. If Alternative 3 is selected, visitation and demand for services could be monitored to determine the actual economic effect.

Ecosystem Management: The Forestry/Agriculture and Manufacturing Sectors

All Alternatives. Ecosystem management in the Monument would be accomplished through prescribed burning and mechanical treatments (e.g., brush crushing, chipping, etc.). While Forest Service crews would accomplish the burning, harvesting and mechanical treatments would typically be done by contract with private companies.

Acres of mechanical treatment would vary from approximately 330 acres per year in Alternative 4, to about 3,810 acres per year in Alternative 5. Within the context of the enormous agriculture sector in Fresno, Tulare, and Kern Counties, these additions would be negligible and no effect on future employment would be expected.

Employment in logging and milling, in the manufacturing sector, would be a somewhat different matter. Table IV-12 shows timber harvest and the number of jobs supported incidental to ecosystem management.

Table IV-12: Timber Harvest and Jobs Supported, 2002-2012

The volume of wood products removed would range from about 0.22 MMCF per year in Alternative 3 to approximately 2.14 MMCF per year in Alternative 6. Alternative 4 would produce no commercial harvest at all. Therefore, Alternative 4 would not support any jobs in the manufacturing sector through commercial logging or milling. The other action alternatives would support from eight to ten jobs under Alternative 3 to as many as 50 to 55 jobs under Alternative 6. Because Alternative 1, the no action alternative, supports 25-30 jobs, the effect of Alternative 3 would be the loss of support for 17 to 20 jobs, while that of Alternative 6 could be the addition of 25 manufacturing jobs in Tulare County. While these jobs are small in number, they are important because they might make the difference between continued operation and closure of the one mill available to serve the Monument.

Social Values Regarding Vegetation Treatments

A social effect is a change in social and cultural conditions that directly or indirectly results from actions taken by the Forest Service. Social impact analyses identify potential public needs, concerns, and values that resource managers must consider in decision-making. These needs, concerns, and values also inform decision makers and the public of potential social effects that may occur as a result of Forest Service actions. This analysis focuses on which alternatives redeem which sets of values regarding forest management.

For purposes of this analysis, the central difference in values pertains to the means and methods of forest management expressed by various members of the public. The overall goal of attaining the desired conditions for historic stand structure, historic fire regimes, and protecting the objects of interest, especially giant sequoias, is widely agreed to. The debate arises from the various methods to achieve that goal. The issue centers on what types of management activities, including logging, mechanical vegetation treatments, or prescribed fire, are appropriate for use within lands designated as the Giant Sequoia National Monument. It considers how application of the prescribed management activities is or is not consistent with expectations, values, and beliefs of different individuals.

Addressing this issue requires the full range of alternatives since different people support a range of values regarding approach to forest management. Some want more active mechanical treatments to maintain and restore resources in the Monument while others want fire alone to make up for man's intervention for the past 100 years. Some believe the cost of forest management should be at least partially offset by the sale of forest products, e.g. timber, while others do not. Accordingly, the indicators of change responsive to this diversity of opinion are the cubic foot volume of wood products that would be available from protection and restoration treatments and the number of acres for which mechanical treatment would be prescribed per year. Note that none of this volume would be produced as part of an industrial wood program. It is an estimate of the volume that might be produced incidental to the protection and restoration activities designed to achieve the desired conditions.

Table IV-13: Indicators of Social Values Regarding Forest Management, Decade 1

Since most of the controversy in values focuses on mechanical treatment inside and outside groves, and on whether any timber volume is produced as a result, Table IV-13 ranks all alternatives accordingly. Values are redeemed approximately according to the two rankings.

Those who prefer fire, without timber production as a management tool, will tend to favor Alternatives 3 and 4. These show the lowest number of acres treated mechanically and the lowest volume or no timber by-product. Alternative 4 would be ranked first because it shows the fewest acres treated mechanically and no timber by-product. Because Alternatives 1 and 2 are virtually identical and treat the next fewer number of acres mechanically, they are given the same third ranking. Alternative 5 would be the fourth choice because it more than doubles the acres treated and enters the groves for a minor amount of mechanical treatment to create the "gaps" requisite for giant sequoia reproduction. Alternative 6 would be fifth as it shows substantial increases in the acres of gaps created and the volume produced.

Those who value active mechanical treatment and incidental production of timber to help defray the costs of restoration would rank the alternatives nearly in the reverse order. Alternative 6 would be ranked first as offering acreages of restoration and giant sequoia regeneration similar to Alternative 5, as well as the largest potential incidental timber volumes. Alternative 5, for similar reasons, would be ranked second. Alternatives 1 and 2, virtually identical, would both be ranked third. Alternative 3 would rank fourth by virtue of some incidental timber production and Alternative 4 would probably rank fifth.

Return to top of page.

Transportation

Roads

All Alternatives

Road management would focus on reducing safety hazards and unacceptable resource impacts, and maintaining the Maintenance Level 3 through 5 roads for public access and reasonable access to private property. Other roads that provide access to important fire protection features, administrative sites, special use permitted areas, and developed recreation areas would also be priorities to maintain. Access to developed recreation sites, special use areas, and private land would be the same for all alternatives.

The existing maintenance funding is not enough to fully maintain the existing Maintenance Level 3 to 5 roads within the Monument. The lack of maintenance, particularly on the lower priority Maintenance Level 1 and 2 roads, is causing deterioration of the roadways. Some roads have become overgrown with brush and trees and are impassable to vehicular traffic. Other roads are causing resource damage in the form of sedimentation, as culverts and other drainage structures no longer function properly.

The maintenance funding for the Forest Service road system is inadequate, which could have cumulative effects on access within the Monument. In the past five years, funding maintained 28% of the road system within the Monument. The current funding is used to repair the most pressing safety-related road problems. As a result, none of the roads are being maintained to standard or within the 20-year maintenance cycle. Certain maintenance-related items are deferred to a later time, and some capital improvements are not accomplished. The lower maintenance level roads are not being maintained, except in a limited number of areas, and some are declining to the point of being unusable. At this rate, the Monument road system would inevitably be affected, and, ultimately, only the Maintenance Level 3 to 5 roads would remain for public and administrative access (see Appendix D, Roads Analysis Process, Map 1).

Direction for the past decade has been to encourage road decommissioning, in part to address the deferred maintenance issue. Funding has been available to decommission three to six miles of road annually within the Monument. Over the past five years, roads have been selected to decommission that are causing resource damage or are overgrown and becoming impassable to vehicle traffic. Road decommissioning is expected to continue under any of the alternatives.

Alternatives 1, 2, 5, and 6

The road system under Alternatives 1, 2, 5 and 6 would be comprised of approximately 900 miles of roads within the Monument. Not all of the mileage is open to public vehicular traffic. Currently, 359 miles are classified as Maintenance Level 1 roads, which are technically closed to vehicular traffic. However, many of these roads in the Monument do not have physical barriers that prevent public use. The expectation is that the majority of roads would continue to be used for public access, as well as resource management activities.

Retaining the road system mileage similar to current levels would provide the highest levels of access for dispersed recreation opportunities, as well as restoration and protection treatment areas, compared to Alternatives 3 and 4.

Alternatives 1, 2, 5, and 6 would have the highest costs for maintaining the road system. The maintenance strategy in these alternatives would require the greatest increase in funding (approximately 72%) to keep the road system in acceptable condition.

If the funding is not adequate to keep the road system in acceptable condition, roads would be repaired, closed, relocated, or decommissioned to reduce impacts. A lack of funding for maintenance could lead to a reduced available road mileage as roads are closed or decommissioned. If maintenance funding is adequate to prevent unacceptable impacts, but is not adequate for full maintenance, the overall condition of the road system could be

lower for these alternatives than for Alternatives 3 and 4.

Alternatives 1, 2, 5, and 6 have the lowest potential for converting roads to trails.

Alternative 3

The road system under Alternative 3 would be comprised of approximately 755 miles of roads. Not all of the mileage is open to public vehicular traffic, as some is classified as Maintenance Level 1 roads, which is technically closed to vehicular traffic. However, many of these roads in the Monument do not have physical barriers that prevent public use. The expectation is that most of the roads would be used for resource management activities, and a portion of the road system would be available for public access, as well.

Reducing the road mileage by decommissioning and closing roads to public vehicular access would provide the lowest level of access for dispersed recreation opportunities, as well as restoration and protection treatment areas, compared to the other alternatives.

Roads proposed for decommissioning would generally be short roads, less than one mile, with moderate to high risk for producing unacceptable resource impacts, and do not provide access to recreation sites, high profile groves, special use permitted areas, or private land.

Alternative 3 would have the lowest costs for maintaining the road system, due to a reduction in the total miles of road from 900 to approximately 755, and by closing approximately 240 miles of road to public vehicular access. This alternative would require the least increase in funding (approximately 60%) to keep the road system in acceptable condition. This assumes the roads that are decommissioned and closed are an equal mix of low standard, Maintenance Level 1 and 2 roads. The reduction in maintenance costs would begin after roads are decommissioned and after closed roads have gates or barriers installed. The cost to decommission roads would be approximately $1,800,000.

Reducing the total road mileage should reduce the maintenance costs in the long run more than the other alternatives.

Alternative 3 would have the highest potential for converting roads to trails through decommissioning, as roads are evaluated for recreational trail use.

Alternative 4

The road system under Alternative 4 would be comprised of approximately 875 miles of roads within the Monument. Not all of the mileage is open to public vehicular traffic, as some is classified as Maintenance Level 1 roads, which is technically closed to vehicular traffic. However, many of these roads in the Monument do not have physical barriers that prevent public use. The expectation is that most of the roads would be used for resource management activities and would be available for public access, as well.

Reducing the road mileage by decommissioning approximately 25 miles of road would provide a small reduction in the level of access for dispersed recreation opportunities, as well as restoration and protection treatment areas, compared to Alternatives 1, 2, 5, and 6. This alternative would provide more vehicle access than Alternative 3.

Roads proposed for decommissioning would generally be short roads, less than one mile, with high risk for producing unacceptable resource impacts, and do not provide access to recreation sites, special use permitted areas, or private land.

Alternative 4 would have lower costs for maintaining the road system than Alternatives 1, 2, 5, and 6, due to a reduction in the total miles of road from 900 to approximately 875. It would require an increase in funding (approximately 70%) to keep the road system in acceptable condition. This assumes the roads that are decommissioned are low standard, Maintenance Level 1 roads. The reduction in maintenance costs would begin after roads are decommissioned. The cost to decommission roads would be approximately $312,500.

If funding is not adequate to keep the road system in acceptable condition, roads would be repaired, closed, relocated, or decommissioned to reduce impacts. A lack of funding for maintenance could lead to a reduced available road mileage as roads are closed or decommissioned. If maintenance funding is adequate to prevent unacceptable impacts, but is not adequate for full maintenance, the overall condition of the road system could be lower for this alternative than for Alternative 3, but somewhat better than in Alternatives 1, 2, 5, and 6.

Alternative 4 would have a lower potential for converting roads to trails than Alternative 3, due to fewer miles of road being proposed for decommissioning that could be considered for recreational trail use.

Return to top of page.

Other Effects

The following described effects have not yet been discussed in this DEIS, as required by 40 CFR 1502.16.

Other related efforts that may affect the Proposed Action as presented in this document include the review of the Framework decision.

Upon completion of his review of Framework appeals, the Chief of the Forest Service affirmed the decision to implement the Framework. The Chief directed the Regional Forester to review three elements of the Framework, along with other concerns raised in the appeals. The Review Team will evaluate any needed changes to the Framework Record of Decision (ROD) relative to:

Framework fuel treatments,

Consistency of the Framework with the National Fire Plan, and

Compatibility of the Framework with the HFQLG Forest Recovery Act (Sierra Nevada Framework Plan Amendment Review Team Charter, Blackwell, 3/1/2002).

The Framework review will consider all portions of the ROD. Upon completion of the Framework review, the Monument management plan will then be reviewed to determine consistency with the results of the Framework review (40 CFR 1502.16(c)).

Other foreseeable actions that may affect this decision include the revision of the Forest Plan. A revised Forest Plan could modify or amend the resulting decision. The Forest Plan revision is scheduled to begin following completion of the Monument Management Plan.

Throughout the planning process, officials from the Sequoia National Forest have been in consultation with the Tribal Council of the Tule River Indian Reservation. The Monument management plan makes allowances to avoid any possible conflicts between Tribal land use plans and the management of the Monument (40 CFR 1502.16(c)).

No other possible conflicts between federal, regional, state, local, or Indian reservation land use plans, policies, and controls for the area are anticipated at this time (40 CFR 1502.16(c)).

None of the alternatives have expected energy requirements and conservation potential (40 CFR 1502.16(e)).

None of the alternatives would affect the design of the built environment (40 CFR 1502.16(g)). The effects of implementing the alternatives on urban quality, and historic and cultural resources are displayed in the Air Quality and Heritage Resources sections of Chapter IV.

Means to mitigate adverse environmental impacts are considered in the alternatives. No separate mitigations were considered (40 CFR 1502.16(h)).

Return to top of page.

Unavoidable Adverse Effects

Implementation 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 would vary by resource.

Implementation of any of the alternatives, including Alternative 1 the no action alternative, would result in smoke emissions from prescribed burning. Emissions would vary in amount by number of acres burned. The more acres proposed for prescribed burning would result in lower emissions from wildfires, which generally result in greater emissions per acre and commonly exceed ambient air quality standards. For further information, refer to the Air Quality section in Chapter IV, Emissions From National Monument Activities.

During prescribed burning, which is considered in all the alternatives, some trees would be killed. The amount of mortality would vary by fuel loading and topography. Mortality estimates result from fire behavior modeling and past experience. For more detailed information regarding the outcomes of the analysis, refer to Fire and Fuels in Chapter IV.

Inventories of archeological findings are required by the National Historic Preservation Act (Section 800). Still, there exists a potential for undiscovered sites to be exposed and/or damaged by surface disturbance or other events. If sites are found prior to implementation, mitigation to provide protection would be applied. However, often the sites are found too late. This potential damage represents an unavoidable adverse effect, present in all alternatives. A detailed description can be found in Chapter IV, Heritage Resources, All Alternatives.

Relationship Between Short-Term Uses and Long-Term Productivity

The 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) is required by NEPA. 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-tem uses and long-term productivity can be found in detail in Chapter IV under individual resource discussions.

Alternatives 1, 2, 5, and 6 would implement ground-disturbing activities that would produce the greatest amount

of short-term effects to soil and water quality while providing the greatest long-term benefits in terms of prevention of and protection from wildfire.

Alternatives 3 and 4 would implement some road closures and road decommissioning. Alternative 3 proposes a net reduction of approximately 250 miles that would change use patterns due to the loss of the roads for public use. In addition, roads that are proposed for decommissioning would require ground-disturbing work to remove the roadbed and replace the natural topography, if that decommissioning method is used. This work would have short-term detrimental effects but would be beneficial to the ecosystems over the long term.

Similar findings would be true under Alternative 3, when dispersed recreation areas not in compliance with the Framework aquatic management strategy are removed from use. To restore sites to their natural settings, some amount of ground disturbance would need to take place. The long-term benefits of the ground disturbance would outweigh the short-term impacts.

Alternatives 3 and 4 propose more prescribed fire over the landscape. Over the short-term, this action would produce more sediment from hotter prescribed fires. This, combined with road decommissioning, would produce more sediment in the short-term but would reduce sediment over the long term.

All potential disturbances would be evaluated and mitigated at a site-specific level prior to implementation through landscape analyses.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

All action alternatives would incorporate the recreation opportunity areas developed by forest recreation personnel. The potential projects included in the opportunity areas would involve some amount of new development and expansion. Areas would be compacted and hardened, resulting in a temporary loss of some resources in the Monument. Prior to implementation of any project, a site-specific analysis would be conducted to analyze the effects of the proposal. Mitigation of potential effects would be included in those proposals. Localized negative impacts on stand structure would occur as vegetation is permanently removed to allow for the development of access roads and structures.

The potential for irreversible commitments of heritage resources exists in all the alternatives. Examples include inadvertently damaged or destroyed sites, vandalized or looted sites, and sites that have not been inventoried and recorded and are undergoing loss from natural processes. To ensure that losses of this type are kept to an absolute minimum, each alternative proposes inventory and evaluation, monitoring, and improved project implementation. A full description can be found in Chapter IV, Heritage Resources, All Alternatives.

Disclosures

The National Environmental Policy Act directs that "to the fullest extent possible, agencies shall prepare draft EIS's concurrently with and integrated with other environmental review laws and executive orders" (40 CFR 1502.25(a)).

The Presidential Proclamation of April 15, 2000 directed the Secretary of Agriculture through the Forest Service to consult with the Secretary of the Interior, through the Bureau of Land Management and the National Park Service. The Forest Service has been in contact and consultation with natural resource managers, particularly giant sequoia specialists, from Sequoia and Kings Canyon National Parks, the Bureau of Land Management, the Tule River Indian Tribe, the California Department of Forestry and Fire Protection, and educators from the California Polytechnic University at San Luis Obispo and the University of California at Berkeley.

In accordance with the Endangered Species Act, the Monument planning team has consulted with the U.S. Fish and Wildlife Service throughout the development of the DEIS. A meeting was held between the Monument planning team and U.S. Fish and Wildlife Service employees in March of 2001 in Sacramento, California. The DEIS was also sent to officials of the U.S. Fish and Wildlife Service for their review and comments.

Ongoing consultation with local Tribal governments and Native Americans has occurred throughout the development of the DEIS. Several meetings with the Tule River Indian Tribal Council, the Sequoia National Forest Supervisor, and members of the Monument planning team are documented in the project file. An employee of the Tule River Tribe has worked closely with the Monument planning team throughout the process.

Consultation with the National Marine Fisheries Service is not required due to the absence of anadromous fish and their habitat.

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices
Word Index

Alternate format

Acrobat PDF
· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Chapter V List of Preparers and Consultants

List of Preparers and Technical Consultants. V-2 | Interdisciplinary Team. V-2 | Technical Consultants. V-6

List of Preparers and Technical Consultants

The following is a list of contributors to this draft environmental impact statement. Numerous other people have also contributed in many ways to this document. Their help is greatly appreciated.

Interdisciplinary Team

Juliet B. Allen; Land Management Planning Staff Officer

Ms. Allen is currently the Land Management Planning Staff Officer on the Sequoia National Forest. She has 27 years with the Forest Service in various planning positions throughout California, often focusing on relating forest management to human communities. She earned a Bachelor's Degree in Political Science and a Master's Degree in City and Regional Planning, both from the University of California at Berkeley.

Denise Alonzo; District Public Affairs Officer

Denise Alonzo is currently the District Public Affairs Officer on the Tule River, Hot Springs, and Hume Lake Ranger Districts of the Sequoia National Forest. She has 14 years of experience with the Forest Service, working in various positions in Fuels and Fire Management before moving into Public Affairs in 1997. She earned a Bachelor of Science Degree in Natural Resources Interpretation at Northern Arizona University in Flagstaff.

Steve Anderson; Wildlife, Range, and Rare Plant Program Leader

Steve Anderson is currently the forest program manager for wildlife, range, and rare plants. He has 24 years of experience with the Forest Service and has served in his present position since 1993. Steve has a Bachelor of Science Degree in Range and Wildlands Science from the University of California at Davis.

Norman M. Carpenter; Assistant Recreation Officer

Norman Carpenter is currently the Assistant Recreation Officer for the Sequoia National Forest. He has 31 years of Forest Service experience, primarily as a landscape architect for the Tahoe and Sequoia National Forests. He was a member of the Sequoia National Forest planning team during the development of the Forest Plan and an interdisciplinary team member on numerous other environmental impact statements and environmental assessments. His areas of responsibility have included: recreation planning and design, wild and scenic river coordination, wilderness and roadless area planning and coordination, scenic management, and scenic byways. Norman received a Bachelor of Science Degree from the University of Massachusetts with a major in Landscape Architecture.

Marianne Emmendorfer; Road Analysis Team Leader

Marianne Emmendorfer is currently the District Planner and Interpreter on the Hume Lake Ranger District of the Sequoia National Forest. She has 15 years of experience with the Forest Service. Marianne earned a Bachelor of Science in Forest Management from Michigan Technological University and a Master of Science in Recreation Management from the University of Idaho.

Annette Fredette; Planner, Giant Sequoia National Monument

Annette Fredette is currently a Planner on the Monument planning team. She has 11 years of experience with the Forest Service in various planning and Geographic Information Systems (GIS) positions in Regions 5, 9, and 3; 9 years of experience with a county parks and recreation department; and 4 years of experience with a state forestry department. Annette earned a Bachelor of Science Degree in Forest Management from Northern Arizona University in Flagstaff.

Alan J. Gallegos; Geologist

Alan Gallegos is currently the Geologist for the southern Sierra province (Sierra, Sequoia, and Stanislaus National Forests). Alan has worked for the Forest Service since 1980 with prior experience in central Utah and northern California. His area of expertise is watershed analysis, with special emphasis on fluvial and mass wasting processes. He is a member of the Geologic Society of America and the Association of Engineering Geologists. He has worked on several multidisciplinary teams, including the President's Ecosystem Management Assessment Team, as well as disaster or emergency assessment teams for fire and floods. Alan has a Bachelor of Science Degree in Geology from the University of Southern Colorado.

Robin Galloway; Zone Wildlife Biologist

Robin Galloway is currently the Zone Wildlife Biologist for the Hume Lake, Tule River, and Hot Springs Ranger Districts of the Sequoia National Forest. She has 16 years of experience with the Forest Service as a district biologist. Robin earned a Bachelor of Science Degree in Biology from California State University, Bakersfield. She participated in the southern Sierra Nevada fisher and marten study and serves as the Forest Spotted Owl Coordinator.

Aaron Gelobter; Forest Fire Management Officer

Aaron Gelobter is currently the Forest Fire Management Officer on the Sequoia National Forest. He has 31 years of experience with the Forest Service, working on five national forests in two regions. Aaron earned a Bachelor of Science Degree in Natural Resources from the University of Arizona.

John Grenz; Civil Engineer

John Grenz is currently the Pre-Construction Design Engineer on the Sequoia National Forest. He has 27 years of experience with the Forest Service and eight years of experience with CalTrans. He has been on this forest for 25 years working on road location, timber harvest system designs, pre-construction design, and construction administration. John earned his Bachelor of Science Degree in Civil Engineering from California State University, Humboldt.

Tom Henry; Giant Sequoia Specialist

Tom Henry is currently the Giant Sequoia Specialist for the Sequoia National Forest. He has 27 years of experience with the Forest Service and has served in his present position since 1988. He has been a Certified Silviculturist for Region 5 since approximately 1984. Tom holds a Bachelor of Science Degree in Natural Resource Management from California State University, Humboldt.

Terry Kaplan-Henry; Forest Hydrologist

Terry Henry is currently the Forest Hydrologist for the Sequoia National Forest. She has 22 years of experience with the Forest Service. Previously, Terry worked for the U.S. Geological Survey and taught Earth Science at Humboldt State University, Chico State University, Butte Community College, and Porterville Community College. Terry holds a Bachelor of Arts Degree in Geology from California State University, Humboldt and a Master of Science Degree in Geology from California State University, San Jose.

Judi Perez; Planner, Giant Sequoia National Monument

Judi Perez is currently a Planner with the Giant Sequoia National Monument Planning Team. She has 15 years of Forest Service experience on five national forests. She has worked as Small Sales Forester, Timber Sale Preparation Forester, Timber Sale Planner, Geographic Information System (GIS) Coordinator, Computer Assistant, and District Planner. Judi earned a Bachelor of

Science Degree in Forest Management from California State University, Humboldt.

Trent Procter; Air Resource Specialist

Trent Procter is currently a Province Air Quality Specialist for the Forest Service. Trent provides air program management and technical assistance to six national forests in the central and southern Sierra Nevada. He has 24 years of experience with the Forest Service and has served in his present position since 1988. Trent holds a Bachelor of Science in Natural Resource Management from Cal Poly, San Luis Obispo. He has authored numerous technical papers and publications on regulatory compliance and the effects of air pollution on forest ecosystems and physical resources.

Nancy Ruthenbeck; Forest Recreation, Lands, Minerals and Engineering Officer

Nancy Ruthenbeck is currently a staff officer for the Sequoia National Forest, providing leadership for recreation, wilderness, heritage resources, land and real estate management, minerals, and engineering. She has been a staff officer on this forest for 11 years and has 13 years of experience with the Forest Service in two regions. For the previous 12 years, she worked for the Indiana Department of Natural Resources, Division of Outdoor Recreation. For most of that time, she was an outdoor recreation planner, responsible for preparing the Statewide Comprehensive Outdoor Recreation Plan (SCORP) and special studies, as requested by the department or state legislature. Nancy has a Bachelor of Landscape Architecture from the University of Illinois.

Tom W. Simonson; Ecosystem Manager

Tom Simonson is currently the Ecosystem Manager on the Sequoia National Forest. He has 29 years of Forest Service experience on four national forests. His other assignments included: tree improvement forester, district culturist, district silviculturist, district timber management officer, forest silviculturist, and forest timber management officer. Tom earned a Bachelor of Science degree in Forest Resources Management from the University of Minnesota. He is a certified silviculturist and a Regional Forester's Representative for Silviculture Certification.

Brent Skaggs; Forest Deputy Fire Management Officer

Brent Skaggs is currently the Forest Deputy Fire Management Officer for the Sequoia National Forest. He was the Forest Fuels Specialist overseeing the implementation of the prescribed fire program for the Forest and the Monument. He has 20 years of experience with the Forest Service, working on suppression engines, working on and supervising suppression and fuel reduction hand crews, and serving as District Fire/Fuels Battalion Chief and Forest Fuels Specialist. Brent is a graduate of the University of Colorado's Technical Fire Management Program and earned an Associate of Science Degree in Forestry.

Philip Strand; Fisheries Program Manager

Philip Strand is currently the Fisheries Program Manager for the Sierra and Sequoia National Forests. He has 25 years of experience with the Forest Service, working on five national forests. Philip earned a Bachelor of Science Degree from the University of Washington.

Diane Travis; Forest Fire Planner

Diane Travis is currently the Forest Fire Planner for the Sequoia National Forest, providing technical support to the fire management organization. She has 15 years of experience with the Forest Service. Diane earned a Bachelor of Science Degree in Forest Management with a concentration in Fire science from Colorado State University.

Stephanie Tungate; Forest Heritage Resource Program Manager

Stephanie Tungate is currently the Forest Heritage Resource Program Manager for the Sequoia National Forest. She has 22 years of experience with the Forest Service in the Pacific Southwest Region. Stephanie earned a Bachelor of Arts Degree in Anthropology from the California State University at Chico.

James Whitfield ; Interdisciplinary Team Leader, Giant Sequoia National Monument

Jim Whitfield currently leads the Giant Sequoia National Monument Planning Team, coordinating the development of the Monument management plan. He has 25 years of experience with the Forest Service as a District Silviculturist, Recreation Planner, and Assistant Forest Recreation Officer. Jim earned a Bachelor of Science Degree in Forest Management from the University of Montana.

****

Technical Consultants

Suraj Ahuja ; Air Resources Specialist

Dr. Ahuja is currently a Province Air Quality Specialist for the Forest Service supporting the air program for the eight northern national forests in California. He has worked for the Forest Service for 25 years in the Southwest and Pacific Southwest Regions in various positions. He holds a Ph.D. from the University of California at Davis. He also has Air Quality Certification from University of California (Extension) Davis. He has written various technical documents and papers for forest-wide and region-wide use.

Klaus Barber

Klaus Barber is currently the Regional Operational Research and Management Science Specialist. He has 36 years with the Forest Service, as District Timber Management Officer, Timber Planner, Forest Land Use Planner, Regional Biometrican, as well as his current position. Klaus earned a Bachelor of Science Degree in Forest Management from the University of California at Berkeley and a Master of Business Administration Degree from the University of Southern California. He has worked on special projects such as the Redwood Park Expansion, Gang-of -Four Spotted-Fisheries Analysis, FEMAT, Cal Owl, and the Sierra Nevada Forest Plan Amendment. He is the co-developer of CIA, ELMO, and RELM computer models.

Larry Burd ; District Silviculturist

Larry Burd is currently the district silviculturist on the Hume Lake Ranger District of the Sequoia National Forest. He has 27 years of experience with the Forest Service, working on four national forests in silviculture, planning, and timber sale administration. Larry is the Sequoia National Forest Pesticide Use Coordinator and has been licensed as a professional forester by the State of California since 1986. He earned a Bachelor of Science Degree in Forest Management from West Virginia University and a Masters of Science Degree in Forestry from Yale University.

Heidi Hosler; GIS Specialist

Heidi Hosler is currently a GIS Specialist on the Sequoia National Forest. She has 24 years of experience with the Forest Service, nine as a GIS Specialist. Heidi earned a B.S. Degree in Forest Management from Humboldt State University and an A.S. Degree in Natural Resources from Reedley City College.

Lewis Jump; Forest GIS Coordinator

Lewis Jump is currently the Forest GIS Coordinator and Giant Sequoia Inventory Specialist. He has 31 years of experience with the Natural Resource Conservation Service and the Forest Service, working as Soil Conservationist, Forester, District Silviculturist, Forest Silviculturist, Land Management Planning Analyst, Forest GIS Coordinator, Giant Sequoia Specialist, and Giant Sequoia Inventory Specialist. He has worked on special projects such as the Sequoia National Forest Mediated Settlement Agreement, the Giant Sequoia Grove Mapping Project, and the Giant Sequoia Grove Inventory. Lewis earned his Bachelor of Science in Forest Management from Northern Arizona University in Flagstaff, and did post-graduate study in Silviculture at Northern Arizona University, Utah State University, and Colorado State University.

Cherie Klein; GIS Coordinator

Cherie Klein is currently the GIS Coordinator on the Hume Lake Ranger District of the Sequoia National Forest. She has worked for the Forest Service for 14 years in the Pacific Southwest Region. She has held jobs in silviculture and database management, and is now the district's GIS coordinator, GPS coordinator, and computer systems support.

Mike Landram; Regional Silviculturist

Mike Landram is currently the Regional Silviculturist for Region 5 (California) of the Forest Service. He has 22 years of experience with the Forest Service as a District Silviculturist, Assistant Regional Reforestation and TSI Program Manager, and Regional Silviculturist, as well as one year of experience with the Bureau of Land Management. Mike earned a Bachelor of Science Degree in Forest Management and a Masters Degree in Business Administration from Northern Arizona University, Flagstaff.

Steve Pintek; District Ecosystem Manager

Steve Pintek is currently the Ecosystem Manager for the Tule River and Hot Springs Ranger Districts of the Sequoia National Forest. He has 27 years of experience with the Forest Service as an Ecosystem Manager, Timber Management Officer, Silviculturist, Timber Sale Prep Officer, Timber Planner, and Compartment Inventory Specialist, as well as 2 years of experience in state, private industry, and consultant forestry. Steve earned a Bachelor of Science Degree in Forest Management from the University of Idaho in Moscow.

Catherine Phillips; Woodland Ecologist

Catherine has her Bachelors of Science degree from Humboldt State University where she studied range management, soils and botany. She earned her Master of Science degree in range ecology from University of California at Berkeley. Catherine began work with the Forest Service in 1990 as an intern for the Ecology Program. She held a liaison position between the Pacific Southwest Research Station and the Forest Service's Regional Office as the Research Natural Area coordinator for two years. In 1993 she transferred to the Stanislaus National Forest to her current position as Assistant Province Ecologist.

Neil G. Sugihara; Regional Fire Ecologist

Neil Sugihara has a B.A. in Botany from Humboldt State University, an M.A. in Biology, also from Humboldt State University, and a Ph.D. in Wildland Resource Science from the University of California, Berkeley. He has spent seven years as Fire Ecologist, five years as Ecologist (both with the Forest Service), three years as Research Specialist at U.C. Berkely, and nine years as Botanist/Ecologist at Redwood National Park. He has authored about 20 publications in plant ecology, mycology, and ecosystem restoration.

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF
· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Chapter VI Document Recipients

List of Agencies, Organizations, and Persons to Whom Copies of this DEIS Were Sent. VI-1 | Scientific Advisory Board. VI-2 | Federal Officials and Agencies. VI-2 | State Officials And Agencies. VI-3 | Local Officials, Agencies, And Organizations. VI-4 | Organizations. VI-4 | Academic Institutions. VI-6 | Libraries. VI-6 | Businesses. VI-6 | Media. VI-7 | Individuals. VI-7

List of Agencies, Organizations, and Persons to Whom Copies of this DEIS Were Sent

Scientific Advisory Board

Dr. Jeanne N Clarke, Ph.D., University of Arizona

Dr. David M Graber, Ph.D., USDI Sequoia-Kings Canyon National Park

Dr. Karen Nissen, Ph.D., California Department of Transportation (Cal-Trans)

Dr. Douglas Piirto, Ph.D., University - Cal Poly

Dr. Nathan L Stephenson Ph.D., USDI Sequoia-Kings Canyon Park

Dr. Daniel R Tormey, Ph.D., Entrix Incorporated

Dr. Paul E Waggoner, Ph.D., Connecticut Agricultural Experiment Station

Dr. George M Woodwell, Ph.D., Woods Hole Research Center

Federal Officials and Agencies

Officials

Hon. Barbara Boxer

Hon. Dianne Feinstein

Hon. George P Radanovich

Hon. Calvin Dooley

Hon. William (Bill) Thomas

Agencies

Advisory Council on Historic Preservation (ACHP)

Department of Agriculture (USDA)

USDA Forest Service

USDA Natural Resources Conservation Service, National Environmental Coordinator

USDA, National Agricultural Library

Department of Commerce (DOC)

National Marine Fisheries Service

Department of Defense (DOD)

U.S. Army Corps of Engineers, Water Management Section

U.S. Army Engineer, South Pacific Division

Department of Energy (DOE)

Director, Office of Environmental Compliance

Federal Energy Regulatory Commission (FERC)

Department of the Interior (USDI)

Director, Office of Environmental Policy and Compliance

USDI Bureau Of Indian Affairs

USDI Bureau Of Land Management

USDI Fish & Wildlife Service

USDI National Park Service

USDI Sequoia-Kings Canyon Park

Department of Transportation (DOT)

U.S. Coast Guard (USCG)

Federal Aviation Administration (FAA)

Western-Pacific Region, Regional Administrator

Federal Highway Administration

Western Region, Regional Administrator

U.S. Environmental Protection Agency (EPA)

Office of Federal Activities, EIS Filing Section

Region IX, Chief, Federal Activities Office

Indian Tribes

Tule River Tribal Council

State Officials And Agencies

Officials

California Attorney General, California Assembly Rep 29th District

California Governor, California Assembly Rep 30th District

California Senator 14th District, California Assembly Rep 31st District

California Senator 16th District, California Assembly Rep 32nd District

Agencies

California Department Of Forestry

California Department Of Fish & Game

California Department Parks & Recreation

California Department Of Transportation (Cal-Trans)

Local Officials, Agencies, And Organizations

Officials

Fresno County Supervisors

Kern County Supervisors

Tulare County Supervisors

Agencies

Fresno County Planning & Resource Management Department

Kern County Board Of Trade

Kern County Planning Department

Tulare County Parks & Recreation Department

Tulare County Resource Agency

Water Quality Control Board

Organizations

Aldo Leopold Wilderness Research

American Motorcycle Association

American Whitewater Association

Backcountry Horsemen

Boy Scouts Of America

Buck Rock Foundation

California Trout

California Association Of 4WD Clubs

California Farm Bureau

California For Western Wilderness

California Forestry Assn

California Lands Commission

California Native Plant Society

Center For Biological Diversity

Chadwick School

Connecticut Agricultural Experiment Station

Diabetic Youth Foundation

Diocese Of San Joaquin

Earth Ear

Earth Justice

Far Horizons Incorporated

Friends Of Animals

Hartland Christian Camp

High Desert Multiple-Use Coalition

Hume Lake Cabin Owners Association

Hume Lake Christian Camp

Huntington Lake Association Incorporated

Integrated Forest Management

John Muir Project, The

Kaweah Flyfishers

Kern River Revitalization

Kerncrest Audubon

McIntyre Tract Organization

Natural Resources Defense Council

National Forest Homeowners

National Forest Recreation Association

National Speleological Society

Naturalists-At-Large

Panorama Heights Property Association

Pecks Camp

Phantom Duck Club

Pine Flat Homeowners Association

Quaker Meadow Camp

R M Pyles Boys Camp

Rogers Camp Homeowners Association

Rube Creek Cattle Company

SAMS Coalition

San Joaquin Houndsmen Club

Save-The-Redwoods-League

Sequoia Forest Alliance

Sierra Club

Sierra Nevada Forest Campaign

Slate Mountain Association

Snowlands Network

Springville Chamber Of Commerce

Sugarloaf Mountain Park

Sugarloaf Mutual Water Company

Sugarloaf Snowmobile Club

Tulare County Farm Bureau

Tulare County Sportsman

Valley Citizens For Water

Wilderness Society, The

Woods Hole Research Center

Yokohl Cattle Company

Yosemite Area Audubon Chapter

Academic Institutions

University Of Arizona

University - Cal Poly

Libraries

Fresno County Library

Kern County Branch Libraries

Kings County Public Library

Tulare County Library

Businesses

Asilomar Management Corporation

Balch Park Packstation

Battle Mountain Ranch

California Land Management

Camp Nelson Mutual Water Company

Cappelen Consulting

Carver-Bowen Ranch

Cedars On Millcreek Incorporated

D & B Partnership

Doyle Springs Association

Entrix Incorporated

Erikson Air-Crane Company

Golden Trout Wilderness Pack Trains

Greystone Environment Consultants

Hafenfeld Ranch

Haglund & Kirtley

Home Realty & Land Company

Kirkpatrick Agricultural Services

Kramer Properties

Kiper & Kiper

M H Reese & Associates

Mason Bruce & Girard Incorporated

Montecito-Sequoia Camp

Pacific Bell (Rights-Of-Way)

Pactech Data & Research

Southern California Edison

Sequoia Truck Parts

Sierra Forest Products

Sierra Nevada Recreation Corp

Sierra Pacific Industries

Spallina & Krase, Attorneys

Sylvandell N R Consulting

Valley Cycle

Media

Back 40 Publishing Company

Bakersfield Californian

Fresno Bee

KFSN TV Channel 30

KFTV Channel 21

KGEP TV Channel 47

KMPH TV Channel 26

KMPH/KTRV News Radio

KSEE TV Channel 24

KTIP Radio Channel 1450

Kern Valley Sun

Porterville Recorder

Southern Sierra Messenger

Tule River Times

Upper Tule News

Visalia Times Delta

Individuals

Donald G Abbott

Albert C (Curt) Abel

Rosemary Adams

Bob Addison

Gary Adest

Ron Adkison

Rick Alexander

Roy & Terri Allard

Julie Allen

Kirk & Kerry Allen

Mary Allison

Aldolph B Amster

Steve Anderson

Tom Anderson

Dick Andrews

Loman E Atkin

Larry Arzouomanian

Philip Aune

Keith Axelson

George F. & Joan Ayers

Marian Ayers

Billie Jane Baguley

Jeff Bailey

Maureen Barile

George Baker

Jon N & Debbie J Ball

Kathy Ball

Jesus & Linda Barbosa

Mary Barcik

Dwight L Barnes

Scott Barnes

T J & Barbara Barnes

Dr Virginia V Barnes

Barbara H Bates

Daniel M Bates

Darden Baumann

Charles Baymiller Trust

Skip Baymiller

Ken & Marge Becas

Vic Bedoian

Bob Beeler

Ron Begley

Lee Belau

Mark & Gaye Belles

Russell Belton

Wayne A Bemis

Jean M Bennett

Robert Bennett

Bill Bentley

Nick Beran

Mary Chislock Bethke

Brad & Judi Billingsley

Michael D Blesse

Bruce Blodgett

Jim Blom

Richard Bloomer

Betty Bloomer

Jack L Boesch

James Bonar

Harold L Borzone Jr

Jackie Bough

Carver & Alice Bowen

Jeff & Sheila Bowen

Frances E Bowker

James F Boylan

Stephen Barile

John A & Nancy Braun

Leonard Brewton

Jeri Bridges

Paul M Brown

Richard & Irene Brown

Steve Brown

Timothy Bruck

Gail A. Bryant

Barbara Brydolf

Tim & Carol Burk

Jeff & Catherine Burnett

David A Burr

William Butler Jr

Rob Cairns

Chris Cameron

Carl Cappelen

Richard Cardella

Norm Carpenter

Marian Carter

Dennis Carver

Nathan Carver

Jim S Cassell

Kerry Cavanaugh

Joseph J Chastain

Roger & Barbara Chew

William D Chilcutt

Dale Chitwood

LaVaun Christensen

Mary Christensen

Rich Cimino

Clement & Miller

Brian Clement

Howard Clement

Kathy Clement

Carla Cloer

Peter & Carole Clum

Richard H Cochran

Henry A Collin

Kent Connaughton

Don Conner

Chris Conrad

Jess & Elaine Copeland

Bill Corcoran

Terry & Laraine Cotton

Jerry Counts

Oliver Crandell

Marvin Crum

Jim Cummings

Charles & Rosalie Dahl

Martha L. Daly

Dutler C Dauwalder

Kenneth Davis

Emmalene Davis

Terry & Debbie Davis

William Denneen

Bob & Betty Dennis

Geroge A Derkum

Maurice Des Pois

Helen Des Pois

Don L & Ann Didier

Dale E Dodge

Steven & Marian Dodge

Phillip & Jean Dodson

Ellis Doyal

Mike Drake

John & Sara Dudley

Jack Duggins

Kenneth Dull

Don E Dunham

Glenn Duysen

Kent Duysen

Larry Duysen

Ruth C Dyer

David Edelson

David B Edelson

Bob Edgeworth

James N Edwards

Edward Eisner

Thomas Eliason

Claudia Elliott

Floyd A & Lottie J Elliott

Marianne Emmendorfer

Patrick Emmert

Clara Engeseth

Jerry Eoff

Gilbert Espinosa

Edwin Ewy

Justin Faggioli

David Farabee

Pat Feeney

Ron Fellows

Laurie Fenwood

Jeri Ferguson

Clarence & Joyce Finch

Marshall & Norma Finn

Charles L Fishcer

Ken Fitch

Duane J. Fitterer

Frank Fitzgerald

James Fletcher

Wendell D Flint

Herb & Eleanor Foerster

Joe Fontaine

Carolyn Foulon

Robert Franzen

James & Raelle Frost Jr

Thomas W Fuentes

Sylvia Fuentes

GDLV, LLC

Douglas Garcia

Duane M Garfield

Russell Gash

Janice Gauthier

Dean A Gay

Aaron Gelobter

Paul Gerdes

Gary & Cindy Gerlich

Stephen L German

John & Gayle Gilbert

J Keith Gilless

Bertha Gilliam

Marvin A Gluck

Paul & Jane Godfrey

Lewis & Betty Goins

Joel & Charlene Golbek

Lynn Gorman

Dennis Grant

John Grant

George W Graves

Clidella Graves

Dennis & Alma Green

Sylvia M Gregory

Mark Grossi

Don Gumz

Rasa Gustaitis

J. Less Guthrie

Bruce Hafenfeld

Slyvia Hafenfeld

Michael Haglund

Jim Hall

Robert Hannam

Delwin W Hansen

James E Hanson

Robert Harmuth

Marti Harris

Marilyn Hartley

Ruskin Hartley

Steven Hartman

Mike Hatcher

Tim Hauert

Stanley J Haye

Gordon C Heebner

Gary E & Anne Hester

Ernest & Ruth Heuer

Alan Hill

Chris Hill

James Hines

Stanley Hoffecker

Marguerite Hoffecker

Robert Hoffman

Dolores Hoffman

Gary & Carol Hohnstein

Dan & Karen Holloway

Bert & Sue Holt

Jared Holve

Warren Hopkins

Charles & Katie Horst

Farrel Hubbard

Patrick Huber

James & Paula Huffman

Irma Hunter

James & Barbara Hunter

Philip D Hunter

Gavin Iacono

Virginia Imler

Rick Jali

Delmar Janson

Mike Jeffries

Wayne Johnson

Dale & Sharon Johnston

Pamela Jones

Judi Kaiser

John Kamansky

Linda L Kane

Richard E Kangas

Albert Kanze

Elizabeth A Kaumeyer

Russell & Dixie Keeley

Juliet Kendrick

Kenneth E Kenoyer

Donald Kern

John R & Kristi Keyes

Nicholas Khoury

Derran Killigian

John & Gay Kinder

Luis S. King

Harold Kiper

Eric Kleinfelter

Martin & Barbara Klepl

David Kope

Brett Korf

Kristopher & Kit Korf

Robert Krase

Tim Kroeker

James W Kropf

Fred Kuhlman

Richard W Kunstman

Alice Kunstman

Martin A Kupel

Richard Lafleur

Greg & Karey Lampman

Patti Laursen

Ray A Lazar

Rosemary Fox Leal

Cheryl Lehn

Rocky Leitzell

Stephon Lewis

Marcus Libkind

Jeff Lilley

Miles O Linman

Allen Linscheid

Charlene Little

Steve & Joyce LoBasso

Colene F Locke

Samuel R & Katie Logan

Terry L Logan

John R (Ray) Longley

Wanda Longueville

Lonnie Lopez

Harry Love

Gary D Lowe

Al Lowery

Christopher W Lyon

Jon C MacKenzie

Frank & Blanche Malahy

Ara L Marderosian

Robin Marlowe

Eric Mart

Frances V Martin

Richard Martin

Rick & Vera Martin

Richard Marvin

Angelina Marvin

Bernie Mateer

Bob Mateer

Richard & Cheryl Matfieg

Bob Mathias

Glen Mathias

Michael Matteson

Laura Matteson

R Brett Matzke

Dan Maymar

Bill Maze

Lisa R McClung

Aileen K McColm

Lloyd McCravey

Jerry McElhaney

Ellen McIntosh

Ralph L McKinght

Helen McKnight

Robert J McLaughlin

Jose Medina

Merritt Medows

S A (Art) Meier

John Mendoza

Roy D Milford

Ronald F & Doris Miller

Doug Mitchell

Belinda Mitchell

Roger Mitchell

John Modin

Robert Montgomery Ruth Montgomery

Gary Moore

Rowland (Rollie) Moore

Rowland W Moore

Ruth I Moore

Raymond Morgan

Bernice Morgan

Tom & Elise Murray

Gary & Judy Myerson

David Nafus

Walter & Pamela Neel

Don Nelson

Teresa A Nemeth

Guy Nenna

David & Kathie Nesbitt

Larry Newby

Paul & Jan Newton

Michael H Nicholas

Lyle Nichols

Deborah Nicol

Christopher North, PhD

Bob Nunziato

Jim O’Brien

Ruby G O'Cain

Vince Oddo

Calvin Olson

Mike & Nan Orgensen

Larry Orzechowski

David Osbelt

Don & Mildred Othman

Lorelei H Oviatt

Ron Paden

Mike Painter

Scootch Pankonin

Harry J Pappas

Ron Paregien

David J Parsons

Jack Patterson

Barbara Patrick

Randall & Debra Penner

Lloyd & Carol Picker

Mike Pierce

Neil Pilegard

Charles Pillsbury

John T & Muriel Platt

Brad Powell

Mickey Powell

Jack T Prestwich

Mark O Price

Dr Wesley D Price

Jay & Mardella Probasco

David & Barbara Prince

Bonnel Pryor

Don Pursell

Harry & Inga Rath

Clifford D Ratliff

Donald Ratliff

Maggie Lakota Ryan

William Ree

Richard Reed

Marily H Reese

Brian Rueger

Lynn Rickard

Bernadette Rickard

Edgar M Ridgeway

Beverly Ridgeway

Max V Riley

Roger & Lee Ila Riley

Charles Rippy, Jr.

Michael Roadcap

Marilee Roadcap

Jason Robertson

Dorothea Rogers

Gary Rogers

Stewart Rogers

Jeannie Rogers

William Rogers

Gil Rone

Loren Ross

Kevin Royle

Nancy C Ruthenbeck

Tim Ryan

David Saulnier

Mike Saunders

Melvin Schellenberg

Adelise Schellenberg

Ron Schiller

Robert A Schlatter

Ronald Schmidt

Rosemary Schmidt

Carl B & Anna Schorsch

John & Sharie Schrader

Stuart B Schroeder

Wendellyn Schroeder

Nate Sciacqua

Dorothy E Seele Trust

Jack R Shannon

Chuck Shaw

James Shevock

Dan Shew

John Shilling

Risa Shimoda

Kassie R Siegel

Hans Siegenthaler

Coby Siegenthaler

Malcolm O Sillars

Thomas Simonson

Marsha Skinner

Fred Smith

Harrison Smith

Jeffery L & Dana Smith

Larry & Rosalie Smith

Les & Mary K Smutz

Claudia Sobel

Jeff Sobin

Harold Spedery

Cliff Speight

John & Donna Spence

Ruth S Sperling

Laura Sperlo

John L Staed

John Stankey

Jim J Steitz

Betsy Steele

Paul M Steele

J Stephens

Stanley J Stephens

Orville & Eva Lee Stephenson

Joan Godsil Stewart

Verla M Stidman

Bonnie Strand

Phil Strand

James & Judy Strang

Del Strange

Joe Street

Don & Jan Stutsman

Lee Sunner

Lee Sutton

K Sweeney

Charles & Diane Symser

William Tallakson

Elizabeth Tallakson

Joe & Linda Tapal

Windsor P Taunton

Earl J Taylor

Judy Taylor

Bill Templin

Craig Thomas

James C Thomas

Amee Thompson

Arlo & Linda Thompson

Ronald Thompson

Rev Stanley Tilley

Jack Tinger

John T Todd

Craig Tolmie

David Toner

Michael & Susan Toth

Shannon Tracey

Mark Travaille

Diane Travis

Elwood & Dove Trotter

E V & Twila Trotter

Linda Tunnell

Andrea E Tuttle

Chad & Tamara Tuttle

Bill Tweed

Stanley Vance

Gail Vander Bie

Zoa Vang

Jake VanRuiten

Dale C Wagner

Adlida C Wainscott

Bruce Waldron

Robert & Jane Walter

Erwin & Adela Ward

Charles L Ware

William R Warren

Jay Watson

George & Ruth Watto

Carolyn Watts

Michael Weber

Bernie Weingardt

Dan Weisenberger

Horace & Shirley Wells

Kurt M Wendelyn

Janet Westbrook

Murray O Westerbeck

Marianne Wetzel

Andrew E Wetzler

Doug & Helen Wheeler

Craig A White

Ken White

Thomas & Leona White

William R White

Dwight M Willard

Jonathan Willems

Pauline Willems

Al Williams

James R Williams

Pamela Williams

Scott Williams

Norma Wilson

William Womack

Harold Wood

John Worthington

Ferd O Wright

John l & Nancy Wright

Cloren & Laura Wynn

Albert R Yackle

Jim & Betty Yates

Glenn A Zane

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF
· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Appendices:

Appendix A - Glossary | Appendix B - References | Appendix C - Summary of Framework Direction | Appendix D - Road Analysis | Appendix E - Monitoring Plan | Appendix F - Science Advisory Board Advisories | Appendix G - Presidential Proclamation | Appendix H - Overview of Modeling and Prescriptions | Appendix I - Transportation | Appendix J - Recreation Demand Analysis

Appendix A

Glossary

Acidification

The decrease of acid neutralizing capacity in water or the base saturation in soil caused by natural or anthropogenic processes.

Acid Deposition

Air pollution produced when acid chemicals are incorporated into rain, snow, fog, or mist.

Acre-Feet

A unit of volume used to measure the capacity of reservoirs. One acre-foot is a volume one foot deep covering an area of one acre. Thus an acre-foot contains 43 560 cubic feet or about 1233.482 cubic meters (0.123 348 hectare meter).

Active Crown Fire

When the main surface fire and the fire burning in the crowns are moving together across the fire front.

Airshed

A geographic area that, because of topography, meteorology, and/or climate, is frequently affected by the same air mass.

Alluvial Fans

Fan-shaped deposits of water-transported material (alluvium) which typically form at the base of topographic features where there is a marked break in slope.

Alluvium

Unconsolidated gravel, sand, and finer rock debris deposited principally by running water, found locally on the floors of canyons and valleys.

Aquatic

Growing or living in or frequenting water; taking place in or on water.

Aquatic Ecosystem

A stream channel, lake or estuary bed, the water itself, and the biotic (living) communities that occur therein.

Arkosic

Having a mineralogy that contains at least 25 percent feldspar.

Attainment Area

A geographic area in which levels of a criteria air pollutant meet the health-based national ambient air quality standard for that specific pollutant.

Basin

The drainage or catchment area of a river or stream.

Beneficial Uses

There are 24 categories of beneficial uses, including water contact recreation, non-water contact recreation, municipal water supply, cold fresh water habitat, and more. Each body of water in the state has a set of beneficial uses it supports that may or may not include all 24 categories. Different beneficial uses require different water quality control. Therefore, each beneficial use has a set of water quality objectives designed to protect that beneficial use.

Bioregions

An area constituting a natural ecological community with characteristic flora, fauna, and environmental conditions and bounded by natural rather than artificial borders.

Carbonate

A mineral compound characterized by a fundamental anionic structure of CO_3^{-2}. Calcite and aragonite, $CaCO^3$, are examples of carbonate minerals.

Carbonate Endemic

Restricted or peculiar to a locality or region where carbonate type minerals occur. Limestone and marble are examples of carbonate rocks.

Carbon Monoxide

A criteria air pollutant that is a colorless, odorless, poisonous gas produced by incomplete combustion, particularly incomplete burning of carbon-based fuels (e.g., gasoline, oil, and wood).

Closed System

A system where water escapes only through evaporation.

Complexity Cover

A rating of cover provided by overhanging vegetation, wood, rock, overhanging banks and white water in a habitat type. Measure of fishery habitat.

Condition Class

Condition classes have been developed to categorize the current condition with respect to each of the historic fire regime group. The relative risk of fire-caused losses of key components that define the system increases for each respectively higher numbered condition class, with little or no risk at the Class I level. Features of each condition class are defined through a qualitative description of the current state of five key ecosystem attributes; disturbance regime; effects of disturbance agents; potential production of smoke emissions; hydrologic function; and vegetative composition, structure, and resilience.

Confluence

The point where two streams meet and flow together.

Control Burn

A type of fuel treatment whereby fire is intentionally set in wildland fuels under prescribed conditions and circumstances. Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and National Environmental Policy Act requirements must be met, prior to ignition.

Critical Aquatic Refuge

A relatively small watershed, ranging in size from about 3,000 to 85,000 acres, that has localized populations of rare and/or at-risk populations of native fish and/or amphibians.

Defensible Fuel Profile Zone (DFPZ)

A system of linear or mosaic patch treatments of forest or shrub vegetation designed and treated to reduce fire spread and intensity, as well as to create barriers to fire spread. This treatment is similar to a fuelbreak, but tends to be wider and can be used as a base treatment for other nonlinear treatments.

Criteria Air Pollutant

A group of very common air pollutants regulated by the Environmental Protection Agency on the basis of criteria, and for which a national ambient air quality standard is established (e.g., SO2, NO2, PM10, Pb, CO, O3).

Crown Base Height

The distance from the top of surface fuels to the base of tree crowns. This measurement helps determine the potential for crown fire initiation during a wildland

fire.

Delta

A triangular alluvial deposit at the mouth of a river.

Dendritic Drainage

Treelike or resembling the pattern of branches and twigs of a deciduous tree. This pattern develops when streams flow over rocks that are fairly uniform in their resistance to erosion. This network pattern is the result of random flow.

Desired Condition

A statement describing a common vision for a key resource in the Monument; a future state to achieve for that resource.

Distributary

A branch of a river that flows away from the main stream.

Drainage Area

The geographical area draining into a river or reservoir.

Emissions

Release of pollutants into the air from a source.

Endangered Species

Those plant or animal species that are in danger of extinction throughout all or a significant portion of their range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Ephemeral Stream

Streams that flow only as the direct result of rainfall or snowmelt. They have no permanent flow.

Fine Fuels

Fuels that ignite readily are consumed rapidly by fire (e.g., cured grass, fallen leaves, needles, small twigs less than ¼ inch diameter, also referred to as 1-hour fuels).

Fire Extent

The size of the area that burned.

Fire Frequency

A general term referring to the recurrence of fire in a give area over time. A frequent fire return interval rarely allows organic fuels to accumulate to a point where higher intensity fires may develop.

Fire Hazard

A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree of ignition and of resistance to control. For example, the moisture content of the fuel will influence the ability of the fuel to catch and sustain fire (degree of ignition) and how difficult it will be to control or extinguish the fire (degree of control).

Fire Management Plan

An approved plan that describes how prescribed fires and naturally caused wildland fires will achieve resource management objectives.

Fire Regime

The combination of fire frequency, predictability, intensity, seasonality, and extent characteristic of fire in an ecosystem.

Fire Return Interval

Expressed as a range of years or as the arithmetic average (mean fire return interval) of all fire intervals in a given area over a given time period.

Fire Susceptibility

A relative ranking of hazard, risk, and severity of large, severe fires. An assessment of the susceptibility of forest lands to wildfire.

Fire Risk

The chance of a fire starting, as affected bya the nature and incidence of causative agents. Any causative agent.

Forest Road

Any road wholly or partly within, adjacent to, and serving the National Forest System, which is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources (23 USC 101).

Forest Service Sensitive Species

Plant or animal species, which are susceptible to habitat changes or impacts from activities. The official designation is made by the USDA Forest Service at the regional level and is not part of the designation of threatened or endangered species made by the U.S. Fish And Wildlife Service.

Fuel Hazard

A fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition and resistance to control.

Fuelbreak

A system of linear or mosaic patch treatments of forest or shrub vegetation designed and treated to reduce fire spread and intensity, and create barriers to fire spread.

Fuels

Plants and woody vegetation, both living and dead, that are capable of burning.

Fuels Management

The planned manipulation and/or reduction of living and dead forest fuels to meet objectives or desired conditions set in the Forest Land Management and Resource Plan or other land use documents.

Fuels Treatment

The treatment process needed to reach or make steps to reach a desired condition. And, if fuels are left untreated, it would interfere with effective fire management or control. For example, prescribed fire is a fuel treatment that can reduce fuels that accumulate on the forest floor.

Fugitive Dust

Dust emitted from diffuse or ill-defined conditions other than a stack or chimney.

Fine Particle

Particulate matter less than 2.5 microns in diameter.

Glaciated

To cover with ice or a glacier; to subject to or affect by glacial action.

Hand Treatment

Manipulation of vegetation and fuels with tools that can generally be carried and used by one person. These tools include, but are not limited to, chainsaws, handsaws, axes, and loppers. Chippers will sometimes be an integral part of hand treatment.

Hanging Valleys

A former glacial tributary valley that enters a larger glacial valley above its base, high up on the valley wall.

Hazard Reduction

In fuels management, the planned treatment or manipulation of naturally growing vegetation or any other flammable material for the purpose of reducing the rate of spread and the output of heat energy from any wildland fire occurring in the treated area.

Hazard Reduction Prescription

The specific parameters used to describe the conditions such as specific width, patch size and shape, species composition, diameter distributions, canopy cover, surface fuel mosaic, fire behavior, and location. They are determined at the site-specific project level based on topography, access, vegetation, risk of ignition, and potential fire behavior (this includes weather and wind).

Heavy Equipment

Large, usually self-propelled machinery that can be used off roads and that usually requires highly trained operators. Heavy equipment includes, but is not limited to, bulldozers, feller-bunchers, cables, loaders, graders, backhoes, and chippers.

High Fire Danger (Weather)

Weather conditions which influence fire ignition, behavior, and suppression, under the worst case scenario. Typically quantified by 90th, 95th, or 98th percentile weather days. These days are the average worst weather characterized by high temperatures,

low humidities, and/or high winds.

Hybridized Species

To render hybrid; to produce by mixture of species.

Hydrologic Unit Code

The United States is divided and sub-divided into successively smaller hydrologic units, which are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to eight digits based on the four levels of classification in the hydrologic unit system.

Indigenous (Species)

Any species of plant or animals native to a given land or water area by natural occurrence.

Intermittent Drainages

Streams which flow part of the time and when flowing may flow subsurface along its length.

Inversion Layer

In meteorology, a departure from the normal decrease of temperature with increasing altitude such that the temperature is higher at a given height in the inversion layer than would be expected from the temperature below the layer. This warmer layer leads to increased stability and limited vertical mixing of air.

Karst

A type of topography that is formed on limestone, gypsum, and other rocks by dissolution, characterized by sinkholes, caves, and underground drainage.

Lacustrine

Found in, or pertaining to, lakes or ponds, the deposits which have been accumulated in fresh-water areas.

Maintained for Public Use

A Memorandum of Understanding with the Federal Highway Administration defines national forest system roads open to the public as those roads open to unrestricted use by the general public in standard passenger cars, including those roads open on a seasonal basis or for emergencies (Sierra Nevada Forest Plan Amendment, Final EIS, Chapter 3, page 444).

Management Area

Areas within the Monument with similar management emphases.

Management Emphasis

A mix of uses and activities that would move a management area toward the desired condition in a manner consistent with the management goals.

A specific multiple-use direction applicable to that management area.

Management Goal

Overall purpose of management aimed at attaining the desired condition for a key resource in the Monument.

A concise statement of a condition to be achieved sometime in the future.

A concise statement that describes an intended result.

Mechanical Treatments

Includes those treatments conducted with heavy equipment such as piling or rearranging fuels for later burning, moving trees that have been thinned to a collection area, chopping or masticating fuels to change their flammability, or moving fuels away from trees or other special features to reduce the risk of damage from fire. Mechanical fuel treatments are commonly followed by prescribed fire to burn the fuel that has been piled or rearranged.

Metamorphic

Said of a rock or rock body derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, essentially in the solid state, in response to marked changes in temperature, pressure, shearing stress, and chemical environment.

Micromhos

One-millionth of an mho. The mho is a unit of electrical conductance.

Morphology

The observation of the form of the land.

National Ambient Air Quality Standards (NAAQS)

Permissible levels of criteria air pollutants established to protect public health and welfare.

National Forest System Roads

Forest roads under the jurisdiction of the Forest Service (23 USC 101).

Native Fish Associations

Assemblage of fish species typically found together in nature.

Naturalized Species

A species not native to an area, but now well established.

Nitrates

Those gases and aerosols that have origins in the gas-to-aerosol conversion of nitrogen oxides (e.g., NO2). O primary interest are nitric acid and ammonium nitrate. Ammonium nitrate is very hygroscopic so its contribution to visibility impairment is magnified in the presence of water vapor.

Nitrogen Dioxide (NO2)

A gas consisting of one nitrogen and two oxygen atoms. It absorbs blue light and therefore has a red-brown color associated with it.

Nitrogen Oxides (NOx)

A criteria pollutant, compounds NO, NO2, NO3, N2O5, alkyl nitrates, etc.

Nonattainment Area

An area designated by the Environmental Protection Agency Administrator pursuant to Section 107(d) of the Clean Air Act as having air quality which does not meet one or more national ambient air quality standards.

Ozone (O3)

A gas similar to oxygen that is a criteria air pollutant and a major constituent of smog.

PCBs

PCB's are a class of chemicals known as polychlorinated biphenyls. They are entirely man-made and do not occur naturally. PCB contamination from historic uses and dumping is widespread throughout the U.S. and the world. Disposal into waterways has caused PCB contamination of rivers, oceans, soils and even the polar ice cap. As a result, many forms of wildlife have become contaminated with PCBs. The EPA has established a maximum contaminant level of 0.5 parts per billion of PCBs in drinking water.

PM10

A criteria air pollutant that is particulate matter in ambient air less than 10 microns in diameter.

Paleoecology

The study of the relationships between ancient organisms and their environments, the death of organisms, and their burial and post-burial history in the geologic past, based on fossil faunas and floras and their stratigraphic position.

Paleohistory

Said of or pertaining to something in the past that is prior to the written records of man.

Pertaining to prehistory, i.e., the study of man during the time prior to written records.

Particulate Matter

Dust, soot, and other tiny bits of solid materials that are released into and move around in the air.

Peak Flow

Highest flow elevation in the annual flood series.

Perennial Stream

A stream that typically has running water on a year-round basis.

Permeable

Capable of being permeated, or passed through; yielding passage; passable; penetrable. Substances which allow the passage of fluids.

Petroglyphs

Literally, a rock carving; it usually excludes writing and therefore is of prehistoric or protohistoric age.

Phytotoxic

Poisonous to plants.

Pleistocene

The time period that spanned from 1.8 million to 11,000 years ago

Pliocene

The time period that spanned from 5 to 1.8 million years ago.

Prescribed Fire or Burn

A type of fuel treatment whereby fire is intentionally set in wildland fuels under prescribed conditions and circumstances. Prescribed burns are frequently used to reduce the risk of large, severe fires and to re-establish more frequent fire return intervals in fire-dependent ecosystems. Tools associated with prescribed fire include, but are not limited to, ground-based ignition devices such as drip torches, helicopter-based ignition devices, portable gas-powered water pumps, chainsaws, hand tools, fire trucks, and other vehicles.

Public Roads

Roads that are under the jurisdiction of and maintained by a public authority, that are open to public travel (23 USC 101(a)).

Recreation Opportunity Spectrum (ROS)

A means of classifying and managing recreation opportunities based on physical setting, social setting, and managerial setting.

Primitive: An area three miles or more from roads and trails having motorized use; generally 5,000 acres or more in an essentially unmodified natural environment.

Semi-Primitive Non-Motorized: An area one-half mile from roads and trails having motorized use; generally 2,500 to 5,000 acres with only subtle modification to an otherwise natural setting.

Semi-Primitive Motorized: Same as semi-primitive non-motorized, but with motorized use of roads and trails, including off-road vehicle touring, snowmobile, hiking, cross-country skiing, etc.

Roaded Natural: An area one-half mile or less from roads; resource modifications range from evident to strongly dominant.

Rural: The setting is substantially modified with structures or other cultural modifications.

Urban: The setting is strongly dominated by structures, highways, and streets.

Regional Haze

A cloud of aerosols extending up to hundreds of miles across a region and promoting noticeably hazy conditions.

Restoration Treatment Area

A system of linear or mosaic patch treatments of forest or shrub vegetation designed and treated to re-introduce fire to the ecosystem.

Riparian

Of, on, or relating to the banks of a natural course of water.

Roof Pendant

A downward projection of metamorphic rock into an igneous intrusion.

A geologic formation that represents country that existed before intrusion of the granitic rock material that is responsible for the Sierra Nevada mountains.

Scenic Integrity Levels or Objectives

Very High: Unaltered. Landscapes where the valued landscape character is intact with only minute if any deviations. The existing landscape character and sense of place is

expressed at the highest possible level. Comparable to VQO of Preservation.

High: Appears unaltered. Landscapes where the valued landscape character appears intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident. Comparable to VQO of Retention.

Moderate: Slightly altered. Landscapes where the valued landscape character appears slightly altered. Noticeable deviations must remain visually subordinate to the landscape character being viewed. Comparable to VQO of Partial Retention.

Low: Moderately altered. Landscapes where the valued landscape character appears moderately altered. Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within. Comparable to the VQO of Modification.

Very Low: Heavily altered. Landscapes where the valued landscape character appears heavily altered. Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain (landforms) so that elements such as unnatural edges, roads, landings, and structures do not dominate the composition. Comparable to the VQO of Maximum Modification.

Smog

A mixture of air pollutants, principally ground-level ozone, produced by chemical reactions involving smog-forming chemicals.

Stand-Replacing Fire

A fire that burns with sufficient intensity to kill the majority of living vegetation over a given area (fires in grass and brush are stand replacement fires for those vegetative types; in forest vegetative types, where 75-80% of the stand is killed by fire).

Standards and Guidelines

Requirements which preclude or impose limitations on resource management activities, generally for the purpose of environmental protection. The primary instructions for land managers, including required (standards) and recommended (guidelines) actions necessary for resource management activities.

State Implementation Plan

A collection of regulations used by the state to carry out its responsibilities under the Clean Air Act.

Strategically Placed Area Treatments (SPLATs)

A system of linear or masaic patch treatments of forest or shrub vegetation designed and treated to reduce fire spread and intensity, and create barriers to fire spread.

Stratigraphic

The study of rock strata, especially the distribution, deposition, and age of sedimentary rocks.

Sulfates

Those aerosols that have origins in the gas-to-aerosol conversion of sulfur dioxide. Of primary interest are sulfuric acid and ammonium sulfate. Sulfuric acid and ammonium sulfate are very hygroscopic so their contribution to visibility impairment is magnified in the presence of water vapor.

Sulfur Dioxide (SO2)

A gas consisting of one sulfur and two oxygen atoms. Of interest because sulfur dioxide converts to an aerosol.

Thinning

A silvicultural or fuels treatment that reduces the density of trees in a stand. The purpose of thinning is frequently to improve residual tree health, growth, and vigor; minimize mortality from drought and insects; reduce fuels; and manage for desired species composition. A thinning is commonly followed by a fuel treatment such as piling or prescribed burning to reduce surface fuels.

Threatened (Species)

Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future, as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

Toxic Air Pollutants

Airborne chemicals that cause serious health and environmental effects.

Tributary

A stream that flows into a larger stream or other body of water.

Unclassified Roads

Roads on National Forest System lands that are not needed for, and not managed as part of, the forest transportation system, such as unplanned roads, abandoned travelways, or off-road vehicle tracks which have not been designated and managed as a trail, and those roads no longer under permit or authorization (Sierra Nevada Forest Plan Amendment, Final EIS, Chapter 3, page 444).

Visibility

Air quality evaluated in terms of pollutant particles and gases that affect how well one can see through the atmosphere.

Visual Quality Objectives (VQOs)

A set of measurable maximum levels of future alteration of a characteristic landscape.

Preservation: Ecological change only.

Retention: Human activities are not evident to the casual forest visitor.

Partial Retention: Human activities may be evident but must remain subordinate to the characteristic landscape.

Modification: Human activity may dominate the characteristic landscape but must, at the same time, follow naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Maximum Modification: Human activity may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background.

Volatile Organic Compounds (VOCs)

Organic compounds that vaporize readily and contribute to the development of ozone.

Watershed

The region draining into a river, river system, or other body of water.

The entire region drained by a waterway, lake, or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

Weir

A dam placed across a river or canal to raise or divert the water, as for a millrace, or to regulate or measure the flow.

Well-sorted

Measurement of uniform particle size in a sediment.

Wildland Fire

Any fire that occurs on wildlands that is not a prescribed fire.

Wildland Fire Threat

The potential fire behavior and related fire effects (rate of spread, fire intensity, tree mortality, structure loss, etc.) due to the interactions of fuels, weather, and topography.

Wildland Fire Use

A naturally (lightning) ignited fire that is managed to meet resource objectives. Wildland fires can be used to meet resource objectives such as reducing fuel loads and restoring fire return intervals.

Return to top of page.

Appendix B

References

Agee, J., B. Bahro, M. Finney, P. Omi, D. Sapsis, C. Skinner, J. VanWagtendonk, and C.P. Weatherspoon. 1999. The Use of Shaded Fuelbreaks in Landscape Fire Management. *Forest Ecology and Management* 127(2000):55-66.

Agee, J.K. 1993. Fire Ecology of Pacific Northwest Forests. Island Press, Washington, DC.

Agee, J.K. 1996. The Influence of Forest Structure on Fire Behavior. Presented at the 17th Annual Forest Vegetation Management Conference. Redding, CA, January 16-18, 1996.

Anderson, M.K. 1993. The Mountains Smell Like Fire. *Fremontia* 21(4):15-20.

Andrews, R.S., ed. 1994. Ecological Support Team Workshop Proceedings for the California Spotted Owl Environmental Impact Statement, August 1993. U.S. Forest Service, Pacific Southwest Region. San Francisco, CA.

Barro, S.C. and S.G. Conard. 1991. Fire Effects on California Chaparral Systems: An Overview. *Environment International* 17:135-149.

Blumenthal, D.L., T.B. Smith, D.E. Lehrman, R.A. Rasmussen, G.Z. Whitten, and R.A. Baxter. 1985. Southern San Joaquin Valley Ozone Study, Final Report, Prepared for Western Oil and Gas Association, by Sonoma Tech. Inc., and Systems Application Inc.

Botti, S.J., and H.T. Nichols. 1995. Availability of Fire Resources and Funding for Prescribed Natural Fire Programs in the National Park Service. In: Proceedings, Symposium on Fire in Wilderness and Park Management, March 30-April1, 1993, Missoula, MT, technical coordination by J.K. Brown, R.W. Mutch, C.W. Spoon, and R.H. Wakimoto, pages 74-103. General Technical Report INT-GTR-320. USDA Forest Service, Intermountain Research Station, Ogden, UT.

Bradford, D.F. 1991. Mass Mortality and Extinction in a High Elevation Population of Rana Muscosa. Journal of Herpetology 25(2):174-177.

Bradford, D.F., D.M. Graber, and F. Tabatabai. 1993. Isolation of Remaining Populations of the Native Frog, Rana muscosa, by Introduced Fishes in Sequoia and Kings Canyon National Parks, California. Conservation Biology 7(4):882-888.

Brown, P. 1996. Presentation to the Natural History and Management of Bats in California and Nevada Workshop. Sacramento, CA.

Bury, R.B. and T.G. Balgooyen. 1976. Temperature Selectivity in the Legless Lizard, *Anniella pulchra*. Copeia 1:152-155.

Bytnerowicz, A., M.E. Fenn, P.R. Miller, and M.J. Arbaugh. 1999a. Wet and Dry Pollutant Deposition to the Mixed Conifer Forest. In P.R. Miller and J.R. McBride (eds.), *Oxidant Air Pollution Impacts in the Montane Forests of Southern California*, pages 235-269. Springer-Verlag, New York.

California Air Resources Board. January, 2001. *Almanac 2001*. Chapter 4: Air Basin Criteria Pollutant Emission and Air Quality Trends and Forecasts. California Air Resources Board. Sacramento, CA.

California Native Plant Society. 1997. Inventory of Rare and Endangered Plants of California. Rare Plant Scientific Advisory Committee, California Native Plant Society, Sacramento, CA.

California State Parks. March, 1998. Public Opinions and Attitudes on Outdoor Recreation in California 1997, An Element of the California Outdoor Recreation Planning Program.

CalFlora Database. 2000. CalFlora: Information on California Plants for Education, Research, and Conservation. Berkeley, CA. (http://www.calflora.org)

Caprio, A.C., L.S. Mutch, T.W. Swetnam, and C.H. Baisan. 1994. Temporal and Spatial Patterns of Giant Sequoia Radial Growth Response to a High Severity Fire in A.D. 1297. Contract report to the California Department of Forestry and Fire Protection, Mountain Home State Forest.

Chang, C.R. 1996. Ecosystem Responses to Fires and Variations in Fire Regimes, Chapter 39. In: Sierra Nevada Ecosystem Project, Assessments and Scientific Basis for Management Options, Final Report to Congress, Volume II. Wildland Resource Center, Davis, CA.

Cooper, C.F. 1961. The Ecology of Fire. *Scientific American* 204:150-160.

Cordell, H. Ken, Principal Investigator. 1999. Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends.

Despaine, Joel. 2002. Summary of Known Caves in the Giant Sequoia National Monument. Personnel Communication. Sequoia and Kings Canyon National Parks, Three Rivers, CA.

Dodge, M. 1972. Forest Fuel Accumulation - A Growing Problem. *Science* 177:139-142.

Duellman, W.E. and L. Trueb. 1986. Biology of the Amphibians. McGraw-Hill Publishing Company. New York, NY. 670 pages.

Evans, L.S. and M.R. Leonard. 1991. Histological Determination of Ozone Injury Symptoms of Primary Needles of Giant Sequoia. *New Phytologist* 117:557-564.

Ewell, D., R. Flocchini, L. Myrup, and T. Cahill. 1989. Aerosol Transport in the Southern Sierra Nevada. *Journal of Applied Meteorology* 28:112-125.

Eyre, F.H. 1980. Forest Cover Types of the United States and Canada. Society of American Foresters, Washington, DC.

Fisher, R.N. and T.J. Case. 1997. A Field Guide to the Reptiles and Amphibians of Coastal Southern California. Biological Resources Division, US Geological Survey. 46 pages.

Finney, M.A. 1999. "Design of Regular Landscape Fuel Treatment Patterns for Modifying Fire Growth and Behavior". USDA Forest Service, Rocky Mountain Research Station, P.O. Box 8089, Missoula, MT 59807.

Fites-Kaufman, J.A. 1997. "Historic Landscape Pattern and Process: Fire, Vegetation, and Environment Interactions in the Northern Sierra Nevada." Ph.D. dissertation. University of Washington, Seattle, WA.

Fry, W. 1933. The Giant Sequoia Avalanche. *Sierra Club Bulletin* 18(1):118-120.

Fry, W. and J.R. White. 1948. Big Trees. Revised enlarged edition. 126 pages. Stanford University Press. Palo Alto, CA.

Fullmer, Donald G., Robert R. Rogers, Jeffrey D. Manley, and Nathan L. Stephenson. 1996. Restoration as a Component of Ecosystem Management for Giant Sequoia Groves in California. In: The Role of Restoration in Ecosystem Management, pages 109-115. Society for Ecological Restoration.

Gary, Margaret, et al. 1974. Glossary of Geology, page 430. American Geologic Institute, Washington, D.C.

Goldberg, S.R. and C.M. Miller. 1985. Reproduction in the Silvery Legless Lizard, *Anniella pulchra,* in Southern California. Southwestern Naturalist 30 (4), pages 617-618.

Graumlich, J.J. 1993. A 1000-year Record of Temperature and Precipitation in the Sierra Nevada. *Quaternary Research* 39:249-255.

Green, L.R. 1977. Fuelbreaks and Other Fuel Modification for Wildland Fire Control. Agricultural Handbook 499. USDA Forest Service, Washington, DC.

Green, L.R., and H.E. Schimke. 1971. "Guides for Fuelbreaks in the Sierra Nevada Mixed Conifer Type." USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.

Greenlee, J.M. 1973. A Study of the Fire Ecology of the Emigrant Basin Primitive Area. Stanislaus National Forest, Sonora, CA. USDA Forest Service. 105 pages.

Grulke, N.E., P.R. Miller, R.D. Wilborn, and S. Hahn. 1989. Photosynthetic Response of Giant Sequoia Seedlings and Rooted Branchlets of Mature Foliage to Ozone Fumigation. In: *Effects of Air Pollution on Western Forests*, Transactions Series No. 16, pages 422-429. Air and Waste Management Association, Pittsburgh.

Grulke, N.E., P.R. Miller, and D. Scioli. 1996. Response of Giant Sequoia Canopy Foliage to Experimentally Manipulated Levels of Atmospheric Ozone. *Tree Physiology* 16:575-581.

Hanes, T. L. 1977. California Chaparral. In: Terrestrial Vegetation of California, edited by

M.G. Barbour and J. Major, pages 417-469. John Wiley and Sons. New York.

Hansen, R.W. 1997. Salamander Diversity in the Kern Valley Region. Kern River Research Center Fieldnotes 6(2):1-3.

Harlow, W.M., E.S. Harrar and F.M. White. 1978. Textbook of Dendrology. 6th edition. McGraw-Hill, Inc.

Harvey, H.T., H.S. Shellhammer, and R.E. Stecker. 1980. Giant Sequoia Ecology. National Park Service. Washington, DC.

Hayes, M.P. and M.R. Jennings. 1986. Decline of Ranid Frog Species in Western North America: Are Bullfrogs (*Rana catesbeiana*) Responsible? Journal of Herpetology 20(4):490-509.

Hemphill, D.V. 1952. The Vertebrate Fauna of the Boreal Areas of the Southern Yolla Bolly Mountains, California. PhD Dissertation, Oregon State College, Corvallis, Oregon.

Husari, S.J. 1980. Fire Ecology of the Vegetative Habitat Types in the Lassen Fire Management Planning Area (Caribou Wilderness and Lassen Volcanic National Park). In: Fire Management Plan, Lassen Fire Management Planning Area, Caribou Unit. Lassen Volcanic National Park and Lassen National Forest.

IPCC (Intergovernmental Panel on Climate Change). 2001. Climate Change 2001: The Scientific Basis, Summary for Policy Makers. www.ipcc.ch/pub/spm22-01.pdf.

Jennings, M.R. 1988. Natural History and Decline of Native Ranids in California. Pages 61-72 in Proceedings of the Conference on California Herpetology. Eds. H.P. DeLisle, P.R. Brown, B. Kaufman, and B.M. McGurty.

Jennings, Mark R. and Marc P. Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. Final Report Submitted to the California Department of Fish and Game, Inland Fisheries Division, Contract #8023. Sacramento, CA. 255 pages.

Keane, R., E.D. Reinhardt and J.K. Brown. 1995. FOFEM: A First Order Fire Effects Model. In: Proceedings: Symposium on Fire in Wilderness and Park Management, page 214. USDA Forest Service General Technical Report, INT-GTR-320.

Keeley, J.E. 1982. Distribution of Lightning and Man-caused Wildfires in California. In: *Proceedings of the Symposium on Dynamics and Management of Mediterranean-type Ecosystems*, technical coordination by C.E. Conrad and W.C. Oechel, pages 431-437. General Technical Report PSW-58. USDA Forest Service, Pacific Southwest Research Station. Berkeley, CA.

Keeley, J.E. 1991. Fire Management for Maximum Biodiversity of California Chaparral. In: C.S. Nodvin and T.A. Waldrop eds. Proceedings of an International Symposium on Fire and the Environment: Ecological and Cultural Perspectives, March 20-24, 1990. General Technical Report SE-69. USDA Forest Service, Southeastern Forest Experiment Station.

Keifer, MaryBeth, N.L. Stephenson, and J. Manley. 2000. Prescribed Fire as the Minimum Tool for Wilderness Forest and Fire Regime Restoration: A Case Study from the Sierra Nevada, California. In: Proceedings: Wilderness Science in a Time of Change. May 23-27, 2000. Proc. RMRS-P-000. USDA Forest Service, Rocky Mountain Research Station, Missoula, MT.

Kilgore, B.M. 1971. The Role of Fire in Managing Red Fir Forests. In: Transactions of the 36th North American Wildlife and Natural Resource Conference, **March 7-1, pages 405-416. Wildlife Management Institute. Washington, DC.

Kilgore, B.M. 1973a. The Ecological Role of Fire in Sierran Conifer Forests: Its Application to National Park Management. *Quaternary Research* 3:496-513.

Kilgore, B.M. 1973b. Fire in Ecosystem Distribution and Structure: Western Forests and Scrublands. In: *Proceedings of the Conference on Fire Regimes and Ecosystem Properties*, technical coordination by H.A. Mooney, T.M. Bonnicksen, L.L. Christensen, J.E. Lotan, and W.A. Reiners, pages 58-89. General Technical Report WO-26. U.S. Forest Service. Washington, DC.

Kilgore, B.M. and R.W. Sando. 1975. Crown-fire Potential in a Sequoia Forest After Prescribed Burning. *Forest Science* 21(1): 83-87.

Kilgore, B.M. and D. Taylor. 1979. Fire history of a sequoia-mixed conifer forest. Ecology 60:129-142.

Kilgore, B.M. 1987. The Role of Fire in Wilderness: A State-of-knowledge Review. In: *Proceedings of the National Wilderness Research Conference: Issues, State-of-knowledge, Future Directions*, compiled by R. C. Lucas, pages 70-103. General Technical Report INT-220. U.S. Forest Service, Intermountain Research Station. Ogden, UT.

Knapp, R. 1994. Wilderness Record. Volume 19, Number 2. Davis, California.

Lehrman, D.E., T.B. Smith, W.R. Knuth, C.E. Dorman, 1994. Meteorological Analysis of the San Joaquin Valley Air Quality Study, Atmospheric Utilities Signature, Predictions and Experiments Program (SJVAQS/AUSPEX). Prepared for PG&E and CARB by Technical and Business Systems Inc.

Leiberg, J.B. 1902. Forest Conditions in the Northern Sierra Nevada, California. Professional Paper No. 5, Series H, Forestry 5. USDI Geological Survey, Washington, DC.

Lewis, H.T. 1993. Patterns of Indian Burning in California: Ecology and Ethnohistory. In: Before the Wilderness: Environmental Management by Native Californians, edited by T.C. Blackburn and K. Anderson, pages 55-116. Ballena Press, Menlo Park, CA.

Lind, A. ****. Herpetologist, Redwood Sciences Laboratory, personal communication.

Mann, M.E., R.S. Bradley, and M.K. Hughes. 1998. Global-scale Temperature Patterns and Climate Forcing over the Past Six Centuries. *Nature* 392:779-787.

Martin, D.L. 1992. Sierra Nevada Anuran Guide. Canorus, LTD. Ecological Research Team. San Jose, CA.

Mathews, Robert A. and John L. Burnett. 1965. Geologic Map of California, Olaf P. Jenkins Edition, Fresno Sheet. Scale 1:250,000. California Division of Mines and Geology, Sacramento CA.

McDonald, P.M. 1990. Quercus Kellogii Newb. In: *Hardwoods*, Vol. 2, of *Silvics of North America*, technical coordination by R.M. Burns and B.H. Honkala, pages 661-671. U.S. Forest Service Agriculture Handbook 654. USDA Forest Service, Washington, DC.

McDonald P.M. and D.W. Huber. 1995. California's Hardwood Resource: Managing for Wildlife, Water, Pleasing Scenery, and Wood Products. General Technical Report PSW-GTR-154. 23 pages. USDA Forest Service, Pacific Southwest Research Station.

McKelvey, Kevin S. 1996. Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Chapter 37, page 1035. Centers for Water and Wildland Resources Wildland Resources Center, Report No. 37. University of California, Davis, CA.

Minnich, R. and L. Howard. 1984. Biogeography and Prehistory of Shrublands. In: *Shrublands in California: Literature Review Research Needed for Management*, edited by J.J. DeVries, pages 8-24. Contribution 191. University of California, California Water Resources Center. Davis, CA.

Minnich, R.A. 1987. Fire Behavior in Southern California Chaparral before Fire Control: The Mount Wilson Burns at the Turn of the Century. *Annals of the Association of American Geographers* 77(4):599-618.

Mitchell, Dale. 2000. California Department of Fish and Game. Personal communication.

Moyle, Peter B. 2002. Inland Fishes of California. University of California Press, University of California, Berkeley, CA.

Muir, J. 1894. The Mountains of California. Houghton. Boston, MA.

NFMAS, National Fire Management Analysis System, Technical Course. 1996. Presented by Compus Services Corporation, Boise, ID.

Nokleberg, Warren J. 1983. Wallrocks of the Central Sierra Nevada Batholith, California: A Collage of Accreted Tectono-Stratigraphic Terraines, page 14. U.S. Geological Survey Professional Paper 1255. U.S. Geological Survey. United States Government Printing Office, Washington, D.C.

Nussbaum, R.A., E.D. Brodie, Jr., and R.M. Storm. 1983. Amphibians and Reptiles of the Pacific Northwest. University of Idaho Press, Moscow, Idaho.

Omi, P.N. 1996. The Role of Fuelbreaks. In: Proceedings of the 17th Forest Vegetation Management Conference, pages 89-96. Redding, CA.

Parsons, D.J. 1976. The Role of Fire in Natural Communities: An example from the Southern Sierra Nevada, California. *Environmental Conservation* 3(2):91-99.

Parsons, D.J. 1981. The Historical Role of Fire in the Foothill Communities of Sequoia National Park. *Madroño* 28:111-120.

Philpot, W. 1997. Summaries of the Life Histories of California Bat Species. USDA Forest Service, Sierra National Forest, Pineridge Ranger Station. 30pages. Unpublished document.

Pierson, Elizabeth, PhD. 1996. Private Consultant, Pierson and Rainey Consultants, Berkeley, CA. Presentation at the North California Mine Assessment for Bats Seminar, Shasta College, Redding, CA. June 4-6, 1996.

Piirto, D. D. and Robert R. Rogers. 1999. An Ecological Foundation for Management of National Forest Giant Sequoia Ecosystems: Technical Paper R5-EM-TP-005. USDA Forest Service, Pacific Southwest Region.

Potter, D.A. 1994. *Guide to Forested Communities of the Upper Montane in the Central and Southern Sierra Nevada.* R5-ECOL-TP-003. U.S. Forest Service, Pacific Southwest Regional Office. San Francisco, CA.

Potter, D.A. 1998. Forested Communities of the Upper Montane in the Central and Southern Sierra Nevada. General Technical Report PSW-GTR-169. 319 pages. USDA Forest Service, Pacific Southwest Research Station, Albany, CA.

Pritcher, D.C. 1987. Fire History and Age Structure in Red Fir Forests of Sequoia National Park, California. *Canadian Journal of Forest Research* 17:582-587.

Roberts, Paul T., Ted B. Smith, Charles G. Lindsey, Don E. Lehrman, and William R. Knuth. 1990. Analysis of San Joaquin Valley Air Quality and Meteorology, Final Report. San Joaquin Valley Air Pollution Study Agency, California Air Resources Board.

Roper Starch Worldwide. 2001. Outdoor Recreation in America. A report on the eigth national survey in an annual series for the Recreation Roundtable.

Rundel, P.W., D.J. Parsons, and D.T. Gordon. 1977. Montane and Subalpine Vegetation of the Sierra Nevada and Cascade Ranges. In: *Terrestrial Vegetation of California*, edited by M.G. Barbour and J. Major, pages 559-599. John Wiley and Sons. New York, NY.

Sando, R.W. 1978. Natural Fire Regimes and Fire Management - Foundations for Direction. *Western Wildlands*, Spring 1978:34-45.

San Joaquin Valley Air Pollution Control District. 1994. Ozone Attainment Demonstration Plan. Fresno, CA.

Schoenherr, A.A. 1992. *A Natural History of California*. California Natural History Guides Series, no. 56. University of California Press, Berkeley, CA.

Scientific Advisory Board, Giant Sequoia National Monument. 2001. Advisories I-XVIII, found at www.r5.fs.fed.us/giant_sequoia/.

Scientific Advisory Board, Giant Sequoia National Monument. 2002. Advisories XIX-XXI, found at www.r5.fs.fed.us/giant_sequoia/.

Shair, F. 1987. Atmospheric Tracer Experiments Aimed at Characterizing Upslope/Downslope Flows Along the Southwestern Region of the Sierra Nevada Mountains. Prepared for CARB by CalTech. Pasadena, CA.

Sherwin, R. 1998. Presentation to the Western Bat Working Group Workshop. February 9-13. Reno, NV. Personal communication.

Skinner, C.N. 1995. Change in Spatial Characteristics of Forest Openings in the Klamath Mountains of Northwestern California. *Landscape Ecology* 10(4):219-28.

Skinner, C.N. and C.R. Chang. 1996. Fire Regimes Past and Present, Chapter 38. In: Sierra Nevada Ecosystem Project, Assessments and Scientific Basis for Management Options, Final Report to Congress, Volume II. University of California Wildland Resource Center, Davis, CA.

95616-8750

Smith, Arthur R. 1964. Geologic Map of California, Olaf P. Jenkins Edition, Bakersfield Sheet. Scale 1:250,000. California Division of Mines and Geology, Sacramento, CA.

SNEP (science team and special consultants). 1996. *Sierra Nevada Ecosystem Project, Final Report to Congress, Assessment Summaries and Management Strategies,* University of California Centers for Water and Wildland Resources. Davis, CA

Stebbins, R.C. 1985. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, MA.

Standiford, R.B., J. Klein, and B. Garrison. 1996. Sustainability of Sierra Nevada Hardwood Rangelands, pages 637-680. In: Sierra Nevada Ecosystem Project: Final Report to Congress, Assessments, Commissioned Reports and Background Information, Vol. III, Chapter 6. University of California Wildland Resource Center, Davis, CA. 95616-8750

Stephens, S. May, 1999. Personal communication with Catherine Phillips, USDA Forest Service Assistant Ecologist. Sacramento, CA.

Stephenson, N.L., D.J. Parsons, and T.W. Swetnam. 1991. Restoring Natural Fire to the Sequoia-Mixed Conifer Forest: Should Intense Fire Play a Role? In: *Proceedings of the 17th Tall Timbers Fire Ecology Conference:* High Intensity Fire in Wildlands: Management Challenges and Options, pages 321-337. Tall Timbers Research Station, Tallahassee, FL.

Stephenson, N.L. 1994. Long-Term Dynamics of Giant Sequoia Populations: Implications for Managing a Pioneer Species. General Technical Report PSW-151. USDA Forest Service.

Stephenson, N.L 1996. Ecology and Management of Giant Sequoia Groves, pages 1431-1467. In: Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options. Centers for Water and Wildland Resources, University of California, Davis, CA.

Stephenson, N.L. 1999. Reference Conditions for Giant Sequoia Forest Restoration: Structure, Process, and Precision. *Ecological Applications* 9:1253-1265.

Sudworth, G.B. 1900. Stanislaus and Lake Tahoe Forest Reserves, California and Adjacent Territory, pages 505-575. In: Annual Reports of the Department of the Interior for the Fiscal Year Ending June 30, 1900. Twenty-First Annual Report of the U.S. Geological Survey, Part V. Government Printing Office, Washington, DC.

Sugihara, N.G., J. vanWagtendonk, and J. Fites-Kaufmann. 2002. Draft Chapter: Fire As an Ecosystem Process. In: Fire in California Ecosystems, edited by Sugihara, N.G., J. vanWagtendonk, K. Shaffer, J. Fites-Kaufmann, and A.E. Thode. Unpublished manuscript.

Swetnam, T.W., C.H. Baisan, A.C. Caprio, R. Touchan, and P.M. Brown. 1992. Tree-Ring Reconstruction of Giant Sequoia Fire Regimes. Final report on Cooperative Agreement DOI 8018-1-0002 to National Park Service, Sequoia and Kings Canyon National Parks, CA.

Swetnam, T.W. 1993. Fire History and Climate Change in Giant Sequoia Groves. *Science* 262:855-889.

Taylor, A.H. 1993. Fire History and Structure of Red Fir (*Abies magnifica*) Forests, Swain Mountain Experimental Forests, Cascade Range, Northeastern California. *Canadian Journal of Forest Research* 23(8): 1672-1678.

Taylor, A.H. and C.N. Skinner. In preparation. Fire Regimes and Landscape Dynamics in the Klamath Mountains.

Tierney, M. 1997. Wildlife Biologist, Tahoe National Forest, personal communication.

Tracer Technologies, 1992. Transport of Acidic Air Pollutants to Forests and Alpine Regions of the Sierra Nevada. Prepared for CARB by Tracer Technologies. San Marcos, CA.

Travis, Diane. 2002. Fire and Fuels Working Paper for the Giant Sequoia National Monument Draft Environmental Impact Statement. Sequoia National Forest, Porterville, CA.

Twitty, V.C., D. Grant, and O. Anderson. 1967. Amphibian Orientation: An Unexpected Observation. Science 155(3760):352-353.

Unpublished data on file at Supervisor's Office, Stanislaus National Forest, Sonora, California.

USDA Forest Service. 1997. Ecological Classification, Mapping, and Inventory Handbook. Forest Service Handbook 2090.11. Washington, DC.

USDA Forest Service. 2000a. The Recreation Agenda. FS-691. September, 2000.

USDA Forest Service. 2000b. Protecting People and Sustaining Resources in Fire-Adapted Ecosystems: A Cohesive Strategy. The Forest Service Management Response to the General Accounting Office, Report GAO/RCED-99-65, October 13, 2000.

USDA Forest Service. 2000c. RPA Assessment of Forest and Range Lands.

USDA Forest Service. 2001a. Transportation Atlas, Records and Analysis. Forest Service Manual 7731. Washington, DC.

USDA Forest Service. 2001b. Administrative National Forest System Roads - Deferred Maintenance and Capital Improvement.

USDA Forest Service, Pacific Southwest Region. Jan, 2001. *Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement*. USDA Forest Service. Vallejo, CA.

USDA Forest Service, Sequoia National Forest. Undated. Soil Survey. In cooperation with the Soil Conservation Service and the Regents of the University of California (Agricultural Experiment Station). 317pages. Porterville, CA.

USDA Forest Service, Sequoia National Forest. 1988. *Land and Resource Management Plan*. USDA Forest Service. Porterville, CA 93257-2035.

USDA Forest Service, Sequoia National Forest. 1988. *Land and Resource Management Plan Final Environmental Impact Statement*. USDA Forest Service. Porterville, CA 93257-2035.

USDA Forest Service, Sequoia National Forest. 1990. *Land Management Plan 1990 Mediated Settlement Agreement*. USDA Forest Service. Porterville, CA 93257-2035. 290 pages.

USDA Forest Service, Sequoia National Forest. 2001. *Defining Ecological Zones of Influence for Giant Sequoia Groves on the Sequoia National Forest: A Draft Report*. USDA Forest Service, Porterville, CA 93257-2035.

USDA NRCS. 1997. The PLANTS Database. National Plant Data Center, Baton Rouge, LA. (http://plants.usda.gov)

USDI National Park Service, Sequoia and Kings Canyon National Parks. August, 2001. Sequoia and Kings Canyon National Parks Fire Effects Monitoring Program: 2000 Annual Fire Report.

USDI National Park Service, Sequoia and Kings Canyon National Parks. March, 2002. Sequoia and Kings Canyon National Parks Fire Effects Monitoring Program: 2001 Annual Fire Report.

Vankat, J.L. 1970. Vegetation Change in Sequoia National Park, California. Ph.D. dissertation, University of California, Davis, CA.

Vankat, J.L. and J. Major. 1978. Vegetation Changes in Sequoia National Park, California. *Journal of Biogeography* 5:377-402.

Vankat, J.L. 1983. General Patterns of Lightning Ignitions in Sequoia National Park, California. In: Proceedings, Symposium and Workshop on Wilderness Fire, edited by J.E. Lotan, B.M. Kilgore, C. William. USDA Forest Service, Intermountain Research Station, Ogden, UT..

vanWagtendonk, J.W. 1972. Fire and Fuel Relationships in Mixed Conifer Ecosystems of Yosemite National Park. Ph.D. dissertation, University of California, Berkeley, CA.

vanWagtendonk, J.W. 1986. The Role of Fire in Yosemite Wilderness. In: Proceedings, National Wilderness Research Conference, Current Research, pages 23-26, July 1985, Fort Collins, CO, compiled by R.C. Lucas. General Technical Report INT-212. USDA Forest Service, Ogden, UT.

vanWagtendonk, J.W. 1996. Use of a Deterministic Fire Growth Model to Test Fuel Treatments. Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options. Centers for Water and Wildland Resources, Davis, CA.

Verner, J., K.S. McKelvey, B.R. Noon, R.J. Gut¯erres, G.I. Gould Jr., and T.W. Beck, technical coordinators. 1992. The Californian Spotted Owl: A Technical Assessment of its Current Status. General Technical Report PSW-133. USDA Forest Service, Pacific Southwest Research Station, Albany, CA.

Wagener, W.W. 1961. Past Fire Incidence in Sierra Nevada Forests. *Journal of Forestry* 59:739-748.

Weatherspoon, C.P., S.J. Husari, and J.W. van Wagtendonk. 1992. Fire and Fuels Management in Relation to Owl Habitat in Forests of the Sierra Nevada and Southern California. In: The Californian Spotted Owl: A Technical Assessment of its Current Status, technical coordination by J. Verner, K.S. McKelvey, B.R. Noon, R.J. Gut¯erres, G.I. Gould Jr., and T.W. Beck, pages 247-260. General Technical Report PSW-133. USDA Forest Service, Pacific Southwest Research Station, Albany, CA.

Weatherspoon, C.P., and C.N. Skinner. 1996. Landscape-Level Strategies for Forest Fuel Management. In: Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Chapter 56. Centers for Water and Wildland Resources, University of California, Davis, CA.

Weaver, H. 1974. Effects of Fire on Temperate Forests: Western United States. In: Fire and Ecosystems, edited by T.T. Kozlowski and C.E. Ahlgren, pages 279-319. New York: Academic Press.

Wilson, C.C. and J.D. Dell. 1971. The Fuels Buildup in American Forests: A Plan of Action and Research. *Journal of Forestry* 68(8):471-475.

Wright, H.E. and M.L. Heinselman. 1973. The Ecological Role of Fire in Natural Conifer Forests of Western and Northern North America. *Quarterly Research* 3:319 - 328

Yoshiyama, Ronald M. 1996. *Sierra Nevada Ecosystem Project, Final Report to Congress, Vol. III, Assessments, Commissioned Reports, and Background Information,* University of California Centers for Water and Wildland Resources. Davis, CA

Zabic, John M. and James N. Seiber. 1993. Atmospheric Transport of Organophosphate Pesticides from California's Central Valley to the Sierra Nevada Mountains. J. Environ. Qual., Vol. January - March, 1993.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White, ed. 1988. California's Wildlife. Volume I. Amphibians and Reptiles. California Statewide Wildlife Habitat Relationships System. Department of Fish and Game, The Resources Agency, Sacramento, CA. 272 pages.

Zeiner, D.C., W.F. Laudenslayer, Jr., K.E. Mayer, and M. White. 1990. California's Wildlife: Volume III, Mammals. California Department of Fish and Game. Sacramento, CA. 407 pages.

Zweifel, R.G. 1955. Ecology, Distribution, and Systematics of Frogs of the Rana Boylii Group. University of California Publication of Zoology 54:207-292.

Return to top of page.

Appendix C

Summary of Framework Direction

The Sierra Nevada Forest Plan Amendment (Framework), signed in January 2001, represents an ecologically based approach to assessing and managing landscapes on 11 National Forests in the Sierra Nevada range. At its signing the Framework amended Forest Land and Resource Management Plans (Forest Plans) for those 11 National Forests.

Management strategies included in the ROD address five problem areas (ROD, page A-1) that were identified through scientific review and public comments. These include:

- Conservation Strategy for Old Forest Ecosystems and Associated Species,
- Aquatic Management Strategy,
- Fire and Fuels Management Strategy,

- Conservation Strategy for Lower Westside Hardwood Ecosystems, and
- Noxious Weeds Management Strategy.

The strategies incorporated management direction and goals; land allocations; desired conditions; standards and guidelines; and a strategy for inventory, monitoring and research to support an adaptive management approach. The following section will summarize management direction and associated standards and guidelines. For desired condition, and monitoring information please refer to the Record of Decision (ROD). Land allocations resulting from the Framework are displayed in the Map Packet, Figure II-1, Alternative 1, No Action, Framework Allocations.

The Conservation Strategy for Old Forest Ecosystems and Associated Species

This strategy provides for environmental conditions, well distributed across the Sierra Nevada national forests that are likely to maintain viable populations of old forest-associated species. The main species of concern is the California spotted owl. The fuels management strategy is integrated with the old forest associated species conservation strategy.

Forest-wide management direction is applied that includes standards and guidelines pertaining to fuels treatments within specific vegetation conditions across the landscape. The strategy assigns new land allocations to the forests, such as: old forest emphasis area, southern Sierra fisher conservation areas, home range core areas, and protected activity centers (PACs) which protect known nesting, roosting and denning sites for California spotted owl, northern goshawk, great gray owl, Pacific fisher and marten.

A network of old forest emphasis areas is defined. Management in these areas emphasizes the reduction of hazardous fuel conditions and re-introducing fire using prescribed fire.

The California spotted owl home range core area allocation includes management objectives similar to those in the old forest emphasis areas. The majority of the monument is included in the Southern Sierra Fisher Conservation Area allocation, which represents the known occupied range of the Pacific fisher and encompasses lands from 4,500 to 8,000 feet in elevation on the Sierra and Sequoia national forests.

Aquatic Management Strategy (AMS)

The fundamental goal of the AMS is to retain, restore, and protect the processes and landforms that provide habitat for aquatic and riparian-dependent organisms, and produce and deliver high-quality waters. This strategy is emphasized as a general regional outline, which sets broad policy direction for managing aquatic habitats. The AMS contains four components, three of which apply to management within Giant Sequoia National Monument:

Aquatic Management Strategy Goals,

Riparian Conservation Areas (RCAs) and Critical Aquatic Refuges (CARs)

Riparian Conservation Objectives (RCOs) and associated standards and guidelines for project level analysis.

The fourth component includes direction pertaining to anadromous fisheries on the Lassen National Forest.

Aquatic Management Strategy Goals are to be considered "end Points" which provide a broad structure for establishing desired condition for ecosystem analysis at other scales. The goals consider water quality; species viability; plant and animal community diversity; special habitats; watershed connectivity; floodplains and water tables; watershed condition; streamflow patterns and sediment regimes; and streambanks and shorelines.

Riparian Conservations Areas (RCAs) area land allocations are designed to maintain or restore the structure and function of aquatic, riparian, and meadow ecosystems. RCAs define buffer width to be applied to perennial streams, seasonally flowing streams, meadows or streams with special features, and other topographic depressions.

Critical Aquatic Refuges (CARs) are land allocations that contain known locations of special species (Threatened, Endangered, or Sensitive), highly vulnerable populations of special native species or localized populations of special species (rare, native or riparian dependent). There are currently two CARs identified in the Monument.

Riparian Conservation Objectives (RCOs) provide a checklist for evaluating whether a proposed activity is consistent with the desired condition described in the AMS goals. The six RCOs provide evaluation of new and existing uses and activities.

Fire and Fuels Management Strategy

Urban Wildland Intermix Zone

The Framework assigned urban wildland intermix zones the highest priority for fuels treatments. The urban wildland intermix zone consists of two components. The defense zones surrounding communities and structures are treated more intensively to prevent the loss of life and property. Within the adjacent threat zone forest fuels would be treated less intensively. Defense zones are a quarter mile buffer surrounding communities on Forest Service land, and threat zone boundaries were refined at the local level based on fire behavior characteristics in proximity to structures and communities (ROD, page A-10). Management direction for urban wildland intermix zones includes:

Design fuel treatment to provide a buffer between developed areas and wildlands;

Design and distribute treatments to increase the efficiency of firefighting efforts and reduce risks to firefighters, the public, facilities and structures, and natural resources;

Determine the distribution, schedule, and types of fuel reduction treatments through collaboration with local agencies, air regulations, groups, and individuals; and

Place the highest density and intensity of treatments in developed areas within the urban wildland intermix zone.

Landscape Fuels Management

The Framework fuels strategies will reintroduce fire, reduce fuel levels, and mitigate the consequences of large damaging wildfire.

The fire and fuels management strategy relies on a combination of four primary strategies for modifying wildland fire behavior and re-introducing fire across broad landscapes:

Strategically placed area treatments (blocks of land ranging between 20 to over 1,000 acres, where vegetation is treated to reduce fuel loading),

Wildland fire use (lightening caused fires used to reduce fuel loads or provide other resources benefits),

Defensible fuels profile zones (strategically located strips of lands where the vegetation has been modified to a less dense fuel type), and

Priority-setting mechanism established in the National Cohesive Fire Strategy. The National Cohesive Fire Strategy is an approach for reducing fuel loadings in fire-prone forests to protect people and sustain resources.

Conservation Strategy for Lower Westside Hardwood Ecosystems

The Framework defined hardwood ecosystems as vegetation communities dominated by California black oak, canyon live oak (tree form), Pacific madrone, or tanoak. Ecosystems dominated by blue oak, valley oak, interior live oak (tree form), or Oregon white oak are referred to as blue oak woodlands. Collectively these are referred to as hardwood ecosystems. Adopted standards and guidelines allow for the retention of large live hardwood trees and snags; maintenance of hardwood species diversity; and recruitment of young hardwood trees.

Noxious Weeds Management Strategy

Standards and guidelines provide specific directions to be taken in implementing Forest Service Manual direction regarding noxious weeds.

Ecosystem Analysis

Ecosystem analysis provides a context for managing entire ecosystems. This type of analysis helps land managers to better understand how watersheds and landscapes function before projects are planned. Ecosystem analyses are conducted at the river basin, watershed, landscape, and project scales. The Framework decision established time frames for completing ecosystem analyses at the different spatial levels.

Standards and Guidelines

Each land allocation described in the Framework has a set of standards and guidelines to determine how management within designated allocations will proceed.

Because land allocations overlap one another the ROD established a priority ordering system (ROD, page A-22). Priority ordering is applied in two ways: (1) land allocations with more restrictive management direction have a higher priority than those with less restrictive direction, and (2) mapped allocations have a higher priority than unmapped allocations.

Mapped allocations include southern Sierra fisher conservation areas, old forest emphasis areas, urban wildland intermix zones, and general forest. California spotted owl protected activity centers, riparian conservation areas, and critical aquatic refuges though unmapped at the issuance of the ROD, have been mapped at the forest level. Land allocations that provide protections to special habitats or species are placed higher in the priority ordering.

Forest-wide Standards and Guidelines

Forest wide standards and guidelines apply to all land allocations, unless otherwise stated. The full text of the standards guidelines is hereby incorporated by reference and can be found in Appendix A (pages A-25 to A-62) of the ROD. Applicable standards and guidelines stated in the ROD are briefly summarized below. Before implementation the full text of the Standards and Guidelines as stated in the ROD should be reviewed.

Fuel Reduction Treatments

Strategically place fuel treatments across the landscape.

Locate fuel treatments to interrupt wildland fire spread and reduce fire severity. Prioritize fuel treatments as follows: (1) urban wildland intermix zones, (2) old forest emphasis areas with high fire hazard and risk, (3) sensitive species habitats, and (4) general forest.

Structural change to treatment acres by mechanical methods is limited to one per decade.

Vegetation and Fuels Treatments in Plantations

Apply the necessary silvicultural and fuels reduction treatment to accelerate old forest characteristics, increase stand heterogeneity, promote hardwoods, and reduce the risk of loss to wildland fire.

Vegetation and Fuels Treatments in Shrubfields

Design mechanical treatments to remove materials to achieve average flame lengths of 8 feet or less, rates of spread less than 50% of the pre-treatment rate of spread, and double fire line production rates.

Fuels treatments in Forested Stands of Large Trees with Moderate to Dense Canopy Cover

In stands greater than 1 acre classified as California Wildlife Habitat Relationships (CWHR) 5M, 5D, and 6 apply the following:

Design mechanical treatments to remove material based on desired outcomes for stands with differing canopy cover.

Design mechanical treatments to achieve or approach desired outcomes by removing surface and ladder fuels less than 12 inches dbh.

Do no reduce canopy cover in dominant and co-dominant trees by more than 10% across the stand.

Use multiple entries for prescribed fire treatments.

Hardwood Management

Create openings around existing California black oak and canyon live oak to stimulate natural regeneration.

Manage for a diversity of hardwood tree size classes.

Retain all blue oak and valley oak trees except where stand restoration strategies call for tree removal, trees are lost to fire, or where tree removal is needed for public health and safety.

Include hardwoods in stand examination.

Vegetation Management Related to Habitat Connectivity for Old Forest Emphasis Species

Minimize old forest habitat fragmentation

Consider forested linkages that are interconnected via riparian areas and ridge top saddles during planning.

If fishers are detected outside the southern Sierra fisher conservation areas, evaluate habitat conditions and implement appropriate mitigation measures to retain suitable habitat.

Large Tree Retention

Retain all live conifers with dbh of 30 inches or greater in westside forest types and 24 inches or greater in eastside pine types.

Snags and Down Woody Material

In Westside vegetation types retain pieces of down wood up to at least 10 to 20 tons per acres over a treatment unit.

Following stand replacing events do not conduct salvage in at least 10% of the area affected by the event.

Retain large snags to specified prescriptions following fuels treatments except were (1) snag removal is needed to address imminent safety hazards, and (2) snag levels are reduced as a result of incidental loss to prescribed fire.

Incidental Removal of Vegetation and Down Woody Material

Incidental removal of vegetation and down woody material for activities such as administering special use permits; maintaining recreation developments; constructing, reconstructing, and maintaining roads, trails and right of ways; expanding resorts based on approved development plans; and removing trees that pose an imminent safety hazard may deviate from vegetation management standards and guidelines.

Fall and remove hazard trees along maintenance level 3, 4, and 5 roads and within or immediately adjacent to administrative sites.

Surveys in Suitable California Spotted Owl Habitat

Prior to vegetation treatment in suitable habitat with unknown occupancy conduct surveys in accordance with survey protocol.

Surveys in Suitable Northern Goshawk Nesting Habitat

Prior to vegetation treatments in suitable habitat that is not within an existing PAC (spotted owl or goshawk), conduct surveys using survey protocols.

Threatened, Endangered, Proposed and Sensitive (TEPS) Plant Species

Conduct field surveys early, so projects can be designed to conserve or enhance TEPS species and their habitat.

Minimize or eliminate direct and indirect impacts from management activities on TEPS plants unless the activity is designed to maintain or improve plant populations.

Noxious Weed Management

Inform forest users, local agencies, special use permittees, groups and organizations in communities near national forests about noxious weed prevention and management.

Work with state agencies to prevent the introduction and establishment of noxious weed infestations and control existing infestations.

Conduct a noxious week risk assessment as part of project planning.

Incorporate weed prevention and control measures into ongoing management activities that involve ground disturbance.

Encourage the use of certified weed free hay and straw.

Include weed prevention measures when amending or re-issuing permits.

Conduct a risk analysis for weed spread associated with burned area emergency rehabilitation (BAER) treatments.

During landscape analysis or project planning, consider restoring or re-vegetating degraded ecosystems to minimize the potential for noxious weed infestations.

Consult with American Indians to determine priority areas for weed prevention and control where traditional gathering areas are threatened by weed infestations.

Complete noxious weed inventories within 3 years of signing the ROD.

Routinely monitor noxious weed control projects to determine success and evaluate the need for additional treatments.

Grazing

Allow livestock to browse on no more than 20% of annual growth of hardwood seedlings and advanced regeneration.

Maintain a minimum of 60% cover in annual grasslands.

Mining

Ensure that plans of operation, reclamation plans, and reclamation bonds address various costs.

Ensure that mine owners and operators limit new road construction, decommission unnecessary roads, and maintain needed roads consistent with roads policy and management directions.

Require mine reclamation be conducted in a timely manner.

Inspect and monitor mining-related activities on a regular basis to ensure compliance with laws, regulations, and operating plans.

Land Allocation Standards and Guidelines

The following standards and guidelines apply to all land allocations unless otherwise stated. The following is presented in summary form, for more detail and the entire text refer to Appendix A of the ROD (pages A-25 through A-61).

Table C.1: Relationships between overlapping land allocations presented in the Framework. (Replicated from Table II.A.1, ROD, page A-24)

California Spotted Owl Protected Activity Centers

Standards and guidelines for PACs supercede standards and guidelines for land allocations in which they are located. Riparian area conservation standards and guidelines apply to PACs (or portions of them) in riparian areas and critical aquatic refuges except where standards and guidelines for PACs place greater restriction on management activities.

Check all available databases when activities are planned adjacent to non-national forestlands, for the locations of spotted owl activity centers.

Conduct surveys to establish or confirm nest locations or activity centers when activities are planned within or adjacent to a PAC and the nest location is uncertain.

Maintain PACs regardless of occupancy status, unless the habitat is rendered unsuitable and surveys conducted confirm non-occupancy.

Maintain a limited operating period (LOP), prohibiting activities within approximately ¼ mile of the nest site during breeding season (march 1 through August 31) unless surveys confirm that owls are not nesting.

The LOP may be waived for individual projects or activities of limited scope and duration or when a biological evaluation (BE) document that such projects are unlikely to result in breeding

disturbance.

The LOP may be waived where necessary to allow for early season prescribed burning in up to 5% of the PACs on all Sierra Nevada national forests each year.

The LOP may be modified or waived to assess the effects of prescribed fire and mechanical treatments on breeding owls as a formal adaptive management study developed in cooperation with the Pacific Southwest Research Station.

Limit stand-altering activities to reducing surface and ladder fuels through prescribed fire treatments. Design prescribed fire treatments that have an average flame length of 4 or less in stands with overstory trees 11 inches dbh and greater outside of PACs.

Prohibit mechanical treatment within a 500-foot buffer around California spotted owl PACs inside defense zones.

Conduct vegetation treatments in not more than 5% per year and 10% per decade of the California spotted owl PACs in the 11 Sierra Nevada forests until a formal monitoring and adaptive management approach is developed.

Evaluate all new roads, trails, OHV routes, and recreational and other developments for their potential to disturb nest sites.

Northern Goshawk PACs

Standards and guidelines for northern goshawk PACs supercede standards and guidelines for land allocations in which PACs are located. Riparian conservation area standards and guidelines apply to PACs in riparian areas and critical aquatic refuges except where PAC standards and guidelines for PACs place greater restrictions on management activities.

Conduct surveys when activities are planned within or adjacent to a PAC and the nest location is uncertain or unknown.

Check all available databases when activities are planned adjacent to non-national forestlands, for the locations of northern goshawk activity centers.

Maintain PACs regardless of occupancy status, unless habitat is rendered unsuitable and surveys confirm non-occupancy.

Maintain LOP, prohibiting activities within approximately ¼ mile of the nest site during the breeding season (February 15 through September 15) unless surveys confirm that northern goshawks are not nesting.

The LOP may be waived for individual projects or activities of limited scope and duration or when a Biological Evaluation (BE) determines the project is unlikely to result is breeding disturbance.

To allow for early season prescribed burning an LOP may be waived in up to 5% of the northern goshawk PACs on the 11 Sierra Nevada national forests per year.

Evaluate all new roads, trails, OHV routes, and recreational and other developments for their potential to disturb nest sites.

In PACs outside of defense zones: Limit stand-altering activities to reducing surface and ladder fuels through prescribed fire treatments. In forested stands with overstory trees 11 inches dbh and greater, design prescribed fire treatments that have an average flame length of 4 feet or less.

In PACs inside the defense zone: prohibit mechanical treatment within a 500-foot buffer around northern goshawk PACs.

Conduct vegetation treatments in not more than 5% per year and 10% per decade of the northern goshawk PACs in the 11 Sierra Nevada forest until a formal monitoring and adaptive management approach is developed.

Great Gray Owl PACs

Standards and guidelines for Great Gray Owl PACs supercede standards and guidelines for land allocations in which PACs are located. Riparian conservation area standards and guidelines apply to PACs (or portions of PACs) in riparian areas and critical aquatic refuges except where

PAC standards and guidelines are more restrictive.

Evaluate all new roads, trails, OHV routes, and recreational and other developments for their potential to disturb nest sites.

Apply an LOP prohibiting vegetation management activities and road construction within ¼ mile of active great gray owl nest stands during the nesting period (typically march 1 to August 15).

In meadow areas of PACs, maintain herbaceous meadow vegetation at least 12 inches in height and covering at least 90% of the meadow.

Forest Carnivore Den sites

Standards and guidelines for den site buffers supercede standards and guidelines for land allocations in which den sites are located. Riparian conservation area standards and guidelines apply to den site buffers (or portions of them) in riparian areas and critical aquatic refuges except where the den site buffer standards and guidelines are more restrictive.

To eliminate disturbance to den sites apply an LOP from March 1 through June 30.

Evaluate the appropriateness of LOPs for existing uses in fisher and marten den site buffers during environmental analysis.

To the extent possible, avoid fuel treatments in den site buffers.

Evaluate all new roads, trails, OHV routes, and recreational and other developments for their potential to disturb den sites.

Old Forest Emphasis Areas

Standards and guidelines for PACs and den site buffers supercede old forest emphasis area standards and guidelines. Old forest emphasis area standards and guidelines apply to areas where the southern Sierra fisher conservation areas overlap with old forest emphasis areas. Where urban wildland intermix zones overlap with old forest emphasis areas, urban wildland intermix fuel treatment standard and guidelines supercede fuel treatment standards and guidelines for old forest emphasis. When old forest emphasis area land allocation overlaps with riparian conservation areas, critical aquatic refuges, or meadows the standards and guidelines of both allocations apply.

Give priority to restoring historic fire regimes where possible.

Emphasize fuel treatments in stands at lower elevation with high fire hazard in pine, mixed conifer, eastside pine and eastside mixed conifer.

Design mechanical fuel treatments over 75% of the stand area to remove the material necessary to achieve 6 foot flame and:

In stands with less than 40% canopy cover achieve an average live crown base height of 15 feet

In stands with 40% to 70% canopy cover achieve an average live crown base height of 20 feet.

In stands with greater than 70% canopy cover achieve an average live crown base height of 25 feet.

Do not treat the remaining 25% of the stand.

Design mechanical treatments to achieve or approach the fuels outcomes described above by reducing surface and ladder fuels less than 12 inches dbh.

Do not reduce canopy cover in dominant and co-dominant trees by more than 10% across a stand following mechanical treatment.

In west side forest types, where pre-treatment canopy cover in dominants and co-dominants is between 50 and 59%, design mechanical treatments to retain a minimum of 50% canopy cover.

Utilize strategically placed area fuel treatments to minimize risks to human life and property, sensitive resources, or the old forest emphasis areas from loss to wildfire.

Conduct an analysis of suitable owl habitat before applying mechanical treatments that remove trees up to 20 inches dbh and reduce canopy cover up to 20%.

Following stand replacing events retain all snags 15 inches or greater except imminent hazards to human safety.

California Spotted Owl Home Range Core Areas (HRCA)

Home range core area standards and guidelines include spotted owl PACs and are identical to old forest emphasis area standards and guidelines. Where overlap occurs, northern goshawk PACs or den site buffer standard and guidelines supercede HRCA standards and guidelines. Home range core area standards and guidelines supercede southern Sierra fisher conservation area standards and guidelines where those allocations overlap. When HRCAs overlap with riparian conservation areas, critical aquatic refuges, or meadows the standards and guidelines of both allocations apply. Defense zone fuel treatments supercede fuel treatment standards and guideline where they overlap. Threat zone fuel treatment standards and guidelines usually supercede fuel treatment standards and guidelines. However, fuel treatments within threat zones must satisfy specific habitat requirements for home range core areas.

Southern Sierra Fisher Conservation Area (SSFCA)

Standards and guidelines for PACs, den site buffers, and HRCAs supercede standards and guidelines for SSFCA. When SSFCA land allocation overlaps with riparian conservation areas, critical aquatic refuges, or meadows the standards and guidelines of both allocations apply. Fuel treatment standards and guidelines for defense and threat zones supercede those for the SSFCAs when these allocations overlap. Where SSFCA overlaps with the old forest emphasis area land allocation, apply standards and guidelines applicable to old forest emphasis areas. Portions of SSFCA that do not overlap old forest emphasis should be managed according to stands and guidelines for general forest allocation.

Manage each planning watershed outside of urban wildland intermix zones, to support fisher habitat requirements. Retain 60% of each 5,000 to 10,000 acre watershed in CWHR size class 4 or greater and canopy cover greater than or equal to 60%.

Identify important wildlife structures, such as large snags and coarse woody material, prior to vegetation treatments.

Urban Wildland Intermix Zone: Defense Zone

Special standards and guidelines for California spotted owl and northern goshawk PACs and den site buffers apply. Standards and guidelines for the defense zone supercede standards and guidelines for old forest emphasis areas, California spotted owl HRCAs and the Southern Sierra Fisher Conservation areas. Where Defense Zones overlap with riparian areas, meadows, and critical aquatic refuges, standards and guidelines for both allocations apply.

Design mechanical fuels treatments over 90% of the stand to remove the material necessary to achieve an average flame length of 4 feet or less and:

In stands with less than 40% canopy cover achieve an average live crown base height of 15 feet.

In stands with 40 to 70% canopy cover achieve an average live crown base height of 20 feet.

In stands with greater then 70% canopy cover achieve an average live crown base height of 25 feet.

Do not mechanically treat the remaining 10% of the stand.

Achieve the above outcomes through thinning from below to remove surface and ladder fuels.

Urban Wildland Intermix Zone: Threat Zone

Standards and guidelines for California spotted owl and northern goshawk PACs and den site buffer supercede standards and guidelines for threat zones. Standards and guidelines for threat zones supercede those for old forest emphasis areas, California spotted owl HRCAs, and the southern Sierra fisher conservation areas. Where threat zones overlap riparian areas, meadows, and critical aquatic refuges standards and guidelines for both allocations apply.

Design mechanical fuels treatments over 85% of the stand area to remove the material necessary to achieve average flame lengths of 6 feet or less and:

In stands with less than 40% canopy cover achieve an average live crown base height of 15 feet.

In stands with 40 to 70% canopy cover achieve an average live crown base height of 20 feet.

In stands with greater then 70% canopy cover achieve an average live crown base height of 25 feet.

Do not mechanically treat the remaining 15% of the stands.

Design mechanical treatments to achieve the stated outcomes through understory thinning to remove surface and ladder fuels up to 20 inches dbh.

For prescribed fire treatments, use multiple entries as need to achieve fuels management objectives up to two burns per decade and four burns over 20 years.

Prior to applying mechanical treatments conduce an analysis of suitable owl habitat around activity centers.

General Forest

Where overlaps occur all other allocations supercede general forest standards and guidelines. Forest-wide standards and guidelines for vegetation and fuels treatments implantations, shrub lands, and forested stands classified as CWHR 5M, 5D, and 6 apply in the general forest.

Design mechanical fuels treatments over 75% of the stand area to remove the material necessary to achieve flame lengths 6 feet or less in:

Stands with less than 40% canopy cover achieve an average live crown base height of 15 feet.

Stands with 40 to 70% canopy cover achieve an average live crown base height of 20 feet.

Stands with greater then 70% canopy cover achieve an average live crown base height of 25 feet.

Do not mechanically treat the remaining 25% of the stands.

Design mechanical treatments to achieve the above outcomes through understory thinning to remove surface and ladder fuels up to 20 inches dbh.

In Westside forest types, where pre-treatment canopy cover is between 50 and 59%, design mechanical treatments to retain a minimum of 50% canopy cover in dominant and co-dominant trees.

For prescribed fire treatments, use multiple entries as needed to achieve fuels management objectives, up to two burns per decade or four burns over 20 years.

Riparian Conservation Areas (RCAs)

Standards and guidelines for RCAs apply except where standards and guidelines of overlapping land allocations place greater restrictions on management activities. Where a proposed project encompasses an RCA (or CAR) conduct a site-specific project area analysis to determine the appropriate level of management with in the area. Assess how the proposed activities measure against the RCOs and their associated standards and guidelines. Implement other related standards and guidelines appropriate to the project and include them in documentation of meeting RCOs.

RCO #1. Ensure that identified beneficial uses are adequately protected.

- Ensure that management related activities do not result in detrimental soil compaction in more than 5% of an RCAs or 10% of an CARs.
- Avoid pesticide application within 500 feet of known sites for special amphibians.
- Implement and monitor BMPs.
- Managing toward Total Minimum Daily Load requirements for water quality limited stream segments.
- Identify existing and potential sources of sediment and reduction in non-point source pollution.
- Prohibit storage of fuels and toxics except at designated administrative sites.

RCO #2. Maintain or restore geomorphic and biological characteristics of special aquatic features, streams and hydrologic connectivity to provide for aquatic dependent species.

- Maintain and restore hydrologic connectivity of streams, meadows, wetlands, and other special aquatic features.

- Ensure the stream crossings do no create barriers to passage fro aquatic dependent species.
- Prior to activities, determine if relevant geomorphic characteristics are with the range of natural variability.
- Prevent disturbance to meadow-associated streambanks and shorelines caused by resource activities.
- In "essential habitat" limit streambank disturbance from livestock to 10% off the occupied stream reach.
- Determine if age class, structural diversity, composition, and cover of riparian vegetation are within the range of natural variability for the vegetation community.
- Cooperate with Federal, Tribal, State and local governments to secure in stream flows needed to maintain, recover, and restore riparian resources, channel conditions, and aquatic habitat.

RCO #3. Ensure a renewable supply of large down logs, applicable in both streams and plantations.

RCO #4. Ensure that management activities, including fuels treatments, within RCAs and CARs enhance or maintain physical and biological characteristics associated with aquatic and riparian dependent species.

- Within CARs, in occupied habitat or "essential habitat" evaluate the appropriate role, timing, and extent of prescribed fire.
- Use screening devices for water drafting pumps.
- When possible locate fire suppression facilities (camps, etc.) outside of RCAs or CARs.
- Design prescribed fire treatments to minimize ground cover and riparian vegetation disturbance in RCAs.
- Allow activities within RCAs and CARs when consistent with RCOs.
- Prior to implementing ground disturbing activities within suitable habitat for the California red-legged frog, the foothill yellow-legged frog, and the mountain yellow-legged frog, assess conditions using Stream Condition Inventory protocols and develop mitigation measures.
- Assess existing uses during landscape analysis and identify conditions that degrade water quality or habitat for aquatic and riparian species.

RCO #5. Preserve, restore, and enhance special aquatic features (meadows, springs, bogs, etc.) to provide the ecological conditions and processes for the species that use them.

- During range management analysis assess hydrologic function of meadow habitats.
- Prohibit or mitigate ground-disturbing activities that adversely affect hydrologic processes that maintain water flow, quality or temperature.
- Locate new livestock or pack stock gathering areas out of meadows and riparian conservation areas.
- Limit livestock grazing under season long grazing in meadows.
- Determine ecological status on all key areas montored for grazing utilization prior to establishing utilization levels.
- Limit browsing to no more than 20% of the annual leader growth of mature riparian shrubs and no more than 20% of individual seedlings.

RCO #6. Identify and implement restoration for water quality, riparian and aquatic species.

- Recommend and establish priorities for restoration practices.
- Reclaim abandoned mines that are degrading aquatic, riparian, and meadow ecosystems.

Critical Aquatic Refuges (CARs)

Standards and guidelines for critical aquatic refuges apply in CARs except in cases where the standards and guidelines of an overlapping land allocation are more restrictive on management activities.

Approve mining-related plans of operation if measures are implemented that contribute toward the attainment or maintenance of aquatic management strategy goals.

Willow Flycatcher Habitat

Evaluate proposals for new concentrated stock areas located within 5 miles of occupied willow flycatcher habitat.

As part of the landscape analysis, give priority to meadow opportunities near or adjacent to known willow flycatcher sites.

To the extent possible, construct no new roads in potential willow flycatcher habitat.

Initiate a 4-year cycle for conducting surveys in know willow flycatcher sites.

If willow flycatchers are detected during surveys, eliminate livestock grazing in the entire meadow.

In unoccupied known willow flycatcher sites where late-season grazing is allowed, annually monitor utilization of riparian vegetation using regional range analysis and planning guides.

Within 3 years of the signing of the ROD survey emphasis habitat within five miles of the known willow flycatcher sites to determine willow flycatcher occupancy.

Apply late-season grazing in known willow flycatcher sites where flycatchers are not detected and in occupied willow flycatchers' emphasis sites during breeding season (June 1 to August 31).

Evaluate site conditions of known sites and emphasis habitat.

Return to top of page.

Appendix D

Roads Analysis Process (RAP)

Giant Sequoia National Monument

Roads Analysis Process

July 3, 2002

M.Emmendorfer & J.Grenz

Background:

In January 2001 the Roads Policy decision was signed, which changed portions of Forest Service Manual (FSM) 7700 and recommended use of Roads Analysis: Informing Decisions about Managing the National Forest Transportation System (FS-643). According to FSM 7712.1 a Roads Analysis is: "Conducted by an interdisciplinary team, the science-based roads analysis process provides Responsible Officials with critical information needed to identify and manage a minimum road system that is safe and responsive to public needs and desires, is affordable and efficient, has minimal adverse effects on ecological processes and ecosystem health, diversity, and productivity of the land, and is in balance with available funding for needed management actions."

According to FSM 7712.11 Outcomes, the final products will be "a report and accompanying maps that document the information and analysis methods used to identify social and environmental opportunities, problems, risks, and priorities for future road management. The report documents the key findings of the analysis and contains graphical, tabular, and geo-spatial displays of the transportation system options, including a minimum road system. It is important that the roads analysis identify access needs and opportunities that are based on current budget levels and realistic projections of future funding."

This Road Analysis Process (RAP) for the Giant Sequoia National Monument (GSNM) follows the six-step process recommended in FS-643. This report will inform the GSNM planning effort, which is at the programmatic level of the National Environmental Policy Act (NEPA). The RAP is not a NEPA document. The core interdisciplinary team included:

- Marianne Emmendorfer, Team Leader and Hume Lake District Planner;
- Norman Carpenter, Forest Assistant Recreation Officer;

- Robin Galloway, Tule River and Hot Springs District Zone Wildlife Biologist;
- John Grenz, Forest Transportation Engineer;
- Margie Clack, Cannell Meadow and Greenhorn District Zone Public Affairs Officer;
- Cherie Klein, Hume Lake District Geographic Information System and Database Manager

Many other Forest Service personnel on Sequoia National Forest and GSNM were instrumental in creating, editing, evaluating and analyzing the road-related materials at various steps throughout this process.

Existing Transportation System:

In accordance with FS-643 the miscellaneous report guiding the RAP, the interdisciplinary team reviewed the existing road system within the Sequoia National Forest and GSNM. Current road management direction is also discussed and compared with the existing road system on the forest and monument (FS-643 pp.22-23).

The Sequoia National Forest transportation system consists of roads and trails for people to access various destinations across the forest. The existing road system is a hierarchical set of classified roads over which the Forest Service has maintenance jurisdiction. There are also several State Highways and County Roads over which the Forest Service does not have maintenance jurisdiction. Several user-created roads exist that the Forest Service does not maintain. These roads may be eliminated if they are found to be of little or no general public benefit, or are not needed for resource maintenance or administrative uses (See description of roads in Appendix A).

Background of Sequoia National Forest Road System:

The Forest road system is a by-product of over 150 years of natural resource exploration and use (See Map 1 in Appendix B). Some roads were originally travel routes used by Native Americans in prehistoric times, or were established by early settlers, sheepherders or cattle ranchers in the mid to late 1800s as evidenced by the locations of prehistoric and historic cultural resource sites. Other historic roads were created for the purpose of resource utilization. The Hume Lake District, for example, has a variety of roads that were developed from log chutes or skid trails created during the logging era of the late 1800s to early 1900s. Some historic travel routes on the Forest followed stream courses and were not engineered for long-term use or with an eye toward resource management in the terms used today. These routes were not designed to any engineering standard, though in the past several years some have been evaluated and reconstructed to meet current standards.

Many roads were developed through more contemporary Forest Service resource management activities (1950s to present day). These roads were designed and constructed to reach certain areas for long-term resource management (recreation sites, timber management, fuels management, etc.). A majority of these roads were developed for timber sale access. The timber roads tend to be short in length and constructed mid-slope (tractor logging) or on ridge tops (tractor and cable logging). The ridge top and mid-slope roads are generally well removed from the riparian areas and not as prone to damaging the surrounding resources as the older, user-created roads.

The majority of roads within the monument area were constructed between the years of 1950 and 1980. Most of these roads were built to access forested areas to help meet the country's growing need for wood fiber. These roads were also designed to higher standards to provide for a diversity of long term uses, including public access. Timber harvest levels have declined sharply since 1993 when the California Spotted Owl Sierran Province Interim Guidelines were implemented. Harvest levels have declined further since the April 2000 presidential proclamation establishing Giant Sequoia National Monument and the January 2001 Sierra Nevada Forest Plan Amendment. Since the early 1990s public use of the roads has increased about three percent per year. Pleasure driving is the single largest recreational use of National Forest System lands, constituting 36 percent of all recreational use in 1996. In summer, recreational drivers on the National Forests account for 13.6 million vehicle-miles per day. The outlook is for recreational road use to grow by an additional 64 percent by the year 2045.

Most National Forest visitors travel on the classified Forest Road System. These roads provide access for millions of national and international tourists annually. Many of these roads serve as extensions to the State and County Roads. Forest roads serve such needs as: recreation, fire protection and suppression, commercial uses, grazing, university research, private property access, mining, vegetation management, and insect and disease control.

Giant Sequoia National Monument can be accessed through several points of entry. Specifically, State Highway (SH) 180, State Route 245, County Roads 265 and 469, State Hwy 198 and the

General's Highway (NPS/FS Road) provide access to the northern portion of the Monument. State Highway 190 east of Porterville, County Roads SM50, SM 56, SM 99, M3, M9 and M109 travel to and through the central and southern portions of the monument. SM 107 (Western Divide) travels north to south through this portion of the monument beginning at the termini of SH 190 and going south near the connection of roads SM50 and 99 (See Map 1 in Appendix B).

The Forest road system, as a whole, is not specifically designed to provide comfortable travel by passenger cars, as are many State and County roads. The Forest road system was designed, and is signed as a low volume road system. An estimated 29 percent of the road system is passable to passenger cars (ML3-5), 31 percent is passable only to high clearance vehicles (ML2) and 40 percent is listed as closed to vehicles (ML1). The roads are authorized for the administration and use of National Forest System lands. Generally they are open to public use but at the discretion of the Secretary of Agriculture. The Forest Service may restrict or control the use of these roads to meet specific management direction (USDA Forest Service, Forest Service Manual Section 7731).

The Forest Service has five different traffic management strategies. They are: encourage, accept, discourage, eliminate and prohibit. Encourage strategy directs forest visitors to important destinations via desirable routes. Accept strategy provides a route marker at the entrance. The discourage strategy informs potential users of road conditions that may detract from the experience they seek when visiting a national forest. Eliminate and prohibit strategies are used to close roads to vehicle traffic with the use of physical barriers or regulatory signs and orders (USDA Forest Service, FSH 7709.59-25.31).

"Road Decommissioning" is defined as activities that result in the stabilization and restoration of unneeded roads to a more natural state (FSM 7703.2(1)). Decommissioning is generally the most effective method to close roads to vehicular traffic and promote rehabilitation. Approximately one to eight miles of road have been decommissioned per year throughout Sequoia National Forest in the past five years. Roads previously selected for decommissioning were identified through site- specific analyses of negative impacts to natural resources, or lack of public and administrative use. At a broad scale this RAP will help determine potential roads to decommission that are causing negative impacts to natural or cultural resources, or are rarely used for administrative or public uses. The RAP would identify high priority roads to analyze at the more site-specific scale of landscape or project analyses.

Annually, newly constructed or acquired roads are added and some roads, if decommissioned, are removed from the Forest Transportation Atlas (FTA) (See Appendix A for definition). Newly constructed roads are typically short, single lane, of local designation and related to a single need such as accessing new recreation opportunities, or serving a private piece of property surrounded by National Forest System land. Other existing roads are often acquired through land acquisitions (purchases or exchanges). Annually less than one mile of roadway is acquired or constructed within the Sequoia National Forest.

The GSNM area has many routes or wheel tracks that are not included in the Forest road system. These roads are termed "unclassified." They have evolved in different ways; some were constructed as temporary roads as part of past timber harvest projects and were not decommissioned at the end of the sale, while others are user-defined roads or paths and generally are considered a non-authorized use. These roads are not inventoried or maintained. They may be a source of environmental damage. The Roads Policy requires watershed scale RAPs to be completed by January 2003. During this interim period, project scale RAPs will be conducted when unclassified roads are encountered to ensure the decision-maker is appropriately informed, in accordance with the Roads Policy. The first step the Forest is taking is to inventory all the unclassified roads within the next ten years, determine whether the route is causing resource damage and if there is an administrative or public access need that warrants adding it to the road or trail system. Once site-specific analysis is complete, the Forest Service is managing these roads using three methods: decommissioning, adding them to the trail system, or adding them to the Forest Transportation Atlas and classified road system. If added to the Atlas, the goal is to maintain the roads at an assigned maintenance level to meet current and expected forest demands.

The Sequoia National Forest has approximately 1,640 miles of road. Within the Forest, the GSNM has approximately 900 miles of road (Table 1). Forest roads are defined as a road wholly or partially within, or adjacent to, and serving the National Forest System and necessary for the protection, administration, and use of the National Forest System and the use and development of its resources (Title 23, US Code, Section 101; FSM 7705 – Definitions). Table 1 displays the miles of road by maintenance level objective within the GSNM. The maintenance level describes the maintenance required for a particular type of road and the level of service the user can expect. Maintenance levels vary from one (1): roads closed to the public, to five (5): a higher standard, paved facility according to Forest Service Handbook 7709.58. Maintenance levels 3 through 5 are accessible to passenger cars. Appendix A contains further descriptions on

maintenance levels. There are several roads on Sequoia National Forest that have a ML1 objective that are not actually closed to the public. This has been an ongoing administrative issue.

Table 1: Maintenance levels for roads within the GSNM

Maintenance Level (Objective)	
1	355
2	280
3	144
4	69
5	47
Total =	**899 miles**

A functional classification system is also used to classify our National Forest System Roads: arterials, collectors and locals (Table 2). Total road miles in GSNM using this classification system are presented in Table 3. Arterial roads are the main roads, which traverse the forest and connect to major State highways or county roads. They may be paved and are designed for slightly higher-speed travel. Collector roads connect arterial roads to the local roads. Local roads are at the termini of the collector roads and tend to be constructed to a lower standard and serve a small segment of land.

Table 2: Road Classifications in Current Use

Table 3: Functional Classifications of Roads in the GSNM

Functional Class	**Miles**
Arterial	116
Collector	147
Local	636
Total	899

These road classification systems identify road management objectives which:

Establish the specific intended purpose of a road based on management needs as determined through land and resource management planning;

Contain operation and maintenance criteria for exiting roads; and

Contain design criteria and operation and maintenance criteria for new roads.

Costs and Funding for Road Construction, Maintenance, and Decommissioning:

National Forest System roads must receive a certain minimal amount of annual maintenance. If the minimal maintenance activities do not occur these activities are termed deferred maintenance (See Appendix A for definition). Deferred maintenance can adversely affect the roads functionality and its impacts on the environment.

To properly maintain the Forest Road System, the roads must be maintained on a 20-year cycle. For example, each year, five (5) percent of ML1 roads must be fully maintained (5% of 520 miles equals 26 miles). The estimated cost figures, per mile used in Table 4 are from the 2002 Electronic Road Log Data Base (ERL). USDA Forest Service Regions 4, 5 (Pacific Southwest) and 6 calculate their annual and deferred road maintenance costs using these ERL figures. Table 4 displays annual road maintenance costs assuming all Sequoia National Forest roads are maintained to standard and on a scheduled cycle. Costs to adequately maintain the road system on a 20-year cycle exceeds the 2002 budgetary allowance by $780,000 as displayed in the table.

In recent years, annual road maintenance budgets have not been sufficient to accomplish minimal maintenance activities on the Sequoia National Forest road system (See Table 4). Only approximately 28 percent of the GSNM road system was partially maintained in fiscal year 2001.

Table 4: 2002 Road Work Activity Costs to Maintain Five-Percent of Sequoia National Forest Roads

In past decades, commercial users (typically timber purchasers) maintained a substantial portion of the National Forest Road System throughout the Sierra Nevadas, including Sequoia National Forest, during timber sale activities. With the decrease in timber sales, however, fewer roads are being maintained to standard. Table 5 below displays the road maintenance program funding for the Sequoia National Forest from 1988 through 1999. Long-term trends for road funding, adjusted for inflation, began gradually decreasing during the early 1990s. By the late 1990s the road maintenance funding was about half the amount available in the late 1980s and early 1990s (Table 5). This reduction is due to both the loss of timber sale activity and reductions in road maintenance budget allocations. The budgeted road maintenance allocation covered approximately half of the road maintenance activities while funds from timber sale receipts covered the other half. The effect of decreasing road maintenance allocations was worsened by the decrease in timber sale receipts at the same time.

Table 5: Budget allocations for Road Construction, Reconstruction, Decommissioning and Maintenance for Sequoia National Forest, 1988-1999 (in Thousands of 1995 Dollars)

Sequoia National Forest

1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1455	1571	1639	1451	1412	1111	738	793	779	877	792	912

The current road maintenance funding received on Sequoia National Forest and within the GSNM is used to repair the most pressing safety-related road problems. As a result, none of the roads are being maintained to their standard or within the maintenance cycle at this time. Currently, there is a backlog of needed road maintenance work, which is referred to as "deferred maintenance." In 2001, the deferred maintenance for the Sequoia National Forest development road system (including roads, bridges and culverts) was estimated as $23,705,900, comprised of the following categories:

- 12% for health and safety (clearing along roadsides, repairing potholes, replacing signs, etc.)
- 39% for resource protection (installing additional water bars, rolling dips and overside drains to prevent or reduce sediment from entering streams, installing larger culverts and open bottom arch culverts for aquatic species passage, closing roads to protect sensitive plant species and to encourage animal migration)
- 49% for the Forest Service mission (providing proper safe access on ML 1 and 2 roads for fire protection and vegetation management)

The resources needed to maintain the entire National Forest System road network are significant. The Forest Service has estimated that, at best, the agency has received approximately 20 percent of the actual funding needed for annual maintenance of this network. The resulting management response has been to defer certain maintenance-related items to a later time and not accomplish some much-needed capital improvements on the network. In recent years, the Forest Service has actively assessed the condition of its road network. The network is in a deteriorating condition due to increased use and the continued deferral of maintenance and capital improvement needs. Roads are becoming unusable through lack of maintenance, are causing resource damage or are no longer needed or desired for administrative or public access. These increasingly unusable roads are candidates for decommissioning after the appropriate site-specific NEPA procedures. It has been projected that at current funding levels, the agency will continue to lose access to the national forests and grasslands. The increasing loss of available access to all publics is demonstrated in the fact that between 1990 and 1998, over 9,000 miles of road became unavailable for passenger car use. Specifically for GSNM, the current funding (See Table 7) is only enough to maintain the ML 4 and 5 roads and a portion of the ML3 roads to standard.

In terms of resource protection, most drainage structures on Sequoia National Forest were designed for the 25-year storm event. Most of the structures on the arterial and collector roads were designed for the 50-year storm. Direction in the 2001 Sierra Nevada Forest Plan Amendment is to replace all culverts with a 100-year storm design, if they are replaced. This culvert replacement direction is part of the deferred maintenance cost estimate. The larger size culverts should ensure unimpeded passage of aquatic organisms because this large of a structure should simulate the existing streambed and stream width.

Road Locations in terms of Important Physical and Biological Features:

The current road system traverses a diversity of physical and biological features within Sequoia National Forest/GSNM. During the Ordovician and Cretaceous Period, shallow seas occupied the area that now comprises the Sierra Nevada Mountains. In the Triassic and late Cretaceous periods molten granitic rock began to intrude. Most of the sediment eroded away, and the area was uplifted by a series of faults along its east side to form the mountain range. Today, several geologic features from these remnant processes typify the Forest. These include granite domes and glacial formations usually located at the highest elevations, generally above 7,500 feet. These areas generally have shallow, granite-based soils. Upland basins and meadow systems occur between 4,500 and 8,000 feet elevation. These contain shallow to fairly deep soils in the meadow-dominated areas. Many steep river canyons exist which are predominately carved from marble and/or granite formations. The Kings River gorge is the second deepest canyon known in North America. The canyon areas are prone to landslides due to the steep terrain and periodic sloughing of rock. The upland areas and creek confluences contribute to the alluvial fans that form in foothill and savannah areas from sea level to 4,000 feet.

Geologic features, historic travel routes, recreation demand, and the need for resource utilization have played a significant role in where roads have been located on the Forest. Roads have evolved over time or been constructed in areas with unstable geologic features including landslides, very steep terrain and faults. Road placement, in some instances, has altered the integrity of aquatic and terrestrial habitats utilized by a variety of species. Some roads, for example, were developed from historic foot or wagon trails into roadways. As a result, some roads are in close proximity to streams. These roads may parallel a stream for one or more miles and cross the stream at multiple locations. These crossings provide a mechanism for large inputs of sediment to enter the stream system that may alter channel morphology and affect aquatic species habitat, especially if the road is poorly maintained.

Some watersheds contain a series of parallel ridges (i.e. Eshom area), which have resulted in a high road density per square mile as people have accessed each sub-watershed for various uses. High road density may contribute to illegal game harvest, road related mortality, increased predation due to lack of hiding cover, increased fragmentation of habitat, and altered habitat use. These factors have the potential to lower habitat suitability for wildlife in general, and in some instances, may negatively influence the presence and persistence of rare or sensitive aquatic and terrestrial wildlife species of concern. Roads may also influence rare botanical species or communities on the forest through road maintenance activity or illegal road use. The road density, location and condition factors can also contribute to introduction and spread of noxious weeds.

The Sequoia National Forest is identified as the southern extent of Pacific fisher, American marten and great gray owl in the State. It is also nesting and foraging habitat for California condor, Northern goshawk and California spotted owl. There is also habitat for several aquatic species including foothill yellow-legged frogs, mountain yellow-legged frogs, and Western pond turtles. Historically there have been wolverine, Sierra Nevada red fox and California red-legged frogs, for which habitat may exist.

The GSNM encompasses a portion of the largest concentration of giant sequoias in the world. Several of the groves are accessible to the public by roads and some include recreation sites. Road types providing grove access by vehicles range from Maintenance Level 1 to 5. Approximately half of the groves were logged in the mid to late 1800s while under private ownership and many of the old railroad beds and skidways have become classified as roads.

Use Patterns:

Historically, the main uses of the road system have been tied to commodity uses such as grazing, timber production, and hunting. The various Native American communities have used the roads to access plant gathering sites, and for cultural or spiritual purposes. There has been an increased desire by people to go to the forests and mountains for various social and spiritual pursuits. These include the need for solitude, getting away from the valley heat, seeing snow, exploration, picnicking, camping, driving for pleasure (including 4 wheel driving, using Off Highway Vehicles and Over Snow Vehicles), hiking and cultural activities including rites at sacred places.

According to the Forest recreation officers, forest use patterns have been changing over the past 10 to 20 years. More people are coming on a daily basis to recreate than for the commodity uses. More extended families are visiting designated day use and camping areas, whereas more individuals are visiting backcountry areas. There is more diversity in the desires of the visiting public, which include amenities such as flush toilets and showers at campgrounds, more roads suitable for travel by passenger vehicles (sedans), and the desire for more solitude. About one million new immigrants arrive in the United States of America each year, and about 81 percent of Forest Visitors are from urban areas according to the National Survey on Recreation and the Environment. Many of these new visitors to National Forests have different

expectations or little understanding of a land ethic in terms of public land stewardship.

The Sequoia National Forest had an active traffic surveillance-monitoring program collecting data on 80 roads from 1977 to 1982. Kern, Tulare and Fresno counties and the state of California (Caltrans) continue to monitor their traffic yearly. According to Tulare County, traffic has grown an average of three percent per year for the last decade. To make the figures in Table 6 relevant to each other, the 1994 and 1982 road counts were inflated to the year 2001 assuming that the use of these roads would increase at the same rate as the county roads. Table 6 displays traffic volumes on the state highways, county roads and major Forest Roads entering or passing through the Monument. Additional traffic data on collector and local roads within the monument and forest is on file at the Forest Headquarters in Porterville. The data on Forest and county roads was only collected during the summer months and is hence referred to as SADT (Seasonal Average Daily Traffic). Caltrans data is entitled ADT (Average Daily Traffic), as it is monitored for an entire year.

TABLE 6: Traffic Surveillance Information on Roads entering the Monument

Of note is the ADT for state highway 180 and the SADT for Forest Road 13S09. These roads provide access to Sequoia and Kings Canyon National Parks and Hume Lake Christian Camp (the largest Christian camp in the nation) as well as the northern portion of GSNM. Also, highway 180 is the recommended route for all tour bus traffic entering Sequoia and Kings Canyon National Parks.

Future demand for recreation access is expected to continue to grow while access needs for commodity production will be lower than in the past. Funds to maintain the current road system using current sources are expected to decrease (Table 5). New road construction is expected to be limited in scope.

The National Survey on Recreation and the Environment 2000 shows surveyed user priorities for Forest Management in descending order:

Manage for Protection (Avg. 74.0 percent)

Protect streams and other sources of clean water

Provide habitat and protection for abundant wildlife and fish

Protect rare, unique or endangered plant and animal species

Manage for Amenities (Avg. 61.6 percent)

Maintain national forests for future generations to use and enjoy

Provide quiet, natural spaces for personal renewal

Use and manage forest areas in ways that leave them natural in appearance

Provide information and educational services about forests, their management and the natural life in them

Manage for Outputs (Avg. 38.1 percent)

Provide access, facilities and services for outdoor recreation

Emphasize planting and management of trees for an abundant timber supply

Provide access to raw materials and products for local industries and communities

Provide roads, accommodations and services to help local tourism businesses

Provide permits to ranchers for grazing for livestock such as cattle and sheep

Unroaded areas:

There are several wilderness and roadless areas within the Forest that are being managed for the unroaded values they contribute to the landscape. In the GSNM these include approximately 5,000 acres of the Golden Trout Wilderness and approximately 9,000 acres of Monarch Wilderness. Roadless Areas within the GSNM include all or parts of Moses Mountain, Slate Mountain, Black Mountain, Dennison, Lion Ridge, Rincon and Agnew. Approximately half of the Kings River Special Management Area, encompassing 22,450 acres, is also within the GSNM. The unroaded areas are generally important socially both for the visiting public, and for

the segment of public that find roadless and wilderness areas have passive value, i.e. that these areas are important to be maintained, even though they may have no intention of visiting.

Benefit, Problem and Risk Assessment:

Road Analysis Process evaluation criteria were created based on specific topic areas described in the FS-643 miscellaneous report. These topics include ecosystem functions and processes; aquatic, riparian zones and water quality; terrestrial wildlife; economics; commodity production in terms of timber, minerals and range management, water production, and special forest products; special use permits; general public transportation; administrative uses; protection; road-related and unroaded recreation; passive use values; social issues; and civil rights and environmental justice.

Some topic areas are best evaluated at the more site-specific landscape scale than at the watershed scale (See SNFPA Appendix T for discussion of scales). Some of the data becomes so diluted at the broad scale that everything appears to have low impacts, when at the more site-specific scale negative impacts can be seen and evaluated. The GSNM Road Analysis Process has been conducted at a broad, watershed scale to identify overall trends. The Roads Policy and FSM 7700 recommend conducting landscape level RAPs prior to site-specific projects affecting the transportation system.

The evaluation criteria developed for the GSNM RAP are (See Appendices C and D for full description of each criterion):

Aquatic Risk Factors

Geologic Hazard

Stream Crossing Density

Riparian Zone – Stream Proximity

Terrestrial Risk Factors

Heritage Resources

Road Density Effects to Wildlife Habitat

Scenic Resources

Access Factors

Private/Non-recreation Public Access

Public Access (Recreation)

Administrative Site Access

Vegetation Management

Fire Protection

Social Factors

Lifestyle, Attitudes, Beliefs & Values

Economics

The interdisciplinary team used the evaluation criteria described in Appendix D of this document to generate an information baseline against which the existing and future road systems can be compared. They then went back through the questions listed in Appendix C and reiterated in Step 4 of miscellaneous report FS-643 to describe the baseline and any apparent benefits, problems or risks of the current road system (FS-643 pp.24-30). This discussion of the analysis follows by topic area.

Ecosystem Functions & Processes

There are few roads that are on highly unstable geologic features so this risk is generally

moderate to low. The majority of the monument road system is on areas with moderate geo-hazard risk and a few roads are on areas with low geo-hazard risk. The roads identified on the northern portion of GSNM with high geo-hazard risk are generally good candidates to decommission because there is little use and recurring resource concerns. The main use of several roads in the northern portion of the GSNM is vegetation management. Some of these roads could also provide opportunities for decommissioning once the vegetation reaches the desired condition as specified under an appropriate land management plan. On the southern portion of the monument over half of the roads on high geo-hazard risk areas are also moderately to highly important for access.

Several roads rated as moderate or low geo-hazard risk have moderate to low access needs and have high risk for other resource risk factors, which make them potential candidates for relocation or removal after site-specific analysis is conducted.

Aquatic, Riparian Zone and Water Quality

The analysis showed that perennial and intermittent stream crossings were not necessarily an issue in comparison to the road's proximity to these streams. At the monument and forest scale, the analysis of road stream crossings and road proximity to perennial and intermittent streams gives a good starting point for further analysis at the Landscape level as defined in the 2001 Sierra Nevada Forest Plan Amendment. Perennial and intermittent streams are the primary habitat for fish and other aquatic species rather than ephemeral streams. However, there are a large amount of ephemeral streams on Sequoia National Forest and in the GSNM. The addition of ephemerals into the equation could drastically change the analysis results and show more roads with an elevated risk both in terms of stream crossings and stream proximity.

Throughout the monument most roads were rated low risk in terms of stream crossing density. A few roads rated moderate and even fewer rated high. Those that did rate high were mainly short roads, less than a mile average, with one or more stream crossings.

In terms of riparian zone proximity, there was a wider and more balanced range of roads that were high, moderate or low risk. Several of the main access routes follow creeks and provide recreation access directly to these stream courses through developed and dispersed recreation sites.

Prior to developing future projects, the stream crossing density and stream proximity evaluations will be conducted as part of the roads analysis at the more detailed landscape scale.

Terrestrial wildlife

The analysis showed that along the major travel corridors, there is higher potential of habitat loss. This loss is mainly in the form of fragmentation, i.e. roads creating breaks in suitable habitat. Overall the Monument road system has a moderate risk to wildlife habitat. Specific locations that are main recreation destinations tend to be heavily roaded and are therefore moderate to high-risk areas in terms of wildlife habitat loss. Wildlife research has shown ML 3 roads tend to have the highest impacts to wildlife because they are maintained for higher speed use, and are still a narrow corridor that wildlife will regularly cross. There are several roads that have objective and operational maintenance levels recorded in the Forest Transportation Atlas, which are known to exist at a completely different maintenance level on the ground. This is an ongoing administrative issue, which has been worsened due to lack of personnel and funding to maintain the Transportation Atlas and the road management objectives (RMO). As a result, the evaluation criteria weighting on ML 3 roads as the highest risk to wildlife should be reviewed at the landscape and project levels to ensure that the roads on site are correctly identified in the Forest Transportation Atlas. The Atlas would be updated at that time.

Economics

Over 70 percent of the Monument road system is lower maintenance level roads (ML 1-2) with corresponding lower costs of maintenance. The lower the maintenance level number, the less it generally costs to maintain, and there are fewer requirements to make these roads accessible to passenger cars. Approximately 55 percent of the Local roads from Table 3 are Maintenance Level (ML) 1, and 45 percent are ML2. Over half of the local roads have the least cost to maintain of all the system roads. Approximately 30 percent of the roads within the GSNM have moderate to high costs of required maintenance due to their objective maintenance levels. These are the level 3, 4 and 5 roads that are required by public laws to be maintained to a minimum safe standard. The Collectors are ML3 and Arterials are ML 4-5. Given the current road funding sources, it is not feasible to maintain the current Monument road system to standard under the current and expected budget allocations as shown in Table 7 (Derived from Tables 3 and 4 on pages 5-6 of this document).

Table 7: 2001 Road Work Activity Costs to Maintain Five Percent of GSNM Roads

As shown above, the current annual maintenance budget does not cover the anticipated maintenance needs of the ML 3-5 roads, even without considering the maintenance needs on ML 1-2 roads. The amount of deferred maintenance is expected to continue to increase, and the lower standard roads will degrade quicker due to lack of adequate maintenance activities.

Funding sources to maintain roads are limited. As discussed earlier the reduction in timber sales has greatly reduced road maintenance funds from timber sale receipts. There are no recreation fees available to supplement the annual maintenance funds, and there is no prospect of recreation fees becoming available in the near future. Gas Tax funds may become available from the Federal Highway Administration to improve and maintain some of the Public Forest Service Roads within the Monument and Forest. Public Service Roads are generally ML 3-5 roads that are subject to the Highway Safety Act (some of these roads are identified in Table 6). The Ten Mile Road (13S09) is one of these roads; this road has also been identified in the Sequoia and Kings Canyon National Park's Draft General Management Plan as the preferred route to direct traffic toward Hume Lake and reduce congestion in the Grant Grove area.

Commodity production-timber management, minerals management, range management, water production and special forest products

The current road system is adequate to support a much larger program of commodity production than is expected in the next decade. The road system is more than adequate to maintain the current plantations, though the quality of these generally low standard roads is deteriorating due to lack of maintenance. The new guidelines in the Sierra Nevada Forest Plan Amendment, and future guidelines from the GSNM plan may affect the need for roads in certain locations and for specific activities. The decline in commodity production has led to a decline in funding for road maintenance, and has resulted in a larger backlog of deferred maintenance on the Forest Road System as discussed earlier in this document.

Special use permits

A few roads are under special use authorization. Some of these roads exist solely to access private property surrounded by National Forest System lands. Other special use roads provide access to resorts, recreation residences, organization camps, communication sites, apiaries and other authorized uses. Most of these Special Use Permit (SUP) roads have a requirement that the permittee maintain the roadway to a specific maintenance level. These roads tend to be short and adequately maintained, and also tend to be low risk to resources.

General public transportation

The current road system provides a fairly wide range of destinations available for public use. Many roads are highly important for public access to the monument. Other roads are rarely or never used for public access. These rarely used roads are often short spurs leading to plantations or other areas with little appeal for recreation or other public uses. Approximately 40 percent of the current road system is identified as ML 1, which is supposed to be closed for public access. However only an estimated 50 percent of these ML 1 roads are actually closed to vehicles.

The existing road system does seem to provide adequate access, though there are some concerns. First, many of the roads were not built for the type of use they are receiving, and second, many of the roads are currently not getting the planned level of maintenance.

Administrative uses

Several of the roads used for administrative purposes are also used for dispersed recreation, while others are closed to public vehicle use. At this time there is adequate road access to serve the current administrative activities within the GSNM. However, to manage the groves, there may be minor changes to the road system to more effectively manage the sequoia resources. There is also the administrative issue of roads in use at maintenance levels that are different than the recorded operational or objective maintenance levels in the Forest Transportation Atlas.

Protection-fuels

Approximately half of the road system is highly important for fire protection purposes. These roads are either important strategic locations for stopping wildfires, or provide access to important strategic locations. Throughout the GSNM, several roads were rated as moderately important, and about 1/3 of the road system was considered low importance for fire protection. The low importance roads were generally the short spur roads leading to

plantations or natural features such as meadows. However, as the focus of fuels management changes from prevention to more active fuels management, the needs for a road system are expected to change.

Social Issues

Sequoia National Forest personnel have gathered information from various public involvement efforts on recreation use, specifically four-wheel drive and off-highway vehicle use for several years. However, none of the existing data is specific to road use by the recreating and non-recreating public of the GSNM. The interdisciplinary team in concert with the GSNM team identified a need to gather information from the public in terms of their lifestyles, attitudes, beliefs and values regarding the GSNM road system. The RAP interdisciplinary team developed a public involvement package in order to adequately evaluate the social environment.

Members of the public who had expressed interest in monument planning or roads on Sequoia National Forest were sent a package regarding the RAP process within the GSNM on January 7, 2002. The package included a summary of the RAP process and how it related to the monument planning process, a Road Use Data Sheet, evaluation criteria regarding lifestyles, attitudes, beliefs and values, a chart listing most of the classified roads in the monument and a map showing all the classified roads in the monument. A glitch in the computer link between the map and the database to create the transportation layer prevented including all the classified roads in the DRAFT Public/Social Access Factors Chart. This problem was disclosed to the public because not all roads would be listed in the chart. People were asked to review the package and then fill in the Road Use Data Sheet and the DRAFT Public/Social Access Factors Chart and return them to the RAP team leader by February 22, 2002. The packages were sent to over 3,500 addresses and as of June 28, 2002 there were 501 responses. This is a 14 percent response rate. Some of the respondents represented organizations of 265 to 500,000 members.

Special interest groups, other governments and other state and federal agencies were contacted to participate in the RAP. The Tule River Indian Tribe participated in the RAP through two meetings between the RAP interdisciplinary team leader and the tribal liaison. Members of the Dunlap Band of Mono Indians were contacted, specifically those with interest in rancherias within in the boundaries of the Hume Lake Ranger District. No one representing the Dunlap Band or associated with the rancherias responded to the public involvement process. The Tule River Tribe and agencies including Sequoia and Kings Canyon National Park, Mountain Home State Forest and CalTrans submitted letters with specific items of clarification or correction to add to the public/social access evaluations. These items were incorporated into this report and the supporting documents to better reflect the needs of these stakeholders in the road system. The California Four Wheel Drive Association requested that the RAP be presented at their annual meeting on February 9, 2002. The interdisciplinary team leader made a presentation at the meeting. A second meeting was held on February 18, 2002 between members of the Cal. 4WD Association and OHV coordinators for the Hume Lake, Tule River and Hot Springs Ranger Districts. Forest Service personnel reiterated the same points brought out in the February 9 meeting at this second one.

Only 15 percent of the respondents have been using the monument for 10 years or less. About 25 percent of the respondents have been using the monument area for 10 to 30 years. Over 60 percent of the respondents have been using this area for over 30 years, 10 percent of which have been using it for over 70 years. The longest use estimate is from the Tule River Tribe with a timeframe between 5,000 and 8,000 years. These responses seem to indicate a high proportion of the respondents are from local areas (i.e. California, mainly Los Angeles Basin and San Joaquin Valley areas). The 1999-2001 National Survey on Recreation and the Environment Report produced by the USDA Forest Service and the University of Tennessee was used for comparison purposes where applicable.

On an annual basis, over 40 percent of the respondents use or live in the monument boundaries for more than six months out of the year. About 35 percent use the monument one to six months out of the year, with the assumption that the bulk of this use is during the summer. About 22 percent of the respondents use the monument for a day to a week per year and less than one percent have never used it.

Several of the respondents wrote about their families' experiences over the generations using and enjoying this area. There were a few stories from families that homesteaded this area before the Forest Service was even existed. Many expressed the need to maintain their connection with these mountains, and the desire to pass their various traditions of using the forest down to their children and grandchildren (See the Respondent Comment Summary in Appendix E).

Several people commented on the need to maintain access both for resource management, but also to allow the public to see and appreciate the groves. Several people mentioned that the

monument was an unnecessary designation because the resources are already protected. Many of these same individuals were concerned that certain special interest groups (i.e. Sierra Club) will close off the monument to the people who have lived in and around it for generations. Twenty four percent of the respondents supported the idea of adding roads to groves to increase tourism and management.

Several respondents wanted to ensure the sequoias and other features of the monument are protected. The most common suggestions were to eliminate roads, specifically logging roads. Many of these individuals also were very concerned about the user-created roads and the use of 4WD, OHV and OSV within the monument. Sixteen percent of the respondents supported the idea of eliminating all roads possible in groves.

The public involvement effort showed that 70 percent of the respondents wanted to keep the road system that exists, and they want it to be a mix of road types similar to the existing mix. A few of the respondents felt the rating of preferences was not well designed.

Table 8: Road Type Public Preferences

Though 19 percent of the respondents wanted to increase the road system, many realized that the Forest is struggling to maintain the current road system. Eleven percent of the respondents want the road system reduced, mainly suggesting elimination of short spur roads and roads causing resource damage.

In addition, respondents to the public involvement for the GSNM included a request to add bus tour routes within the monument. This request was added as one of the options for the RAP public involvement process. Of the 501 respondents to the RAP, 3 ranked it as their first choice (<1 percent), 15 as second (3 percent), and 27 as third (5 percent) and 9 wrote in a "no" category. Several respondents said bus tours would not work for two main reasons. The monument is physically separated by Sequoia National Park into a northern and southern portion and the road system is not configured for bus tours. There is no existing road system that is a direct route between the two portions of monument, and the current road system was not built for tour bus traffic. Several portions of the current road system are too narrow and winding to allow buses to travel safely.

It can be assumed that many of the respondents have developed traditions and lifestyles associated with the GSNM and Sequoia National Forest. However, as one can see from Table 8 (See discussion under Roaded Recreation/Public Use) and the categories developed for the NRS, there is a lot of overlap and therefore similar results in some areas. As the NRSE conclusion states, "These early findings suggest that outdoor recreation is still a basic part of the American lifestyle. As a matter of lifestyle, traditional land, water, snow and ice settings are still very much in demand as places for casual activities such as walking, picnicking, family gatherings, sightseeing and visiting nature centers or nature trails." The current monument road system is a direct link to, and often an integral part of, these recreation and other traditional land uses as shown by the responses to the public involvement process.

Recreation-unroaded recreation and road-related recreation,

There are no plans to build roads in unroaded areas in the GSNM. There are several roads rated by Forest Service recreation staff as highly important for recreation access, both for reaching specific destinations and driving for pleasure. In the northern portion of GSNM, roads were generally rated of either high or low importance, whereas in the southern portion of GSNM, most roads were either of high or moderate importance. This difference between the importance ratings in the northern and southern portions of the monument may be due to the differing layout of the road systems in conjunction with the locations of privately owned land, recreation destinations, and other non-recreation public access needs.

Roaded Recreation/Public Use

Many people use the road system for a variety of uses. Table 9 below lists the public response regarding the reasons they use roads in the GSNM. The primary reason for use is driving for pleasure. Several respondents commented on enjoying the ability to explore different areas of the forest by traveling different roads and following them just to see where they go. The second most common use was access for camping. The third most commonly selected use was to get to hunting and/or fishing areas. Some of the respondents noted that they hike roads that are gated, and there was a mix of opinion on whether these roads should be open to the driving public. Most respondents (68 percent) agreed that they want access maintained, as it presently exists.

It must be noted that the intent of the Roads Analysis public involvement was to focus on road use and not the overall recreation use of the monument. In light of this intent, a comparison

with the National Recreation Survey (NRS) shows similar results. The top five NRS averages in order from most popular outdoor activity to least are:

Individual Trail/Street/Road Activities (walking, bicycling, mountain biking, hiking and horse riding/equestrian),

Traditional Social Activities (family gathering and picnicking),

Viewing and Photographing Activities (bird watching, viewing other wildlife, viewing wildflowers and natural vegetation and viewing natural scenery),

Viewing and Learning Activities (visiting nature center/nature trail/zoo, visiting prehistoric/archaeological site, visiting historic site),

Driving for Pleasure Activities (sightseeing, driving for pleasure through natural scenery, and off road/4-wheel driving/ATV/motorcycle).

The rest of the reasons for use within GSNM in descending order are shown in Table 9. As one can see four of the top six most selected reasons to use roads in the GSNM are also within the top five NRS most popular outdoor activities as well.

Table 9: Reasons People Use Forest Roads within GSNM

Of the respondents who selected "Other," approximately 80 percent of them said they use roads to go to their private land or special use cabin. They did not select the available choices, "Pass through to other land" or "Get to SUP site." Of the remaining "Other" respondents, several mentioned using Forest Roads for fire escape routes, needing roads because age or disabilities have limited their ability to walk very far, mountain biking and cross-country skiing. A few mentioned the need to access their grazing allotments, the Tule River Tribe mentioned resource management, the Park Service mentioned access to Dillonwood Grove, and the California Department of Fire and Forestry mentioned access to Mountain Home State Forest. These needs were used to edit the administrative evaluation of the non-recreation public access criteria and are reflected in the Road Use Data Chart (Appendix E).

Civil rights and environmental justice

Some of the respondents were concerned that as taxpayers they may be excluded from their public lands. These respondents expressed a general concern that certain special interest groups (i.e. Sierra Club) will close off the monument to the people who have lived in and around it for generations.

There is also a concern from several respondents about reduced vehicle access for people who have disabilities that limit their ability to walk to sites. Some of the elderly respondents also mentioned concerns about their road access needs due to physical limitations as they've aged. They want to keep roads accessible by automobile because they now need to drive to areas they could have hiked to in the past.

The NRSE surveyed individuals to determine if different segments of society differ in their values toward the National Forests. For five National Forest values, the researchers broke down responses by individuals' ages, gender, race, income groups and education. One of these values is "Provide access, facilities and services for outdoor recreation." The importance ratings changed across each category evaluated. This forest value became increasingly important for segments of the population in the following categories:

As people age (especially from age 45+),

Females,

Native Americans (much more important),

Blacks (slightly higher importance),

Income of $15,000 to $24,000,

Individuals attaining up to and including an eighth grade education.

Information of this type was not requested during the Road Analysis public involvement. However, the change in terms of age does coincide with the RAP responses received (See Appendix E). Further study would be necessary to determine if different segments of society differ in their values toward providing road access within the GSNM.

Issues:

In accordance with Forest Service miscellaneous report FS-643, the interdisciplinary team identified road-related issues based on coordination with Forest and District line officers and the information obtained from the public involvement process (FS-643 pp.23-24).

There are six main issues associated with roads on the Sequoia National Forest, both within and outside the GSNM:

Concern that roads will negatively affect the water flow within the watersheds for various reasons including the shallow, erosive soils, areas of steep terrain and proximity of roads to stream courses.

Concern that adequate road access is maintained for private landowners, recreation and business users, administrative and vegetation management activities, and for fire protection.

Concern the lifestyles and traditions associated with using roads for commodity production will have to change because the monument is no longer part of the suitable timber base for the forest.

Concern the lifestyles and traditions associated with using roads for 4WD/OHV/OSV associated recreation will have to change because certain factions of the public want no 4WD/OHV/OSV use allowed in the monument.

Concern that roads have negative effects to the human dimension by allowing people to access and damage heritage resource sites, and create scars on the land.

Concern that roads have negative effects to wildlife by fragmenting wildlife habitat leading to species and suitable habitat declines.

Access is the primary public issue related to roads. For some of the public that means access should be maintained for "their" needs. Many visitors have strong family traditions and ties to certain areas, which have become a belief in the right to continue accessing these areas. Another part of the public wants access to be limited, specifically for OHV use, timber production, cattle grazing and other uses they deem damaging to the natural resources …(Forest Trail Plan FEIS, Appendix O; and RAP public involvement, see Appendix E of this document).

The primary concern for land managers is to provide adequate access for public use and resource management, including recreation, private land, and vegetation treatment for fuels reduction, fire protection and wildlife habitat improvement. Within the monument specifically, the focus is on management of sequoia ecosystems and the other objects of interest as discussed in the 2000 Presidential Proclamation establishing Giant Sequoia National Monument.

The primary legal constraints on roads and roads management are requirements to protect heritage resources, requirements to allow reasonable access to private in-holdings, and the standards and guidelines in the 2001 Sierra Nevada Forest Plan Amendment including the aquatic management strategy. The other constraint at this time is the budgeted road maintenance allocation.

Opportunities and Priorities:

This portion of the report identifies the management opportunities, establishes priorities and formulates technical recommendations for the existing and future road system. These opportunities and priorities were developed using the issues, benefits, problems and risks identified in the preceding steps. The questions below are from the FS-643 miscellaneous report and guide the discussion (FS-643 pp.31-33).

The RAP showed that most roads within GSNM are used by both the public and Forest Service for a variety of reasons.

Does the existing system of roads create an unacceptable risk to ecosystem sustainability?

Portions of the existing road system create risks to ecosystem sustainability. The roads that follow perennial and intermittent creeks generally have a higher impact on water flow and quality. There are also densely roaded areas within the monument that are affecting the quality of wildlife habitat. Aquatic species and their habitat are being affected by the road stream crossings and the proximity of roads to creeks. However, the extent of negative effects is not certain at this scale. If the road system is not adequately maintained, the potential risks to the ecosystem are likely increase in different areas mainly in terms of sediment yield to creeks. It is imperative that road effects to terrestrial and aquatic species habitat be revisited

at the more site-specific, landscape scale. More site-specific evaluation criteria may need to be developed to better address concerns within specific landscapes as well.

Can the maintenance requirements of the existing system be met with current and projected budgets?

The limiting factor in road management at this time is funding. As stated repeatedly in this report, the current and predicted road maintenance budgets do not adequately fund maintenance of the existing road system (See Table 7). If Sequoia National Forest personnel used the current allocated road maintenance budget to bring roads within the GSNM up to standard, approximately 70 percent of the road system would not be maintained at all. This has the potential to significantly affect the risks to the ecosystems and access needs if the road system continues to deteriorate at the current rate. Only the ML 4 and 5 roads and a portion of the ML 3 roads within the GSNM could be maintained. Though there are social and economic factors that could benefit from more roads, or roads at higher maintenance levels (ML 3-5) than currently exist, the economic feasibility does not exist. Map 2 in Appendix B shows the "minimum road system" in terms of current and expected funding from current and expected sources. It may be better termed the "maximum affordable road system." These few roads would become the minimum or backbone road system in accordance with FSM 7712.1 quoted on page 1 of this document.

Are some existing roads not needed to meet projected access needs?

Some existing roads have been rated low in importance for access both by the public and for administrative purposes. Some of these same roads have moderate to high resource risk factors, which may make them likely candidates to consider for decommissioning. Several of the roads have been rated high in importance for vegetation management. However, the vegetation management needs should decrease under the SNFPA as plantations reach maturity and no longer need maintenance. This may result in several more roads becoming available to consider for decommissioning in the next few decades. Depending on the GSNM planning effort, the road system may be altered due to changes in management direction.

If new access is proposed, what are the expected benefits and risks?

At this time addition of new roads in the GSNM would be limited. Newly constructed roads are typically short, single lane, of local designation and related to a single need such as accessing new recreation opportunities, or serving a private piece of property surrounded by National Forest System land. Other existing roads are sometimes acquired through land acquisitions (purchases or exchanges). The alternatives in the monument planning process may affect the amount of roads within the transportation system. Annually less than one mile of roadway is expected to be constructed within the GSNM. Dependent on the alternative, zero to one mile or more could be decommissioned or converted to trail annually. With little additional access proposed, the expected risks and benefits are minimal.

What opportunities exist to change the road system to reduce the problems and risks or to be more consistent with forest plan direction and strategic intent of the roads system?

Several opportunities exist to change the road system to reduce problems and risks. Roads to consider include:

Roads rarely used by the public or Forest Service that have high resource risks could be considered for decommissioning.

Roads rarely used by the public or Forest Service that have low resource risks could be considered for decommissioning.

Roads accessing vegetation that has reached desired condition may be evaluated for decommissioning.

Roads frequently used by the public or Forest Service with moderate to high resource risks could be evaluated to relocate portions of the roads away from resource risks or create alternate access routes with fewer resource risks.

Two or more roads accessing the same area, where traffic could be directed onto the more stable road and decommission the less stable road(s).

Create a loop road to eliminate several spurs accessing the same area.

There would be an initial cost outlay to relocate, decommission roads, or convert roads to trails. The long-term effect would be reduced risk to ecosystems from deteriorating roads and

a smaller and more efficient road system to fund. Reducing the road system mileage should allow the limited maintenance funds to be used on a larger proportion of the transportation system.

Several action items were identified that need to occur for decision-makers to be better informed on the road system:

The operational road maintenance levels need to be verified on the ground and the database corrected prior to implementation of projects that affect or are affected by the road system.

Additional evaluation criteria may need to be developed to fully determine effects at the landscape or project level (i.e. location of PACs, etc. in relation to roads).

Reevaluate the objective road maintenance levels in light of the change in management objectives within GSNM, and the national and local trends in road maintenance funding.

Update the current Forest Transportation with the information gathered in the RAP, and maintain the FTA.

As stated throughout this document, there are several roads in use and being maintained at a maintenance level different than the recorded operational or objective maintenance level in the Forest Transportation Atlas (FTA). Correcting maintenance levels in the FTA to reflect existing conditions on the ground would improve the information available to resource specialists and decision makers in terms of roads and their effects on other resources. It should also make administrative decisions regarding road maintenance level more consistent throughout the monument.

Appendix A

Glossary

Road Definitions:

- **Forest Road:** Any road wholly or partly within, adjacent to, and serving the National Forest System and which is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources (23 USC 101).
- **Public Roads:** Roads that are under the jurisdiction of and maintained by, a public authority that are open to public travel (23 USC 101(a)).
- **National Forest System Roads:** Forest roads under the jurisdiction of the Forest Service (23 USC 101).
- **Forest Transportation Atlas:** An inventory, description, display and other associated information for those roads, trails and airfields that are important to the management and use of National Forest System lands or to the development and use of resources upon which communities within or adjacent to the National Forests depend.
- **Classified Roads:** Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service (36 CFR 212.1).
- **Deferred Maintenance:** Maintenance activities that can be delayed without critical loss of facility serviceability until the work can be economically or efficiently performed.
- **Low Standard Roads:** Forest roads constructed and maintained for use by prudent drivers in high clearance vehicles (such as pickup trucks, 4WD vehicles and sport utility vehicles) as opposed to ordinary passenger cars. These roads are low-standard, unsurfaced, single-lane roads with turnouts. They were designed to be driven at five to ten miles per hour.
- **Temporary Roads:** Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be a part of the forest transportation system and not necessary for long-term resource management (36 CFR 212.1).
- **Unclassified Roads:** Roads on National forest System lands that are not needed for, and not managed as part of, the forest transportation system, such as unplanned roads, abandoned travel ways, off-road vehicle tracks which have not been designated and managed as a trail, and those roads no longer under permit or authorization.
- **Maintained for Public Use:** A Memorandum of Understanding with the Federal Highway Administration defines national forest system roads open to the public as those roads

open to unrestricted use by the general public in standard passenger cars, including those roads on a seasonal basis or for emergencies.

- **Decommissioning:** is defined as activities that result in the stabilization and restoration of unneeded roads to a more natural state (FSM 7703.2(1)). Decommissioning includes applying various treatments, which may include one or more of the following:

Reestablishing former drainage patterns, stabilizing slopes, and restoring vegetation;

Blocking the entrance to a road; installing water bars;

Removing culverts, reestablishing drainage-ways, removing unstable fills, pulling back road shoulders, and scattering slash on the roadbed;

Completely eliminating the roadbed by restoring natural contours and slopes; or other methods designed to meet the specific conditions associated with the unneeded roads.

Maintenance Levels:

- **Maintenance Level 5:** Roads that provide a high degree of user comfort and convenience. Normally double lane, paved facilities or aggregate surface with dust abatement. This is the highest standard of forest Service road maintenance.
- **Maintenance Level 4:** Roads that provide moderate degree of user comfort and convenience at moderate speeds. Most are double lane, paved surfaced though some may be single lane.
- **Maintenance Level 3:** Roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Typically, low speed, single lane, with turnouts and native or aggregate surfacing.
- **Maintenance Level 2:** Roads open for use by high clearance vehicles. Passenger car traffic is discouraged. Traffic is minor administrative, permitted, or dispersed recreation. Non-traffic generated maintenance is minimal.
- **Maintenance Level 1:** These roads are closed though some intermittent use may be authorized. When closed, they must be physically closed with barricades, berms, gates, or other closure devices. Closures must be in place for one year or more. When open, the road may be maintained at any other level. When closed to vehicular traffic, the road may be suitable and used for non-motorized uses, with custodial maintenance to protect adjacent resources.

Appendix B

Maps

USDA Forest Service, 1999. Roads Analysis: Informing decisions about Management the National Forest Transportation System. Misc. Rep. FS-643. Washington, D.C.

Historic traffic count figures on the Sequoia National Forest and in Tulare County.

1998 Report of the Forest Service Performance Highlights of the Natural Resource Agenda.

Cordell, Ken, et al, 1999-2000 National Survey on Recreation and the Environment, USDA Forest Service and the University of Tennessee, Knoxville, Tennessee.

Sierra Nevada Forest Plan Amendment, Final EIS, Volume 2, Chapter 3, part 5.5, page 446

This data and the maintenance level information (Table 1) were taken from the Forest Transportation Atlas and Transportation Inventory System database.

Road Analysis: Informing Decisions about Managing the National Forest Transportation System, USDA Forest Service, FS-643, August 1999, p.12

Sierra Nevada Forest Plan Amendment, Final EIS, Volume 2, Chapter 3, part 5.5, page 446

Sierra Nevada Forest Plan Amendment, Final EIS, Volume 2, Chapter 3, part 5.5, page 447

Sierra Nevada Forest Plan Amendment, Final EIS, Volume 2, Chapter 3, part 5.5, page 447

Administrative National Forest System Roads – Deferred Maintenance and Capital Improvement, Oct. 19, 2001.

Cordell, et al.

Ibid.

Ibid.

Thomas, J.W., H. Black Jr., R. J. Scherzinger and R. J. Pedersen. 1979. Deer and Elk, Chapter 8, IN: Wildlife Habitats in Managed Forests the Blue Mountains of Oregon and Washington. Jack Ward Thomas Technical Editor. Agricultural Handbook No. 553. U.S. Department of Agriculture, Forest Service. Sept. 1979.

Highway Safety Act of 1966 (PL 89-564).

Cordell, Ken, et al, 1999-2001 National Survey on Recreation and the Environment, USDA Forest Service and the University of Tennessee, Knoxville, Tennessee, pp.1-4.

NSRE data shows that 17.5 percent of the population 16 or Older participated in Off Road, 4 Wheel Driving, ATV or Motorcycle use, whereas 52.1 percent participated in Sightseeing and 51.5 percent participated in Driving for Pleasure through Natural Scenery.

Cordell, Ken, et al, 1999-2001 NRSE powerpoint presentation, Keeping Ourselves Informed about What the Public Values.

Duck Creek-Swains RAP, version 1, April 2001

Sierra Nevada Forest Plan Amendment, Final EIS, Volume 2, Chapter 3, part 5.5, page 444

Sierra Nevada Forest Plan Amendment, Final EIS, Volume 2, Chapter 3, part 5.5, page 444

Return to top of page.

Appendix E

Monitoring Plan

MONITORING AND EVALUATION REQUIREMENTS

PURPOSE

The purpose of monitoring and evaluation is to provide information on the results and progress of Forest Plan implementation so that:

-Necessary changes in the management practices can be instituted; and,

-Indicated plan amendments/revisions can be made.

MONITORING AND EVALUATION SYSTEM

The total monitoring system on the Monument consists of a wide variety of actions that are closely linked to the Adaptive Management Strategy found in the Framework. Data collected for this monitoring plan is expected to be compatible with the protocol and objectives of the Framework plan. Data will be able to be aggregated "upward" in order to support monitoring from stand level up to bioregional levels. The monitoring plan presented in this document consists of those special activities that focus on evaluating the broad aspects of plan implementation. Other monitoring consists of reports, reviews and records that occur as a routine part of Forest management. Actions not duplicated in this plan include such things as: individual and annual fire reports; management attainment reports; annual vegetation management action plans, reviews and reports; budget and financial management documents; recreation information management reports; environmental analysis reports; activity reviews; audits; and general management reviews.

Monitoring and evaluation are separate, sequential tasks. Monitoring is designed to observe and record the results of both natural processes and actions permitted by forest land and resource management plans. Evaluation looks at those results, determines how well those results meet forest plan direction, and identifies measures to keep the plan viable.

There are three distinct levels of monitoring: 1) implementation monitoring, 2) effectiveness monitoring, and 3) validation monitoring. Each is defined as follows:

Implementation Monitoring: Implementation monitoring determines if plans, prescriptions, projects and activities are implemented as specified in the project level environmental document (e.g., EAs). Implementation monitoring answers the question: "Was the required measure performed on the ground as specified in the project environmental document?"

Effectiveness Monitoring: Effectiveness monitoring determines if prescriptions and management activities meet management direction, objectives, and the standards and guidelines. This level of monitoring is conducted on a limited basis as determined by resource values and risks, and public issues. Effectiveness monitoring is done only after determining that the plan, prescription, project, or activity to be monitored has been implemented according to the plan's direction. Effectiveness monitoring answers the question: "Did the required practice actually work?" If the answer is "yes", no further monitoring need be done. If the answer is "no", the appropriateness of the mitigation must be evaluated. Until that determination is made, other activities in the same watershed may or may not be halted, depending on the characteristics and scope of the problem and its context.

Validation Monitoring: Validation monitoring determines whether the initial data, assumptions, and coefficients used in development of the plan and required practices are correct; or if there is a better way to meet forest planning regulations, policies, goals, and objectives. Validation monitoring is generally done only when effectiveness monitoring results indicate that a given practice may not be working. The primary exceptions are in fields such as wildlife, where broad population trends must be evaluated. Figure E-1 displays the process for evaluating monitoring results from each monitoring level. There is a direct, sequential relationship between the levels. This relationship is designed to focus initial attention at the implementation monitoring phase.

Figure E-1: Diagram displaying evaluation process for monitoring levels

THE TWO-PART APPROACH TO MONITORING

A two-part approach to monitoring and evaluation is adopted for the Giant Sequoia National Monument Management plan.

Project Monitoring

The major part and centerpiece of the monitoring effort focuses on in-the-field project monitoring.

The District Ranger is responsible for ongoing and post-project review of all projects. All projects are monitored to ensure that prescribed activities were implemented as planned (see Figure E-2, Phase 1). He/she performs implementation monitoring and coordinates effectiveness monitoring. The ranger files a monitoring report on each project that is kept at the district office. Copies are filed in the Supervisor's Office, as well, to facilitate public review of them. Annually the forest management team selects a sample of completed projects drawn from each district to review the management results on the ground (see Figure E-2, Phase 2). Projects are to be selected with an emphasis on soil productivity and water quality. At year's end, the management team reports on both the monitoring effort and on-the-ground results. Evaluation of results and recommendations for Plan amendment, or changes in practices and policies, are made at this time.

Table E-1 shows in detail those items that shall be monitored as appropriate to a given sample project. The heading "Assessment Process" identifies the monitoring process to be followed at each of the three phases of monitoring. Precision is the exactness or accuracy of measurement techniques. Validity is the expected probability that information acquired through sampling will reflect actual conditions. Both precision and validity are qualitatively rated as high, moderate, or low. The expected accuracies for precision and validity levels are:

Level of Precision/Validity	Expected Accuracy
High (H)	Within + 10%
Moderate (M)	Within + 33%
Low (L)	Within + 50%
N/A	Cannot be established.

Minimum monitoring frequency specifies how often and at what sample size the assessment will be made. The responsible staff is, in each case, the member of the forest management team who is responsible for the assessment. The standard indicating further action is the "trigger" for further monitoring procedures. Estimated average annual costs are shown for each assessment process. If a practice is already part of on-going forest management and thereby already budgeted, it is labeled "SOP" for "standard operating procedure".

Figure E-2: Diagram of Two Phases of Monitoring

Program Monitoring

The second part of the monitoring process responds to the need to monitor some aspects of the program on a landscape or forest-wide basis (see below). The following results of this monitoring will occur:

(1) Improve our ability to develop cost-effective program

Implement our plans.

Gain efficiency and consistency in achieving our agreed-upon objectives

Carry out congressional direction.

MONITORING OBJECTIVES AND APPROACH

The following section lists the monitoring objectives and approaches by resource area. They describe the required monitoring with the following specifics: scale, frequency, precision and validity, responsible staff, and estimated annual cost.

Monitoring Tables 1 - 11:

Vegetation - Landscape and Stand/Project Level

Fire and Fuels - Landscape and Project Level

Fire and Fuels - Monument-wide/Watershed Scale

Air Quality - Project Scale

Air Quality - Bioregional Scale

Caves

Aquatic Resources

Soils and Geology

Erosion

Fire

Flooding Frequency

Return to top of page.

Appendix F

Scientific Advisory Board Advisories

Giant Sequoia National Monument

Scientific Advisory Board

Adopted Advisories

Advisories last updated February 26, 2002

This appendix has two parts. Part 1 is a summary of how the Forest Service did use or will use the advisories. Part 2 is a complete list of the Advisories issued by the Scientific Advisory Board as of January 29, 2002.

Part 1: The Use of Scientific Advisory Board Advisories in the EIS Documentation

This section summarizes the way in which the advisories were used in the preparation of the Draft Environmental Impact Statement or may be used in subsequent planning activities. Please refer to Table F-1 for detailed information.

Part 2: The Advisories

This section presents the Advisories issued to the Forest Service by the Scientific Advisory Board. Advisories are presented in the following format:

Issue or Question

Facts

Implications to the Monument

I. Priority of objects.

- *Issue*: Given the numerous objects of interest to be protected and/or promoted in the Giant Sequoia National Monument, as noted in the Presidential Proclamation, how should the agency set priorities among the objects to be protected, especially when protection of one object conflicts with another?
- *Facts*: Scientists have delineated the range of the Giant Sequoia species, and have discovered key natural elements and objects within the Sequoia's ecosystem. The Giant Sequoia itself can be considered an indicator species for the ecosystem. The purpose of the Monument, as stated clearly in the Presidential Proclamation creating the monument, is to protect the Giant Sequoia and its ecosystem. This must be considered as the top priority in drafting a management plan for the GSNM. However, the proclamation also mentions other objects. It mentions protecting unusual geological formations, such as caves; it also seeks to preserve the historical record, including its use by Native Americans and Euroamericans; finally, the proclamation states that the monument will be open to public/recreational/educational use to the extent consistent with preservation (and natural regeneration) of the Giant Sequoia. Ecosystems science seeks to uncover the interrelationships among all elements within the ecosystem. It is no easy task identifying all the subtle relationships that comprise the whole; nevertheless, the goal is to identify the essential elements that allow for the healthy functioning of the entire ecosystem. Ecosystems management is the applied component of ecosystems science. It uses ecosystems science to manage in a holistic manner, as opposed to one that encourages a single, or dominant, use.
- *Implications for the Giant Sequoia National Monument and its Management*: As the designated management agency, the Forest Service is encouraged to continue using ecosystems science to uncover the essential natural, physical, and historic elements within the monument boundaries. Ecosystems management does not allow for rigid, or hard and fast, prioritization of one object over another; rather it seeks to foster diversity and to employ adaptive management. Given the large geographic extent of the monument, it is possible to identify sub-areas, which will allow for different management goals and emphases. However, it must always be kept in mind that the overall purpose of the Monument is the protection of the Giant Sequoia species. This includes its natural regeneration. If a use conflicts with that goal, then it must be reconsidered.
- *Advice*: The Forest Service should use ecosystems science as the basis for its management plan for the Giant Sequoia National Monument. Its management plan should be characterized by: interrelatedness of the parts to the whole; fostering the natural diversity of the ecosystem; allowing for public use, education, and enjoyment of the monument to the extent consistent with protection and preservation of the Giant Sequoia species.

II. Eras

- *Issue*: What shall we call the eras before and after the Sequoia Forest changed during the Nineteenth Century?
- *Facts*: Pollen records within the present groves show that giant sequoias began to increase dramatically with the onset of a slight global cooling at the end of the Altithermal era thousands of years ago (Antevs 1948, 1955; Anderson 1994, Anderson and Smith 1994). Though pollen records reflect small changes in the proportions of species to the present, the most dramatic changes were completed by about A.D. 900 (Graumlich 1993). From A.D. 900 to 1875, both climate and fire regimes continued to vary (Hughes and Brown 1992, Graumlich 1993, Scuderi 1993, Swetnam 1993).

From 900 AD into the 19111 Century California Indians manipulated the environment with fire to promote vegetation regeneration, for hunting, to capture insects for food, and other activities (Blackburn and Anderson 1993; Anderson and Moratto 1996; Lewis 1973; Bean and Lawton 1973). Indigenous tribes have occupied California for at least 12,000 years (McGuire and Garfinkel 1980; Moratto 1984, Hull and Moratto 1999). They did not suppress natural fires and their intentional burning produced landscapes more open than in the 20th century. Some tribes considered giant sequoias important and to be protected (Powers 1877; reprinted by Heizer 1976: 398). Euroamerican contact, gold rush and settlement in the 19th century ended much tribal manipulation of giant sequoias and other ecosystems.

The loss of fire due to disruption of traditional tribal practices plus subsequent fire suppression profoundly changed the forest. At 68 sites in the parks adjacent to the Monument, the median year of last natural fire was 1875 (Caprio et al. 1997). The year 1875 also roughly corresponds to the time that logging and its effects began to become prevalent in the southern Sierra Nevada (Otter 1963).

- *Implications for the Monument:* For four reasons, ca. A.D. 900- 1875 provides a useful reference period for change (see Stephenson 1999).

Indians used fire to manage the forest;

Logging had not yet become prevalent;

Forest composition (but not necessarily structure) was similar to that of the present; and

Climate, though variable, included periods similar to the recent climate.

- *Advice*: Call the era ca. A.D. 900-1875 of similar climate and Indian use of the forest, "pre-1875". Call the period since that time "post-1875".

References:

Anderson, R.S. 1994 Paleohistory of a giant sequoia grove: the record from Log

Meadow, Sequoia National Park. *In* P. S. Aune, technical coordinator, Proceedings of the Symposium on Giant Sequoias: Their Place in the Ecosystem and Society, pp. 49-55.23-25 June 1992, Visalia, California. USDA Forest Service General Technical Report PSW -151.

Anderson, M.K. and M.J. Moratto 1996 Native American land use practices and ecological impacts. *In* Sierra Nevada Ecosystem Project: final report to Congress, Vol. II, assessments and scientific basis for management options, pp. 187-206. Wildlands Resources Center Report No.37, Centers for Water and Wildlands Resources, University of California, Davis, California.

Anderson, R.S. and S.J. Smith 1994 Paleoclimatic interpretations of meadow sediment and pollen stratigraphies from California. Geology 22:723- 726.

Antevs, E. 1948 Climatic Changes and Pre- White Man. *In* The Great basin, With Emphasis on Glacial and Postglacial Times. University of Utah Bulletin 38(20):168-191.

Antevs, E. 1955 Geologic-Climatic Dating in the West. American Antiquity 20(4):317-335.

Bean, L.J. and H. W .Lawton 1973 Some Explanations for the Rise of Cultural complexity in Native California with Comments on Proto-Agriculture and Agriculture. *In* H. Lewis, Patterns of Indian Burning in California: Ecology and Ethnohistory,. Ballena Press Anthropological Papers 1, pp. v- xlvii. Ramona, CA.

Blackbum, T.H. and K. Anderson (compilers and editors) 1993 Before the Wilderness: Environmental Management by Native Californians. Ballena Press, Menlo Park, CA.

Caprio, A., C. Conover, M. Keifer, and P. Lineback 1997 Fire Management and GIS: A Framework for Identifying and Prioritizing Fire Planning Needs. Presented at Fire in California Ecosystems: Integrating Ecology, Prevention, and Management, Nov. 17-20,1997, San Diego, CA.

Graumlich, L.J. 1993 A 1000-year record of temperature and precipitation in the Sierra Nevada. Quaternary Research 39:249-255.

Heizer, R.F. (editor) 1976 Tribes of California (by S. Powers; originally printed in

1877). University of California Press, Berkeley.

Hull, K.L. and M.J. Moratto 1999 Archeological Synthesis and Research Design Yosemite National Park, California. Yosemite Research Center Publications in Anthropology No.21. Yosemite, CA.

Hughes, M.K. and P.M. Brown 1992 Drought frequency in central California since 101 B.C. recorded in giant sequoia tree rings. Climate Dynamics 6:161-167.

Lewis, H. 1973 Patterns of Indian Burning in California: Ecology and Ethnohistory. Ballena Press Anthropological Pagers 1, Ramona, CA.

McGuire, K.R. and A.P. Garfinkel 1980 Archaeological Investigations in the Southern Sierra Nevada: The Bear Mountain Segment of the Pacific Crest Trail. USDI Bureau of Land Management, Bakersfield, CA.

Moratto, M.J . 1984 California Archaeology. Academic Press, San Francisco, CA.

Otter, F .L. 1963 The Men of Mammoth Forest. Edwards Brothers, Ann Arbor, Michigan.

Scuderi, L.A. 1993 A 2000-year tree ring record of annual temperatures in the Sierra Nevada mountains. Science 259: 1433-1436.

Stephenson, N. L. 1999 Reference Conditions for Giant Sequoia Forest

Restoration: Structure, Process, and Precision. Ecological Applications 9:1253-1265.

Swetnam, T.W. 1993 Fire history and climate change in giant sequoia groves. Science 262:885-889.

III. Desired conditions.

- *Issue*: What are desired conditions for vegetation?
- *Facts*: We have already entered climatic conditions that have no recent precedent, and pollution and pest conditions with no known precedent. For example, current atmospheric CO2 concentration is the highest it has been in at least 420,000 yrs, and perhaps 20 million years (IPCC 2001). Global temperature is rising, and the 1990s was probably the warmest decade in the last 1,000 years (Mann et al. 1998; IPCC 2001). In the Sierra Nevada, current temperatures are also rising, and are among the warmest of the last millennium (Graumlich 1993). Global average temperature is projected to increase an additional 1.4 to 5.8 C (2.5 to 10.4 F) by 2100 (relative to 1990), at a rate that is likely to be unprecedented in the last 10,000 years (IPCC 2001). Layered on top of these ongoing changes are other immediate stressors that have no precedent, such as air pollution and introduced pathogens.
- *Implications for the monument:* The Proposed Action's desired condition for vegetation is too rigidly defined. Restoring and maintaining vegetation within a pre-Euroamerican range of variability may soon become undesirable or impossible. It may become undesirable because pre-Euroamerican vegetation conditions may soon become less stable or resilient to ongoing and unanticipated changes than some other set of vegetation conditions. It may become impossible because certain species, combinations of species, or vegetation structures simply may not be able to survive in future conditions.
- *Advice*: The overriding desired condition for vegetation is one that exhibits both stability and resilience, while best maintaining native biodiversity. That is, the overriding goal for vegetation is the ability to resist stressors (stability) and to recover from stresses once they occur (resilience). The presidential proclamation itself speaks of "restoring natural forest resilience" in the Monument.

For the near future and because environmental conditions have not yet deviated radically from pre-1875 conditions, the goal of restoring stability and resilience can be met by using pre-1875

mosaic of vegetation as a reference (Stephenson 1996). For example, many forested areas of the Monument are more dense and have much more surface fuel now than in pre-1875 times. Restoring pre-1875 forest densities and fuel loads would make these forests more stable (e.g., resistant to being severely altered by 1 wildfire, droughts, pathogen outbreaks, or air pollution), and more resilient (more able to rebound from such stressors when they occur).

References:

Graumlich, L. J. 1993. A 1000-year record of temperature and precipitation in the Sierra Nevada. Quaternary Research 39:249-255.

IPCC (Intergovernmental Panel on Climate Change). 2001. Climate Change 2001: The Scientific Basis. Summary for Policy Makers. http://www. ipcc.ch/pub/spm22-01.pdf

Mann, M. E., R. S. Bradley, and M. K. Hughes. 1998. Global-scale temperature patterns and climate forcing over the past six centuries. Nature 392:779- 787.

Stephenson, N. L. 1996. Ecology and management of giant sequoia groves.

Pages 1431-1467 in Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, Assessments and scientific basis for management options. Centers for Water and Wildland Resources, University of California, Davis.

Stephenson, N. L. 1999. Reference conditions for giant sequoia forest restoration: structure, process, and precision. Ecological Applications 9: 1253-1265.

IV. Restoration of the Natural Fire Regime.

- *Issue*: Can fire alone be used to reach the desired condition for the giant sequoia groves and their surrounding ecosystem?
- *Facts*: Fire often is a useful tool for restoring giant sequoia groves and other fire-adapted ecosystems (Hardy and Amo 1996; Stephenson 1996, 1999). However, issues such as human safety, air quality, water quality, endangered species, cumulative impacts with other management actions, current and desired forest structure, and current fuel loads mean that fire alone cannot always be used to achieve desired forest conditions, (Weatherspoon 1996; Fule et al. 1997; Piirto and Rogers 1999). In areas where fire alone cannot be used to achieve desired conditions, mechanical thinning often proves to be a useful alternative (Weatherspoon 1996).
- *Implications for the Monument:* It is unrealistic to use fire alone to reach desired conditions in all areas of the monument. In some areas, mechanical thinning will be needed, and is allowed, "if clearly needed for ecological restoration and maintenance or public safety (Clinton 2000)."
- *Advice*: Develop a decision tree to help determine which methods of forest restoration and maintenance should apply at different locations. Consider factors such as the following:

- Ecological Need - Number of fires missed by an area
- Reduced biodiversity
- Deviation from pre-1875 structure, composition, and process
- Hazard
- Fuel load
- Fire ladders
- Ignition probability
- Stand density
- Adjacent vegetation
- Vegetation mosaic
- Risk
- Objects of Interest
- Public Safety
- Traditional uses by Tribal members of Tule River Reservation and other Native Americans
- Recreation

- Water Quality
- Erosion potential
- Air Quality
- Endangered species
- Feasibility
- Access
- Economic
- Social Acceptance References

References:

Clinton, W.J. 2000. Establishment of the Giant Sequoia National Monument: a

Proclamation by the President of the United States of America. Apri115, 2000.

Fule, P. z., w. w. Covington, and M. M. Moore. 1997. Determining reference conditions for ecosystem management of southwestern ponderosa pine forests. Ecological Applications 7: 895-908.

Hardy, C. C., and S. F. Amo (eds.). 1996. The use of fire in forest restoration. U.S.D.A. Forest Service General Technical Report INT-GTR-341.

Piirto, D. D. and Rogers, R. R. 1999. An ecological foundation for management of national forest giant sequoia ecosystems. R5-EM-TP-005. U. S. D. A. Forest Service, Pacific Southwest Region.

Stephenson, N .L. 1996. Ecology and management of giant sequoia groves.

Pages 1431-1467 in: Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, Assessments and scientific basis for management options. Wildland Resources Center Report No.37 , Centers for Water and Wildland Resources, University of California, Davis, California, USA.

Stephenson, N. L. 1999. Reference conditions for giant sequoia forest restoration: Structure, process, and precision. Ecological Applications 9: 1253-1265.

Weatherspoon, C. P. 1996. Fire-silviculture relationships in Sierra forests. Pages 1167-1176 in: Sierra Nevada Ecosystem Project: Final Report to Congress, vol.ll, Assessments and scientific basis for management options. Wildland Resources Center Report No.37 , Centers for Water and Wildland Resources, University of California, Davis, California, USA.

V. Prioritizing areas of land.

- *Issue:* Is there a need to prioritize areas within the Monument for management action?
- *Facts:* Neighboring Sequoia and Kings Canyon National Parks have found that reestablishing pre-1875 fire regimes and forest structure is a lengthy and difficult process (Caprio and Graber 2000). Sequoia and Kings Canyon National Parks are considered to be among the leaders in restoring fire to coniferous forest ecosystems. After three decades of prescribed burning, fire regimes approaching pre-1875 frequencies have been established in some, but not all areas of the Parks. Limitations to the rate at which fire has been reintroduced have included understaffing, air quality restrictions, and weather (W. *Kaage, personal communication,* July 2001).

Additionally, the need for management action varies across the landscape (Caprio

et al. 1997; Keifer et al. 2000). For example, fuel loads and the consequent risk of severe wildfire vary greatly with location on the landscape.

- *Implications for the monument:* Restoration of fire regimes and forest structure in the Monument may take many decades, and in fact may never be fully complete. Additionally, some areas will need management action more urgently than others.
- *Advice*: Areas within the Monument must be prioritized for management action. There is value in using an explicit, quantitative scheme to identify areas most in need of management action, such as restoring pre-1875 fire regimes and forest structure (Caprio et al. 1997; Keifer et al. 2000). Such a scheme would probably consider (but not necessarily be limited to) some weighted combination of:

HAZARD of catastrophic stress, such as stress by severe wildfire. Factors to consider would likely include (but not necessarily be limited to) fuel load, ignition probability, stand density, fire ladder, adjacent vegetation types, and current vegetation mosaic.

RISK to values and objects of interest. Factors to consider would likely include (but not necessarily be limited to) water quality, erosion, sensitive species, public safety, ceremonial and traditional uses, and identification as objects of scientific or historical interest.

ECOLOGICAL NEED. Factors to consider would likely include (but not necessarily be limited to) number of fire cycles missed, biodiversity, and deviation from pre-1875 vegetative structure, composition, and function.

FEASIBILITY. Factors to consider might include (but not necessarily be limited to) economic, site access, legislated land designations, and social acceptance.

It is unreasonable to expect that a thorough, fine-grained prioritization of management areas will be included in the first Monument management plan. However, at a minimum, the plan should include the determination to set priorities plus the factors to be considered for prioritizing areas, or better yet, a quantitative scheme to be used in the prioritization.

References:

Caprio, A., C. Conover, M. Keifer, and P. Lineback. 1997. Fire management and GIS: a framework for identifying and prioritizing fire planning needs. Proceedings of the Conference on Fire in California Ecosystems: Integrating Ecology, Prevention, and Management. Nov. 17-20,1997, San Diego, CA. (http:/ /www .nps.gov/seki/fire/pdf/sd97 _frid. pdf)

Caprio, A. C., and D. M. Graber. 2000. Returning fire to the mountains: can we successfully restore the ecological role of pre-Euroamerican fire regimes to the Sierra Nevada. Pages 233-241 in D. N. Cole, S. F. McCool, W. T. Borne, and J. O'Loughlin, compilers. Wilderness Science in a Time ofChange Conference --Volume 5: Wilderness Ecosystems, Threats, and Management. Proceedings RMRS-P-15-VOL-5. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Keifer, M., A. C. Caprio, P. Lineback, and K. Folger. 2000. Incorporating a GIS model of ecological need into fire management planning. Proceedings of the Joint Fire Science Conference and Workshop, Crossing the Millennium: Integrating Spatial Technologies and Ecological Principles for a New Age in Fire Management, June 14-16, 1999, Boise, ID. http://www.nps.gov/seki/fire/Ddf(ifsQ.Qdf)

VIII. Air Quality

- *Issue:* Prescribed burning may increase short-term smoke emissions and affect public health.
- *Facts*: The San Joaquin Valley Air Basin is classified as a serious non-attainment area for the health-based National Ambient Air Quality Standards for particulate matter with an aerodynamic diameter of 10 microns or less (PM-IO). As such, the San Joaquin Valley Unified Air Pollution Control District (District) was required by the Federal Clean Air Act to prepare an Attainment Demonstration Plan (Plan). The Plan sets forth the direction and framework, including the emission control strategies that the District needs to implement, to achieve attainment of the National Ambient Air Quality Standards. The Federal Clean Air Act requires that the Plan develop Best Available Control Measures for prescribed fire.

On March 23, 2000, the California Air Resources Board amended Title 17, Agricultural Burning Guidelines (which became Smoke Management Guidelines for Agricultural and Prescribed Burning). To implement the new Title 17 requirements, District Rule 4103 (Prescribed Burning and Hazard Reduction Burning) was promulgated on June 21,2001.

As a serious non-attainment area for PM-IO, the San Joaquin Valley Air Basin has low tolerance for additional smoke. Yet Giant Sequoia National Monument inevitably will contribute smoke to the Basin, regardless of management approach (e.g., see Cahill et al. 1996). At one extreme, if no forest restoration efforts were undertaken and all fires were fought aggressively, the Basin would still experience episodes of moderate to extreme smoke from wildfires that inevitably escape control and burn through dense, unrestored (and hence fire-prone) forest. (Indeed, wildfires in the Sequoia National Forest produced an average of nearly 2,500 tons of PM -10 per year from 1981 through 1995 [USDA Forest Service 2001].) On the other hand, management actions that restore forest conditions that are less prone to uncontrollable wildfires, whether

those actions emphasize prescribed fire or mechanical means, will also produce smoke. For obvious reasons, use of prescribed fire alone inevitably produces smoke, though the timing and quantity are much more controllable than that produced by wildfires. (Additionally, prescribed fires generally produce less smoke per acre than wildfires [USDA Forest Service 2001].) Mechanical means of restoring forest structure and reducing fire hazard must deal with slash and dead surface fuels, and often the most pragmatic and cost-effective way of dealing with some or all of these fuels is by burning, again producing smoke. Additionally, mechanical approaches to forest restoration can contribute to PM-IO through increased dust production, though this contribution is probably minor relative to that of smoke.

- *Implications for the Monument:* As suggested in the Science Advisory Board's Advisory IV. (http://www.r5.fs.fed.us/giant_sequoia/documents/adv.pdf), smoke production should be one of the factors considered in developing management alternatives for forest restoration.
- *Advice*: Game out scenarios of PM-10 production using various combinations of management approaches to forest restoration, including a "wildfire only" scenario. The approach taken in the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001) provides a good model for gaming various scenarios. The analysis might proceed roughly as follows, though these suggested steps are not meant to be prescriptive.
  - 1. Produce three scenarios of future air quality standards in the San Joaquin Valley: (a) Assume that current standards are retained,

(b) Assume a realistic scenario in which standards become more restrictive for smoke production by prescribed fire, and

(c) Assume a realistic scenario in which standards become less restrictive for smoke production by prescribed fire.

2. For a typical range of conditions in forests that require restoration, calculate the likely production of PM-10 (from both smoke and dust), in tons per acre, that would be produced by prescribed fire alone, mechanical means (and any associated burning), and wildfire.
3. For each of the three scenarios of future air quality standards, game out the maximum area of forest that could be restored annually using various combinations of prescribed fire alone and mechanical means (along with any associated burning). Additionally, game out possible smoke production from wildfires alone, assuming that no forest restoration is undertaken (perhaps using past wildfires to help estimate possible future wildfires).
4. Use the information gained in (1) and (3), in concert with other factors as suggested in the Science Advisory Board' s Advisory number 4 (http:/www.r5.fs.fed.us/giant_sequoia/documents/adv.pdt), to develop management alternatives for forest restoration that are within current and future potential air quality standards.

References

Cahill, T. A., I. I. Carroll, D. Campbell, and T. E. Gill. 1996. Air quality. Chapter 48 (pages 1227-1261 *in* Sierra Nevada Ecosystem Project: final report to Congress, vol. II, Assessments and scientific basis for management options. Wildlands Resources Center Report No. 37, Centers for Water and Wildlands Resources, University of California, Davis, California, USA. (http://ceres.ca.gov/snep/pubs/web/PDF/VII_C48.PDF)

USDA Forest Service. 2001. Air quality. Section 3.7 (pages 323-354) *in* Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement, Vol. 2. USDA Forest Service, Pacific Southwest Region.

IX. Undesirable Fire Effects

- *Issue*: Fuels reduction strategies in the Sierra Nevada Forest Plan Amendment may not adequately protect the giant sequoias and mixed conifer ecosystem from catastrophic fire. (For the purposes of this Advisory, "catastrophic fire" is defined as fire of an extent and severity beyond that which is consistent with the values for which the Monument was created.)
- *Facts:* Page 18 of the January 2001 Record of Decision (ROD), Sierra Nevada Forest Plan Amendment Environmental Impact Statement (EIS), states regarding Giant Sequoia National Monument that "Lands within the monument are subject to the decisions made

through this ROD. However, the monument management plan, and subsequent plan amendment, may modify this direction to protect the values for which the monument was created." Thus, if the fuels reduction strategies in the Forest Plan Amendment EIS are determined to inadequately protect the giant sequoias and mixed conifer ecosystem from catastrophic fire, the Monument management plan can deviate from the Plan Amendment.

The Plan Amendment (ROD p. 4) generally prescribes that, outside of the 0.25-mile wide urban-wildland defense zone and for trees greater than 6 inches in diameter at breast height (dbh), forest canopy cover reduction is not to exceed 20%, and that canopy cover is not to fall below 50%. Additionally, trees greater than 20 inches dbh generally are to be retained.

One of the goals stated in the Monument proclamation is to restore "natural forest resilience" (Clinton 2000). Some foresters, forest ecologists, and others believe that in some areas of the Monument, the standards set forth in the Forest Plan Amendment may be too restrictive to meet this goal with regard to catastrophic wildfire, and to protect other objects of interest in the Monument. Yet, no quantitative analysis has been conducted specifically to test this belief.

Implications for the Monument: It is possible some areas of the Monument, the Forest Plan Amendment standards may be too restrictive to meet the intent of the Monument proclamation. A quantitative analysis needs to be conducted to test this possibility.

- *Advice*: Conduct a quantitative test of the possibility that the Forest Plan Amendment standards are too restrictive to meet the intent of the proclamation. The test might proceed as follows:
  - 1. Define acceptable levels of risk of catastrophic wildfire that are consistent with the goals of the proclamation. For example (and for illustrative purposes only), under 95th percentile August weather conditions, less than 35% of the general coniferous forest landscape, and less than 20% of giant sequoia grove area, is susceptible to wildfire that would kill more than 70% of all trees greater than 20 inches in diameter at breast height (dbh). Other possible approaches to defining acceptable levels of risk can be found in Shulman and Gelobter (1996), Piirto and Rogers (1999), and elsewhere.
  - 2. For at least 10 randomly selected Monument watersheds that contain >500 acres of mixed coniferous forest (at least 7 of which contain sequoia groves), project forest structure and fuels that would follow treatments that adhere to the Forest Plan Amendment standards. (The number and sizes of watersheds suggested here are for illustrative purposes, and may need to be altered to meet the goal of this Advisory.)
  - 3. Using FARSITE, BEHAVE, or similar fire behavior and spread models, for each of these watersheds after fuel treatments, model the potential effects of a wildfire burning under 95th percentile weather conditions for August.
  - 4. Compare the results with the previously defined acceptable levels of risk.
  - 5. Use the preceding comparison in concert with other considerations (as suggested in the Science Advisory Board' s Advisory IV http://www.r5.fs.fed.us/giant_sequoia/documents/adv.pdf]) to determine whether the standards outlined in the Sierra Nevada Forest Plan Amendment need to be modified to meet the goals of the Monument.

The biggest limitation to this analysis is likely to be existing data. Regardless, every attempt should be made to conduct a similar quantitative analysis.

References:

Clinton, W. J. 2000. Establishment of the Giant Sequoia National Monument: a proclamation by the President of the United States of America. Apri1 15, 2000.

Piirto, D. D., and R. R. Rogers. 1999. An ecological foundation for management of National Forest giant sequoia ecosystems. USDA Forest Service, Pacific Southwest Region, publication R5-EM- TP-005.

Shulman, D., and A. Gelobter. 1996. Evaluating potential loss from wildfire of specified forest arid stand attributes in Sequoia National Forest. Unpublished draft report (dated 2/96) on file in the Porterville office of Sequoia National Forest.

USDA Forest Service. 2001. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement. USDA Forest Service, Pacific Southwest Region.

X. Will increased numbers of visitors, recreation infrastructure, and methods of fuels treatment lead to impairment of watershed functions?

- *Facts:* The Monument contains multiple watersheds, the waters of which support numerous beneficial uses, both inside and outside of Monument boundaries. The watershed is the natural management unit for evaluating the physical consequences of management decisions. Although many interests cross watershed boundaries, managing the functionality of the underpinnings of the biophysical system most logically occurs at the watershed level. The scale of the action under consideration will define the watershed scale of analysis.

Recreational activity and associated infrastructure can alter water quality and watershed functions (Kattelmann 1996, Moyle and Randall 1996). Areas of more intensive recreational use and development have the greatest potential for impairing water quality. The sources of such change include roads, trails, intensive use of riparian areas, septic systems, and antiquated infrastructure, among others (Kattelmann 1996).

Restoration of the natural fire regime also has the potential to affect Monument watersheds, based upon both past management activities and current or proposed management activities. High-severity wildfire has diverse effects on watersheds and the aquatic environment. Direct short-term effects can include loss of streamside and upland vegetation and alteration of soil characteristics (Brown 1990, Minshall et al. 1990, Swanson 1991, Rieman and Clayton 1997, Poff 1996). Indirect effects can include increased flooding, increased sediment erosion and deposition, increased stream temperature, decreased fish and macro-invertebrate abundance, and alteration of instream habitat (Brown 1990, Minshall et al. 1990, Novak and White 1990, Swanson et al. 1987, Swanson 1991, Ewing 1996, Rieman and Clayton 1997). Although many effects of high-severity fire on streams may be considered adverse in the short term, the effects improve with time. Fire has a critical role for creating and maintaining landscape characteristics, habitat and species diversity, and life history complexity (Brown 1990, Rieman and Clayton 1997, Gresswell 1999).

The alternatives to wildfire, prescribed burning and mechanical treatments, have less severe direct and indirect effects to watersheds than does high-severity wildfire. The relatively low intensity of prescribed fires results in less post-fire soil erosion and change to soil structure, if the fire remains within prescription. Mechanical treatments have variable effects on soil erosion and alteration of soil conditions, depending upon the method used. These effects range from less than to greater than prescribed fire (Kattlemann 1996, Poff 1996).

The Forest Service currently applies a method of cumulative watershed effect (CWE) analysis (Berg et al. 1996, Menning et al. 1996). The method quantifies the effects of past management activities and current or proposed management activities. The threshold of concern (TOC) is defined in the method as an indicator that an unacceptable level of stream degradation could occur. The TOC is a measure of the watershed's tolerance for disturbance, and when approached indicates that more rigorous, field-based, analysis is required prior to the management activity.

Management activities in the Monument would likely lead to an exceedance of the TOC of some subwatersheds. Of particular concern for fuels treatment are the urban interface zones, where subwatersheds at or near the TOC would also be the focus of greater fuels management. Of concern for recreation is increased use and development of already developed areas, where watersheds are already at or near the TOC.

- *Implications for the Monument:* The methods used to achieve the desired conditions in the Monument may result in the degradation of some streams or watersheds to above their TOC. If Clean Water Act or state water quality standards may be violated, then the use of fuel control methods or types of recreation could be restricted to certain geographic areas.
- *Advice:* Use the CWE analytical framework as a basis for predicting the effects of recreation on watersheds. The current CWE analytical tools will need to be expanded beyond consideration of sediment transport in order to allow the flexibility to address chemical water quality and water use as appropriate. Consider restoration of existing water quality impairment in conjunction with management plans for expanded recreational use. The scale of watershed under analysis may need to be expanded from the current approach depending upon the extent of the proposed actions.

The CWE analysis is also a primary element of determining the effect on watersheds of different methods of fuel treatment (Advisory IV, *Restoration of the Natural Fire Regime*). The existing CWE model focuses on the impacts of timber harvest; it will need to be expanded to include

quantification of the other methods of fuel treatment that may be proposed for the Monument, including prescribed burning and wildfire. Include a determination of the potential effect of severe wildfire on subwatersheds in prioritizing areas requiring fuels treatment (Advisory V, *Prioritizing Areas of Land*).

Watersheds may require restoration in conjunction with management actions to ensure that the TOC is not exceeded. Use the determination of areas most in need of fuels treatment and most likely to be the focus of recreational use (Advisory V, *Prioritizing Areas of Land*), together with existing information on subwatersheds near the TOC, to develop a prioritization of watersheds that should be restored to conditions well below the TOC. Of those watersheds near or above TOC, first consideration for restoration should be given to areas in the Ecological Zone of Influence for giant sequoia groves, then the urban interface zone, then the remainder of the Monument (Advisory I, *Priority of Objects*).

Maintaining the integrity of watersheds, and the biophysical system they support, faces the challenge that the waters cross political boundaries. Giant Sequoia National Monument, Sequoia National Forest, Sequoia National Park, Tule River Indian Reservation, CDF-managed lands, and private lands are all entwined in the network of watersheds. The Giant Sequoia Ecology Cooperative could serve as a basis for informing integrated management of watershed issues. If the Monument maintains a full-time scientific presence (Advisory XVIII, *Scientific Presence*), then this position would be a natural focal point for transforming the deliberations of the Cooperative into management advice for the Monument.

References

Berg, N.H., K.B. Roby, and B.J. McGurk. 1996. Cumulative Watershed Effects: Applicability of available methodologies to the Sierra Nevada. In: Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chap. 2. Davis, CA: University of California, Centers for Water and Wildland Resources.

Brown, J.K. 1990. Effects of fire on aquatic systems. Pages 106-110 in F. Richardson and R.H. Hamre, editors. Wild trout IV: Proceedings of the symposium. U.S. Government Printing Office, Washington, D.C.

Ewing, R. 1996. Postfire suspended sediment from Yellowstone National Park, Wyoming. Water Resource Bulletin 32:605-627.

Gresswell, R.E. 1999. Fire and aquatic ecosystems in forested biomes of North America. Transactions of the American Fisheries Society, 128:193-221.

Kattelmann, R. 1996. Hydrology and Water Resources. In: Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chap. 30. Davis, CA: University of California, Centers for Water and Wildland Resources.

Menning, K.M., D.C. Erman, K.N. Johnson, and J. Sessions. 1996. Modeling Aquatic and Riparian Systems, Assessing Cumulative Watershed Effects, and Limiting Watershed Disturbance. In: Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chap. 2. Addendum. Davis, CA: University of California, Centers for Water and Wildland Resources.

Minshall, G.W., D.A. Andrews, J.T. Brock, C.T. Robinson, and D.E. Lawrence. 1990. Changes in wild trout habitat following forest fire. Pages 111-119 in F. Richardson and R.H. Hamre, editors. Wild trout IV: Proceedings of the symposium. U.S. Government Printing Office, Washington, D.C.

Moyle, P.B., and P.J. Randall. 1996. Biotic Integrity of Watersheds. In: Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chap. 34. Davis, CA: University of California, Centers for Water and Wildland Resources.

Novak, M.A., and R.G. White. Impact of a fire and flood on the trout population of Beaver Creek, upper Missouri Basin Montana. Pages 120-127 in F. Richardson and R.H. Hamre, editors. Wild trout IV: Proceedings of the symposium. U.S. Government Printing Office, Washington, D.C.

Poff, R.J. 1996. Effects of Silvicultural Practices and Wildfire on Productivity of Forest Soils. In: Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, chap. 16. Davis, CA: University of California, Centers for Water and Wildland Resources.

Rieman, B., and J. Clayton. 1997. Wildfire and native fish: issues of forest health and conservation of sensitive species. Fisheries 22(11):6-15.

Swanson, D.N. 1991. Natural Processes. Pages 139-180 in W.R. Meehan, eidtor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society, Spec. Pub. 19, Betheseda, Maryland.

Swanson, F.J., L.E. Benda, S.H. Duncan, G.E. Grant, W.F. Megahan, L.M. Reid, R.R. Ziemer. 1987. Mass failure and other processes of sediment production in Pacific Northwest forest landscapes. Pages 9-38 in E.O. Salo and T.W. Cundy, editors. Proceedings of the Symposium on streamside management: forestry and fishery interactions. University of Washington, Institute of Forest Resources, Seattle.

XI. Sequoia

- *Issue:* The limitation on crown canopy reductions and tree diameter size removal may not provide adequate opportunities to meet desired ecological conditions for the giant sequoias and the associated mixed conifer ecosystems. The Desired conditions are: 1) create openings to establish young giant sequoias; and 2) create a vegetative mosaic of age and size classes.
- *Facts:* Fire disturbances create gaps, which in turn become patches (i.e., aggregations) of overlapping vegetation in the giant sequoia-mixed conifer ecosystem. Many authors recognize this mosaic pattern as being an important attribute of the groves (Bonnicksen and Stones 1981, 1982 a, b; Stephenson et al. 1991; Stohlgren 1993 a, b). Piirto and Rogers (2000) review in detail the literature on gap and patch size, frequency, and plant community composition.

This vegetation mosaic is composed of differing species in various combinations of size and age classes. The degree to which vegetation renews itself after a disturbance event is affected by: 1) the extent of the disturbance; 2) Existing vegetation conditions; 3) Site conditions (e.g., slope angle, aspect, soil type, geological and topographic conditions); 4) weather; and 5) alignment of desired conditions to enable plant/tree germination, survival, and optimum growth. This natural successional renewal of gaps and resulting even-aged patches (i.e., cohorts) of vegetation has often been referred to as episodic or pulsed.

The boundaries of gaps and patches in giant sequoia groves are often characterized as being diffuse, without sharp edges with many gaps having living trees that survived the disturbance (Demetry and Duriscoe 1996). Piirto and Rogers (2000) state: "It is critical to realize that in the natural or 'ancient' forest only a few patches (on a scale of a fraction to a few acres) may be dominated by large, old trees. However, large, old trees will be scattered throughout the forest matrix (on a scale of hundreds of acres) giving the entire landscape an 'old-growth', 'ancient forest' or 'late seral stage' character."

However, fires generally have had a fairly predictable pattern of reoccurrence in the Sierra Nevada giant sequoia mixed conifer ecosystems in the 1000-year period preceding Euro American settlement (i.e., pre-1875). It is generally agreed that low to moderate intensity fires in the mixed conifer forest were much more frequent prior to the late 1800s than they are today. Skinner and Chang (1996) summarized data from several authors that describe a reference variability for fire return interval of 1 to 35 years for the giant sequoia-mixed conifer ecosystem. Swetnam et al. (1992) and Swetnam (1993) reported afire return interval for the pre-settlement giant sequoia- mixed conifer forest of 3 to 8 years with a maximum interval generally less than 15 years.

The risk of high severity fires has increased over the last century due to a reduction in the aerial extent of fire in the Sierra Nevadas. Giant sequoia mixed conifer forests now have: 1) more and smaller trees with higher proportions of white fir and incense cedar than were present historically; 2) increased levels of fuel both on the forest floor and as fuel ladders; and in some cases 3) fewer canopy openings (McKelvey et al 1996; Skinner and Chang 1996; Stephenson 1994; Piirto and Rogers 2000); and 4) several orders of magnitude less giant sequoia seedling development as compared to the pre-1875 forest (Stephenson 1994,1996). Stephenson (1994) states: "By far the largest deviations from equilibrium conditions (stationary age distributions) in giant sequoia populations over the last two to three millennia is due to the effects of fire suppression during the last century."

- *Implications for the Monument:* Adherence to the Sierra Nevada Framework guidelines may not enable gap development through mechanical means as no tree greater than 20 inches can be removed.

Failure to regenerate giant sequoia could adversely affect the long-term sustainability of the giant sequoia ecosystem.

- *Advice:* A simulation test possibly using the Stand Visualization System (SVS) and/or the Environmental Visualization System (En Vision) should be undertaken to determine how

restrictive the Sierra Nevada Framework Guidelines are in achieving desired giant sequoia vegetation structural objectives.. For further information on these visualization/modeling systems contact Robert McGaughey USDA Forest, PNW Station, University of Washington, P.O. Box 352100, Seattle, W A 98195-2100; phone-- (206) 543-4713; e-mail-- bmcgaughey@fs.fed.us

Review and use as a reference the information offered by Demetry and Duriscoe (1996), Piirto and Rogers (2000) and Stephenson (1994,1996) on gap size, gap frequency, and plant community composition for the approximate 20,000 acres of giant sequoia land within the 340,000 acre Monument. It is important to recognize that each grove has its own set of vegetation/ecosystem conditions that will necessitate the development of site/grove specific management prescriptions.

References

Bonnicksen, Thomas M.; Stone, Edward C. 1981. The giant sequoia-mixed conifer forest community characterized through pattern analysis as a mosaic of aggregations. Forest Ecology and Management 3(1980/81): 307-328.

Bonnicksen, Thomas M.; Stone, Edward C. 1982a. Reconstruction of a pre settlement giant sequoia-mixed conifer forest community using the aggregation approach. Ecology 63(4): 1134-1148.

Bonnicksen T.M.; Stone, Edward C. 1982b. Managing vegetation within U.S. national parks: a policyanalysis. Environmental Management 6(2): 101-102.

Demetry, Athena; Duriscoe, Daniel M. 1996. Fire-caused canopy gaps as a model for the ecological restoration of giant forest village. Unpublished report to Sequoia and Kings Canyon National Parks, National Park Service, USDI.

McKelvey, Kevin S.; Johnston, James D. 1992. Historical perspectives on forests of the Sierra

Nevada and the Transverse Ranges of southern California: forest conditions at the turn of the century. In: Verner, J.; McKelvey, K.S.; Noon, B.R.; Gutierrez, R.J.; Gould Jr., G.I.; Beck T .W., technical coordinators. The California spotted owl: a technical assessment of its current status. Gen. Tech. Rep. PSW-GTR-133. Berkeley, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture; 225-246.

Piirto D. D. and R. R. Rogers. 1999. An ecological foundation for management of national forest giant sequoia ecosystems. USDA Forest Service, Pacific Southwest Region, Sequoia National Forest Technical Report R5-EM-TP-005.

Rundel, P.W. 1971. Community structure and stability in the giant sequoia groves of the Sierra Nevada, California. The American Midland Naturalist 85(2): 478-492.

Skinner, C.N.; Chang, C. 1996. Fire regimes, past and present. In: Sierra Nevada Ecosystem Project: Final report to Congress, vol. II, chap. 38. Davis, CA: University of California, Centers for Water and Wildland Resources.

Stephenson, N.L. 1996. Ecology and management of giant sequoia groves. In: Sierra Nevada Ecosystem Project: Final report to Congress, vol. II, chap. 55. Davis: University of California, Centers for Water and Wildland Resources.

Stephenson, N.L. 1994. Long-term dynamics of giant sequoia populations: implications for managing a pioneer species. In Proceedings of the symposium on giant sequoias: Their place in the ecosystem and society, technical coordination by Phil Aune, 56-63. Gen. Tech. Rep. PSW-151. Forest Service, U.S. Department of Agriculture.

Stephenson, N.L.; Parsons, D.I.; Swetnam, T.W. 1991. Restoring natural fire to the sequoia-mixed conifer forest: should intense fire playa role. In: Proceedings of the 17th Tall Timbers Fire Ecology Conference, High Intensity fire in Wildlands: Management Challenges and Options; Tallahassee, FL, Tall Timbers Research Station, 321-337.

Stohlgren, Thomas. J.1993a. Spatial patterns of giant sequoia *(Sequoiadendron giganteum)* in two sequoia groves in Sequoia National Park, California. Can. J. For. Res. 23: 120-132.

Stohlgren, Thomas J. 1993b. Intraspecific competition (crowding) of giant sequoias *(Sequoiadendron giganteum)*. Forest Ecology and Management 59: 127-148.

Stohlgren, Thomas J. 1991. Size distributions and spatial patterns of giant sequoia in Sequoia

and Kings Canyon National Parks. Davis: University of California; 300 p. Ph.D. dissertation.

Swetnam, T .W. 1993. Fire history and climate change in giant sequoia groves. Science 262: 885-889.

Swetnam, T.W.; Baisan, C.H.; Caprio, A.C.; Touchan, R.; Brown, P.M. 1992. Tree-ring reconstruction ofgiant sequoia fire regimes. Unpublished final report to Sequoia, Kings Canyon and Yosemite National Parks. Cooperative Agreement No. DOl 8018-1-0002. Tucson: University of Arizona, Laboratory of Tree Ring Research.

Willard, Dwight. 1995. Giant sequoia groves of the Sierra Nevada, a reference guide. Self published. Address inquiries to D. Willard, P.O. Box 7304, Berkeley, CA 94707.

XII. Wildlife

- *Issue:* Additional mechanical treatments and/or prescribed burning may adversely affect wildlife species that are dependent on late seral/old growth (LS/OG) habitat by reducing the amount of that habitat.

Facts: Because the Sierra Nevada, and especially the mixed-conifer zone, is a highly disturbance (fire)-driven system, there are relatively few vertebrates commonly considered to be dependent upon the characteristics of late seral forest compared to forests in the Northwest. Those characteristics, which include the frequent presence of large (e.g. >80 cm dbh) trees (generally >100 years old), snags, and logs, a relatively closed canopy with moderated temperatures and humidity, undamaged soil structure, and (generally) un-grazed herbaceous layer. The short list of Sierran vertebrates with suspected LS/OG dependencies includes northern goshawk, California spotted owl, great gray owl, Vaux's swift, white-headed woodpecker, pileated woodpecker, red-breasted nuthatch, pygmy nuthatch, brown creeper, hermit warbler, purple finch, Cassin's finch, evening grosbeak, northern flying squirrel, and Pacific fisher (Graber 1996). There is no evidence that the use of giant sequoia groves by vertebrates differs in any significant way than use of other mixed-conifer stands possessing similar structural attributes, i.e. large trees, open structure, and relatively closed canopy (National Park Service 2001). The greatest species richness occurs in forests that contain both old-growth attributes and forest openings of at least 0.25 ha (Graber 1996). These openings, in their early successional stages, promote the growth of herbs and shrubs, which support vertebrates directly, or indirectly through invertebrate production. Meadows and riparian stringers support species not found elsewhere in the forest, and greatly increase support infrastructure for others by providing a source of water as well as riparian food items not found elsewhere within the forest stand (DeSante 1995, Graber 1996, Moyle and Randall 1996, Wilkerson and Siegel 2001). It is generally accepted that for the Sierra Nevada as a whole, as a consequence of settlement and resource extraction activities, there is substantially more landscape in early-successional stages, and substantially less habitat in late-successional stages than before 1875.

The reasons why a particular vertebrate is dependent upon LS/OG may be a requirement for a nesting, resting, or hibernation site in a large, decadent snag or log (e.g. white-headed woodpecker) (California Dept. of Fish and Game 2000); the effect of moderated climate and large trees (spotted owl, northern flying squirrel) (Verner at al. 1992); un-grazed meadow and large trees (great gray owl) (Hayward and Verner 1994), but in most cases the only compelling information thus far is strong correlation (e.g. Pacific fisher) (Campbell et al. 2000) with LS/OG, without a clear understanding of the causal relationship (Hejl 1994). In addition, brown-headed cowbirds, which parasitize a great many neotropical migrants, do not invade LS/OG more than about 7 km (Rothstein et al. 1984), thus protecting LS/OG-using (not necessarily dependent) species in the interior of large blocks.

- *Implications for the Monument:* Special status animals, such as spotted owl, northern goshawk, and Pacific fisher presently invoke constraints on fuels reduction in LS/OG habitats (i.e. Sierra Forest Plan Amendment) that would significantly alter their characteristics. In most cases, the specific elements of LS/OG upon which these species may (or may not) be dependent are not entirely understood. Clearly these animals existed prior to fire suppression, although it is possible that they were less abundant than at present. Many of these species are presently far less broadly distributed than records of past decades or centuries indicate. Consequently, their vulnerability combined with uncertainty about what practices might produce further harm argue for the most conservative forest management practices in mature forests, that is those that produce the least change from present conditions. On the other hand, failing to reduce fuels could well eventually result in a stand-destroying fire, completely eliminating LS/OG habitat for a century or more (Verner et al. 1992).

Sequoia and Kings Canyon National Parks have encountered minimal conflict between permitted

recreational activities and their support infrastructure, and appear to sustain viable populations of LS/OG-correlated wildlife species, although this has not been verified except for California spotted owl.. Other activities not permitted in the parks, such as off-road driving and hunting, might produce unacceptable levels of disturbance, particularly when nesting or young are present.

- *Advice:* The Monument should closely follow current and future research on the relationships between LS/OG-correlated species, and stand-structure modification as well as grazing. Direct monitoring of sensitive LS/OG species, *not merely monitoring of habitat*, is called for until those relationships are better understood. The California Wildlife Habitat Relationships System (California Dept. of Fish and Game 2000), however imperfect, is presently the most powerful tool available for predicting which species will be advantaged and which species disadvantaged when habitats are changed in specific ways. Assuming that stand modification through burning or mechanical thinning is detrimental to some of these vertebrate species, science cannot say whether long-term forest health or short-term conservative protection of LS/OG-dependent vertebrates is the correct choice.

References

California Department of Fish and Game. 2000. California Wildlife Habitat Relationships System (CWHR), version 7.0 personal computer program Sacramento, CA.

Campbell, L.A., W.J. Zielinski and D. Macfarlane. 2000. Assessment for Sierra Nevada red fox (Vulpes vulpes necator). Unpublished report. USDA Forest Service. Sierra Nevada Framework Project. 801 I Street, Sacramento, CA 95814. 20 pages.

DeSante, D.F. 1995. The status, distribution, abundance, population trends, demographics, and risks of the landbird avifauna of the Sierra Nevada mountains. Unpublished file report to Sierra Nevada Ecosystem Project, Davis, CA. 100 pages.

Graber, D. 1996. Status of terrestrial vertebrates. In: Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II: Assessments and Scientific Basis for Management Options. Wildland Resources Center Report No. 37. Univ. of Calif., Davis.

Hayward, G. D., and J. Verner, (eds.). Flammulated, arboreal, and great gray owls in the United States: A technical conservation assessment. General Technical Report RM-253. USDA Forest Service, Ft. Collins, CO.

Hejl, S. J. 1994. Human-induced changes in bird populations in coniferous forests in western North America during the past 100 years. Pp. 232-246 In: J. R. Jehl, Jr., and J. K. Johnson (eds.). A century of avifaunal change in western North America: Studies in Avian Biology No. 15.

Moyle, P.B. and P.J. Randall. 1996. Biotic integrity of watersheds. Pages 975-985.In: Sierra Nevada Ecosystem Project: Final report to Congress, Vol. II, Assessments and scientific basis for management options. Univ. of Calif., Centers for Water and Wildland Resources, Davis.

National Park Service. 2001. Sequoia and Kings Canyon National Parks, Vertebrate Observation Database.

Rothstein, S. I., J. Verner, and E. Stevens. 1984. Radio-tracking confirms a unique diurnal pattern of spatial occurrence in the parasitic brown-headed cowbird. Ecology 65:77-88.

Verner, J., K. McKelvey, B. Noon, R. Gutierrez, G. Gould, T. Beck (technical coordinators). 1992. The Calif. spotted owl: a technical assessment of its current status. Gen. Tech. Rep. PSW-GTR-133. USDA Forest Service, Pacific Southwest Research Station, Albany, CA: 285 pages.

Wilkerson, R. L., and R. B. Siegel. 2001. Establishing a southern Sierra meadows important bird area: Results from meadow surveys at Stanislaus, Sierra, and Sequoia National Forests, and Yosemite and Sequoia/Kings Canyon National Parks. Unpublished report. Institute for Bird Populations. Pt. Reyes Station, CA. 90 pages.

XIII. Would the absence of a local market for timber adversely affect the objective of reducing the risk of catastrophic fire in the Monument (by limiting options)?

- *Facts:* As outlined in the Science Advisory Board's Advisory IV, for numerous reasons mechanical thinning will be needed for forest restoration in some areas of the monument. Mechanical thinning is allowed, "if clearly needed for ecological restoration and maintenance or public safety" (Clinton 2000).

Forest restoration and fuel reduction by mechanical means, when necessary, is very expensive. Past experience suggests that it is unreasonable to expect that all necessary restoration will be subsidized solely by federally appropriated dollars (Stewart 2001, SNEP 1996, Moote 2001). Scientists of the Sierra Nevada Ecosystem Project have discussed the need to economically restore forest conditions that are less prone to catastrophic wildfire (SNEP 1996). Ample precedent exists for trying to recover costs, such as for hazard tree removal in national parks. The cost of the hazard tree removal in national parks often is expected to be at least partly offset by sale of the removed trees, so long as safety or ecological needs alone, not economics, have motivated any tree removal.

Yet partial or total recovery of costs is only realistic when a local market exists (Stewart 2001, Moote 2001). Dr. Stewart stated to the Giant Sequoia National Monument Science Advisory Board that "Lack of a local timber industry will severely constrain what can be done in the monument" (Stewart 2001). Only one mill is still operating in the southern Sierra Nevada today. Based on recent experience in areas where the established forest products industry is eliminated, resource management options are severely reduced and local communities have not developed the necessary infrastructure to compensate for the loss of the existing industry (Stewart 2001, Moote 2001, SNEP 1996, California Forestry Association 2000).

Given that trees will be removed only "if clearly needed for ecological restoration and maintenance or public safety" (Clinton 2000), most removed trees would be in the smaller diameter classes. It is thus unlikely that ecologically motivated forest restoration in the monument will be fully economically self-sustaining, and is likely that supplemental appropriated funds will be needed. Additionally, the quality and quantity of outputs may be insufficient to fully maintain a local market.

- *Implications for the Monument*: Loss of a local market for timber would reduce options for ecological restoration and fire hazard reduction in the monument.
- *Advice:* Seek ways of building trust that mechanical thinning, when necessary, is ecologically motivated and not economically motivated, and that economic feasibility is critical to forest restoration efforts.

References

California Forestry Association. 2000. Letter to Regional Forester Eleanor Towns August 30, 2001.

Clinton, W. J. 2000. Establishment of the Giant Sequoia National Monument: a Proclamation by the President of the United States of America. April 15, 2000.

Moote, Ann. 2001. Communities and Forests Newsletter.

SNEP (Sierra Nevada Ecosystem Project). 1996. Status of the Sierra Nevada, Assessment Summaries and Management Strategies. Volume 1, Chapter 4: "Fire and Fuels." University of California Wildland Resource Center, U.C. Davis.

SNEP (Sierra Nevada Ecosystem Project). 1996. Status of the Sierra Nevada, Assessments, Commissioned Reports, and Background Information. Volume 3, Chapter 23: "Economic Assessment of the Ecosystem." University of California Wildland Resource Center, U.C. Davis.

Stewart, W. 2001. Address to the Giant Sequoia National Monument Science Advisory Board, November 1, 2001.

XIV. Should special consideration be given to maintaining roads used by the Tule River Indian Tribe?

- Facts:

The Tule River Indian Reservation was established in 1873 and contains approximately 55,000 acres of land.

The Tule River Indian Reservation is a federally recognized Indian Tribe and is a sovereign government.

The Giant Sequoia National Monument (GSNM) bounds more than 50% of the perimeter of the Tule River Indian Reservation.

Approximately 15,000 acres of conifer forest managed by the Tule River Indian Reservation form a continuum with the GSNM forest. Approximately 800 of those acres have giant sequoia; four GSNM giant sequoia groves extend into the Reservation.

Approximately 9,000 acres of the GSNM are situated within the upper reaches of the Tule River Indian Reservation's watershed.

Several U.S. Forest Service roads, including but not limited to 21S94, 21S90, and 21S95, provide critical ingress and egress for Tribal management purposes on the Reservation's eastern boundary with the GSNM (e.g., timber harvesting, forest management, fuels management, fire suppression, emergency evacuation, public works, grazing) and community uses (e.g., access to traditional plant and other material gathering areas, access to sacred sites). The roads provide recreation, cultural resources management, and commercial access for Tribal residents and operations. Baker and Stewart (1996:1358) note: "Since the reservation assumed direct control of its natural resources from the Bureau of Indian Affairs, the reservation's timber management program has sought to balance the economic values of timber with recreational and aesthetic values and the socio-cultural benefits the forests provide the reservation's inhabitants. Timber harvest levels and employment generation are sometimes reduced if planned timber harvests or other resource extraction activities would damage tribally defined ecological, cultural resources or other non-commodity resources."

Traditional territory of the tribal groups now residing on the Tule River Reservation included lands now within the GSNM (Gayton 1948a, b; Cook 1960, 1962; Kroeber 1970; Latta 1977; Spier 1978a,b; Wallace 1978). Those lands have archaeological sites and sacred sites important to Tribal members. There are also traditional plant and other raw material gathering areas within the Monument (Baker and Stewart 1996).

Approximately 40% of the timber harvested on Tribal lands is transported via National Forest roads located within the GSNM.

Long-term road improvements funded by Tribal projects have been made on GSNM roads.

Closure of roads accessing Tule River Reservation from the GSNM would result in a loss of jobs and management opportunities on the Reservation.

- *Implications for the Monument:* Since the Tule River Indian Reservation forest and Monument forest form a continuum, management of Reservation forest affects the risk of fires and pests in the Monument and vice versa. Successful management to sustain the Reservation forest depends on access by roads from the Monument.
- *Advice:* To ensure that the management plan considers the effects of proposed actions and policies the GSNM management planning team should consult with the Tule River Indian Tribe to identify which roads are important for Tribal use per Presidential Memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments", Presidential Executive Order (E.O.) 13175, "Consultation and Coordination with Indian Tribal Governments", E.O. 13007 "Indian Sacred Sites", the American Indian Religious Freedom Act of 1978, the National Historic Preservation Act as amended, and other legislation and executive orders.

References

Baker, M and W. Stewart, 1996. Ecosystems under Four Different Public Institutions: A Comparative Analysis. IN Sierra Nevada Ecosystem Project: Final report to Congress, Vol. II, Assessments and scientific basis for management options, pp. 1347-1367. Davis: University of California, Centers for Water and Wildland Resources.

Cook, S.F. 1960. Colonial Expeditions to the Interior of California: Central Valley, 1800-1820. University of California Anthropological Records 16:6. Berkeley: University of California Press.

Cook, S. F., 1960. Expeditions to the Interior of California: Central Valley, 1820-1840.

University of California Anthropological Records 20:5. Berkeley: University of California Press.

Gayton, A.H. 1948a. Yokuts and Western Mono Ethnography I: Tulare Lake, Southern Valley, and Central Foothill Yokuts. University of California Anthropological Records 10*:1*. Berkeley: University of California Press.

Gayton, A.H. 1948b Yokuts and Western Mono Ethnography II: Northern Foothill Yokuts and Western Mono. *University of California Anthropological Records 10:2*. Berkeley: University of California Press.

Kroeber, A.L. *Handbook of the Indians of California*. Berkeley: California Book Company. Originally published in 1925.

Latta, F.L. *Handbook of Yokuts Indians*. Santa Cruz, CA: Bear State Books.

Spier, R.F.G. 1978a Monache. IN, R.F. Heizer, ed., *Handbook of North American Indians,Volume 8: California*, pp. 426-436. Washington, D.C.: Smithsonian Institution.

Speir, R.F.G. 1978b Foothill Yokuts. IN, R.F. Heizer, ed., *Handbook of North American Indians, Volume 8: California*, pp. 471-483. Washington, D.C.: Smithsonian Institution.

Wallace, W.J. Southern Valley Yokuts. IN, R.F. Heizer, ed., *Handbook of North American Indians, Volume 8: California*, pp. 448-470. Washington, D.C.: Smithsonian Institution.

XV. How to build consensus in situations of long¤standing group conflict over natural resources management goals and practices.

- *Facts:* The newly created Giant Sequoia National Monument is part of a larger natural and social ecosystem that has a relatively long history of conflict over public lands management goals and practices. This conflict dates from at least the 1960s, when a U.S. Forest Service proposal to develop a high¤density outdoor recreation site in the Mineral King Valley was challenged in the federal courts by the Sierra Club (Nienaber, 1972). Conflicts over timber production in the 1980s led to a mediated settlement agreement which resolved some issues but not all. Dissent surfaced again as a result of President Clinton's 2000 presidential proclamation creating the Giant Sequoia National Monument. Among its other manifestations is a lawsuit brought by Tulare County, et al. in 2000. A history of conflict in the region has produced a culture of mistrust among parties claiming a vital interest in national forest management.

Group conflict over natural resources management, especially pertaining to the 29% of the nation's land which is managed by the federal government, is not confined to the Giant Sequoia National Monument lands. Scholars have documented the intensification of conflict over the past twenty years in numerous areas in the West; they have correlated an increase in group conflict with significant human population increases, with increased affluence of residents, and with increased individual mobility in the Sunbelt states of the New West (Wilkinson, 1992; Duane, 1996; Davis, 2001).

Researchers also have documented increases in recreational/visitor use on the Sierra Nevada public lands over the past ten years and more (Daniels and Gimblett, 2001; Duane, 1996; USFS/SNF n.d.). Each year shows an increase in recreation visitor days (RVDs) over the previous year. At the same time new modes of recreational use ¤ e.g., snowmobiles and off highway ¤vehicles ¤ have developed, and these groups of recreationists demand consideration of their interests by federal land managers (Valenzuela, 2001), along with traditional users such as hikers, backpackers, equestrian users, bicyclists, and motor vehicle drivers. Federal land managers have seen an absolute increase in the numbers of constituency groups claiming an interest in, or use of, the public lands (Clarke and McCool, 1996). It is a social trend beginning about twenty years ago. In a number of regions this has led to a condition of political and social gridlock.

In response to these social and political changes, new techniques of consensus building have emerged, including alternative dispute resolution, environmental conflict resolution, and collaborative management. These new approaches have been successful in a number of locations, including the Carson National Forest in New Mexico and some Bureau of Land Management lands in Colorado (Baker, 2001; Udall Institute for Environmental Conflict Resolution, 2001).

- *Implications for the Monument:* The creation in 2000 of a new federal land management entity, the Giant Sequoia National Monument, provides U.S. Forest Service managers with a unique opportunity to go beyond traditional public participation techniques in both drafting and implementing a management plan for the Monument. A long history of conflict in this region also indicates that a new approach beyond so-called public meetings might prove fruitful. The current NEPA/EIS process is a necessary one, but not a sufficient one, to win the community acceptance of the management plan for GSNM and so avoid future gridlock.

Collaborative management techniques have been employed successfully in several cases (Gray, et al., 2001; Frentz, et al., 1999; Cortner and Moote, 1999). Key features of this approach include:

Involve the public early in the process.

Use diverse and continuing methods of involvement ¤ e.g., field trips to specific sites in the Monument with small groups.

Create ongoing forums for information sharing and for group learning.

Utilize fully the local expertise of Monument lands, their condition, and their history. Create "buy¤ins" for interested parties.

Use All¤Party Monitoring after the management plan has been adopted.

Foster cross-jurisdictional planning and implementation of significant projects and activities.

- *Advice:* U.S. Forest Service managers for the Giant Sequoia National Monument should consider using collaborative management methods, and/or similar techniques, to reach a consensus on the initial management plan for the Monument, and in implementing the plan.

References

Baker, M. 2001. Presentation to the Science Advisory Board. Nov. 1. Visalia, CA.

Clarke, J.N. and D. McCool. 1996. Staking Out the Terrain: Power and Performance Among Natural Resource Agencies. 2nd ed. State University of New York Press.

Cortner, H. and M. Moote. 1999. The Politics of Ecosystem Management. Island Press.

Daniels, T. 2001. Presentation to the Science Advisory Board. November 1, 2001. Visalia, CA.

Davis, C., ed. 2001. Western Public Lands and Environmental Politics. Westview Press.

Duane, T.P. 1996. "Recreation in the Sierra." Ch. 19 of the SNEP Report. Washington, D.C.

Frentz, I., et al. 1999. "Rural Development and Community¤Based Forest Planning and Management: A New, Collaborative Paradigm." University of Arkansas Agricultural Experiment Station Project 1676. September.

Gimblett, H.R. 2001. Presentation to the Science Advisory Board, Nov. 1. Visalia, CA.

Kusel, J., et al. 1996. "The Role of the Public in Adaptive Ecosystem Management." Ch. 20 in the SNEP Report. Washington, D.C.

Nienaber, J. 1972. "The Supreme Court and Mickey Mouse." American Forests 78, 7, pp. 28¤31, 41¤43.

Stewart, W. 2001. Presentation to the Science Advisory Board. Nov. 1. Visalia, CA

Valenzuela, F. 2001. Presentation to the Science Advisory Board. Nov. 1. Visalia, CA.

U.S. Institute for Environmental Conflict Resolution. August 2001. Overview. Tucson, AZ.

Wilkinson, C. 1992. Crossing the Next Meridian: Land, Water, and the Future of the West. Island Press.

XVI. Equestrian Recreation –Shall the Forest Service continue to allow equestrian recreational use?

Facts: There is a long tradition of private packs and saddle stock, and commercial pack operations in the southern Sierra Nevada. Until relatively recently, horses were the principal form of transportation away from roads. Pack stock is still used heavily for transport in the management of Sierran public and private lands. Individuals who are not fit to hike are dependent upon horses to visit backcountry; for other it is simply a deeply held customary practice. However, stock can have several significant impacts: Among these are consumption of herbaceous vegetation, especially in meadows, leading to changes in biomass, productivity, and species composition; introduction of invasive alien plants in feed; trampling and shearing of moist and delicate soils such as wet meadows and stream banks; damage to trails; deposition of urine and feces, attracting flies, and creation of dust that impinges upon enjoyment by hikers.

- *Implications for the Monument:* In recent years that has been significant social conflict between stock users and those opposed to stock use in the high Sierra. Recent studies such as the Sierra Nevada Ecosystem Project have emphasized the fragility and importance of meadows and stream corridors; these studies are reflected in the Sierra Nevada Forest Plan Amendment. Research has been conducted in the Sierran national parks on using residual biomass as an indicator of acceptable grazing levels. Other

published research discusses hoof print and shearing impacts on sensitive substrates.

- *Advice*: These social and ecological concerns should be acknowledged and dealt with in the planning process. Scientific questions have to do with the basis of social conflicts, and the relationship between stock use levels and ecological impacts. Scientific inspection does not produce an apparent conflict between traditional recreational stock use and the purposes of the Monument. Appropriate regulation, segregation, or local or temporary closures may adequately ameliorate most social and ecological concerns about pack and saddle stock while continuing this customary activity in the Monument.

XVII. The transportation plan will largely determine the pattern and volume of public use on the Giant Sequoia National Monument. The issue is whether the Forest Service's June 8, 2001, Proposed Action considers a full range of transportation alternatives.

- *Facts:* The Presidential Proclamation of 2000 establishing the Giant Sequoia National Monument states that the management plan "shall contain a transportation plan for the monument...." The objectives of such a plan are: (1) To help protect the Giant Sequoia Groves and other significant objects of interest within the Monument; and (2) To provide for educational, scientific, and recreational use. The Proclamation also states that "no new roads or trails will be authorized within the monument except to further the purposes of the monument." The Proclamation is clear with respect to objectives and parameters for the Monument's transportation system.

The Forest Service's June 8, 2001, Proposed Action affirms the objectives stated in the Proclamation. It also describes the agency's Desired Conditions and Management Goals for the existing network of roads and trails within the Monument. It envisions extensive public use of the Monument by providing "well¤maintained roads and trails for public access to all national forest system lands within the monument (emph. added)." There is no mention of a public, or mass, transportation alternative that would supplement the primary mode of transportation currently used to visit the Monument.

Forest Service researchers as well as outside researchers have documented a steady increase in recreation visitor days (RVDs) during the past decade on most national forests and national parks in California (SNF data; SNEP 1996; Daniels and Gimblett, 2001). Demographers also have projected a substantial increase in the state's population to the year 2040, with significant population growth in the regions adjacent to the national forests and parks of the Sierra Nevada. If these projections are correct, there will be even heavier use of the public lands than there is today. Long¤range, integrated recreation and transportation planning is essential to manage this growth in human use of the resource.

- *Implications for the Monument:* Numerous outdoor recreation researchers (Daniels, 2001; Valenzuela, 2001) have documented the effects produced by a change in land¤use designation ¤ eg., from a national forest to a national monument, or from a national park to a national recreation area. One effect is to increase visibility and therefore to increase visitor use. As the Giant Sequoia National Monument gains greater public visibility, visitor use will very likely increase above the general increase in RVDs on other public lands.

In drafting the management plan for the Monument, planners will need to take into account substantial increases in overall demand for outdoor recreation opportunities, as well as for increasing use of the Monument for educational and scientific purposes. All of this increased human use of the Monument must be accommodated in a manner, which protects the Giant Sequoia groves and other objects of interest. Reconciling these two potentially conflicting goals ¤ resource protection and visitor use/enjoyment ¤ will require the agency to consider a wide range of transportation alternatives, including public or mass transit for the most heavily used areas of the Monument.

In this regard, GSNM planners can learn from the experiences of other land management planners, including those at Yosemite National Park, Mt. St. Helens National Monument, Glacier National Park, and Grand Canyon National Park. Valenzuela (2001) observed that National Monument designation produces a human use pattern that closely resembles National Park designation. Thus Forest Service planners will want to look at how planners at heavily used national parks and national recreation areas have accommodated increased visitor use in devising a transportation system for the Monument.

There also exists an important research opportunity that would measure and evaluate the effects of transportation corridors on Giant Sequoia groves. Understanding how the effects of air pollution, noise, road construction, and proximity of roads and trails do or do not impact the health of groves could be an integral part of the research agenda for GSNM.

- *Advice:* The range of alternatives in developing the transportation component of the

management plan should include a public transportation alternative for the most heavily used areas of the Monument. The plan should take into account substantial increases in visitor use and exploit opportunities for collaboration with nearby communities and businesses plus the National Park. Basic research on the Giant Sequoias and transportation¤related impacts should be conducted.

References

Clinton, President William J. 2000. Presidential Proclamation: Establishment of the Giant Sequoia National Monument. April 15. Washington, D.C.

Daniels, Terry. 2001. Personal Interview; Presentation to the Science Advisory Board. Nov. 1, Visalia, CA.

Duane, T.P. 1996. "Recreation in the Sierra." Ch. 19 of the SNEP Report. Washington, D.C.

Gimblett, H. R. 2001. Presentation to the Science Advisory Board. Nov. 1, Visalia, CA.

National Research Council. 2000. Environmental Issue in Pacific Northwest Forest Management. Washington, D.C.

U.S. Forest Service, Sequoia National Forest Supervisor. 2001. Letter: Proposed Action to Guide GSNM Management Plan. June 8. Porterville, CA.

U.S. Forest Service, Sequoia National Forest. n.d. Recreation Data for Sequoia National Forest and other national forests in California.

Valenzuela, Francisco. 2001. Presentation to the Science Advisory Board. Nov. 1, Visalia, CA.

Zinser, C.I. 1995. Outdoor Recreation: U.S. National Parks, Forest, and Public Lands. John Wiley.

XVIII. How shall the Forest Service meet the Monument's local scientific information needs?

- *Facts:* Among public land management agencies, there has been a long-term trend toward greater and greater reliance on science to support decision-making. This trend is unlikely to diminish or change in the future.

Given the long time-scales of many ecological responses to disturbances and management actions, particularly in forests, continuous long-term research and monitoring are essential to support adaptive management.

A diverse and outstanding cadre of scientists already exists in the Forest Service's Pacific Southwest Forest and Range Experiment Station (PSW). Many of these scientists will be able to meet many of the Monument's needs. However, none of these scientists concentrates solely on the Monument's needs, and all can be diverted to other topics depending on regional research needs.

Experience shows that there is great value in maintaining continuous rather than episodic, on-site rather than absentee research and monitoring programs within individual land-management units. An on-site scientific presence offers several advantages, including (1) frequent interaction with the land managers, which helps assure the relevance of research and monitoring, (2) enhanced technology transfer to land managers, (3) enhanced ability to maintain long-term studies, and (4) greater ability to advocate, facilitate, and leverage research and monitoring by scientists beyond the Forest Service devoted to the Monument's needs.

- *Implications for the Monument:* The Proclamation states "These giant sequoia groves and the surrounding forest provide an excellent opportunity to understand the consequences of different approaches to forest restoration." The National Academy of Science made its first recommendation for sustainability, "Develop a research framework that integrates global and local perspectives to shape a "place-based" understanding of the interactions between environment and society". The proclaimed purpose and Monument will benefit from a "place-based" research and monitoring presence.
- *Advice:* Strive for an on-site research and monitoring presence. Seek and learn from models of successful on-site research and monitoring programs, both within the Forest Service (such as Mt. St. Helens National Monument) and other land-management entities (such as the National Park Service and The Nature Conservancy). Determine whether the Giant Sequoia Ecology Cooperative has an appropriate role to play, and if so, enlist its

support.

References

National Academy of Sciences. 1999. Our Common Journey: A Transition Toward Sustainability. Washington, D.C.: National Academy Press. P. 10.

XIX. Visitor data

- *Issue:* How should the Forest Service improve its visitor use database for the Giant Sequoia National Monument?
- *Facts:* The Presidential Proclamation that designated the Giant Sequoia National Monument (GSNM) clearly emphasizes the importance of the scientific values within the Monument. This is in accord with the fact that the Monument was established under the provisions of the Antiquities Act of 1906 (6 USC 431-433), Sec. 3 which states: "That the President of the United States is hereby authorized, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the Government of the United States to be national monuments . . .".

The Proclamation notes the following in regard to visitor use: "The [management] plan will provide for and encourage continued public and recreational access and use consistent with the purpose of the monument." It continues in discussion of the management plan that it shall " . . . contain a transportation plan for the monument that provides for visitor enjoyment and understanding about the scientific and historic objects in the monument, consistent with their protection."

The Forest Service's June 8, 2001 Proposed Action notes under the heading Dispersed and Developed Recreation that: "Visitors to the GSNM will find a rich and varied range of recreational and social opportunities enhanced by giant sequoias and their ecosystems, historic and prehistoric artifacts, and unique geological features." The management goals under that heading state that the GSNM will "Provide visitors with a wide range of opportunities for recreation, interpretation, and education related to the objects of interest and the values of the monument. Improve visitor facilities, information, and services to meet projected demand for recreation and visitation . . ." The Proposed Action also has language for visitor use and enjoyment under the headings of Historic and Prehistoric Resources, Transportation System, Caves, and New Management Areas. The Forest Service's Notice of Intent for preparation of the EIS for the GSNM management plan reiterates the need to provide for visitor and recreational use.

In the SNEP report Vol. II, Chapter 19, "Recreation", Duane (1996) notes that the U.S. Forest Service is the largest land manager in the Sierra Nevada; Forest Service lands were reported to account for the majority of Recreational Visitor Days (RVDs—defined as a 12 hour period) on the public lands in the Sierra. Two-thirds to three-fifths of the RVDs occur on land administered by the Forest Service; 9% of the RVDs on Forest Service lands in the Sierra Nevada occur on lands of the Sequoia National Forest. Duane also commented that: "The RVD accounting methodology itself has several significant weaknesses." Those weaknesses included the following:

1) Variable and inconsistent accounting practices between . . . different ranger districts within a single national forest and over time due to changes in personnel and/or methods;

2) Poorly defined RVD accounting classifications resulting in inconsistent classification of some activities (especially new recreational activities as they first emerge); and

3) Highly subjective accounting procedures that exacerbate problems of both classification and accounting (Duane 1996:559-560).

Zinser (1995:274 ff.) discussed the obsolete RIM (Recreation Information Management) system and the current RRIS (Recreation Resource Information System) which is linked to GIS used by the Forest Service.

- *Implications for the Monument: T*he Sequoia National Forest currently lacks adequate information on visitor use for scientific purposes, recreation, or other purposes that are consistent with the uses outlined in the Presidential Proclamation for the Giant Sequoia National Monument. Without good data on visitor use, e.g., recreation, travel through the monument, scenic enjoyment, educational, traditional Native American uses, etc., it will be difficult for the Forest Service to provide for public access and use consistent with the purposes outlined in the Presidential Proclamation and the Forest Service's

June 8, 2001 Proposed Action.

- *Advice*: The Giant Sequoia National Monument Management Plan needs to include a plan to develop good quantitative and qualitative information on visitor use, activities undertaken, and enjoyment of proposed interpretive programs and facilities to comply with the Presidential Proclamation. A comprehensive database would assist in developing methods to accomplish adaptive management within the Giant Sequoia National Monument. The National Park Service at Sequoia and Kings Canyon National Park has developed some methods for assessing visitor use and appreciation which might assist the Forest Service in inventorying visitor use in the Giant Sequoia National Monument. The staff of the Giant Sequoia National Monument should collaborate with staff on those national parks in interpretive and other visitor programs.

Manning (1999:282 ff.) described inventory techniques that could be used to develop an outdoor recreation management framework as well as information on how to develop management objectives and monitoring which could assist the Forest Service in assessing visitor use on the Monument. The Scientific Advisory Board's (SAB) Advisory XVII on the Transportation Plan also reviews presentations to the SAB and the Giant Sequoia National Monument planning team that could assist in development of visitor use assessments that would comply with the Presidential Proclamation. The Forest Service should also consult with the Tule River Indian Reservation for information on their traditional uses of lands within the Monument. The Management Plan should include provisions to acquire better data on visitor use and methods for analysis and use of those data.

References

Duane, T.P. 1996 Recreation in the Sierra. In Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. II, Assessments and Scientific Basis for Management Options, pp. 557-609. Wildlands Resources Center Report No. 37, Centers for Water and Wildlands Resources, University of California, Davis, California.

Manning, R.E. 1999 Studies in Outdoor Recreation: Search and Research for Satisfaction. 2nd edition. Corvallis: Oregon State University Press.

Zinser, C.I. 1995. Outdoor Recreation: United States National Parks, Forests, and Public Lands. New York: John Wiley & Sons, Inc.

XX. Definition of treatment

- *Issue*: How shall a reader understand different treatments of vegetation and fuel named in documents?
- *Facts*: Creation of the Monument management plan will be aided by the use of clearly defined terms. Particularly, the various tools and approaches for restoring and maintaining vegetation and fuels need simple, descriptive terms.
- *Implications for the Monument:* It will be beneficial for the Monument to include a glossary with the Draft Environmental Impact Statement and other documents.
- *Advice:* Include a glossary with the Draft Environmental Impact Statement and other documents as needed. Consider the following definitions related to management of vegetation and fuels.

Prescribed fire is fire set by managers to meet specific objectives. Tools associated with prescribed fire include, but are not limited to, ground-based ignition devices such as drip torches, helicopter-based ignition devices, portable gas-powered water pumps, chain saws, hand tools, fire trucks, and other vehicles.

Hand treatment is manipulation of vegetation and fuels with tools that can generally be both carried and used by one person. These tools include, but are not limited to, chain saws, handsaws, axes, and loppers. Chippers will sometimes be an integral part of hand treatment.

Heavy equipment generally includes large, usually self-propelled machinery that can be used off roads and that usually requires highly trained operators. Heavy equipment includes, but is not limited to, bulldozers, feller-bunchers, cables, loaders, graders, backhoes, and chippers.

Mechanical treatments include both hand treatments and those conducted with heavy equipment.

XXI. Plain language

- *Issue:* How shall Alternatives be presented to inform the public and the official who must choose the management plan?
- *Facts:* The NEPA process intends first to inform the public of intended actions so they may make pertinent comments and thus minimize avoidable harm to the human environment (Council on Environmental Quality (CEQ) 1997). This hoped for outcome will only come if the alternatives are written in the plain language required by regulation 1502.8 (CEQ 1979).
- *Implications for the Monument:* The public's trust, which is so essential to acceptance of the management plan, will increase if the alternatives are plainly described and the logic of the decision-maker is transparent (regulation 1502.14, CEQ 1979). The test of reasonable range (Bass, Herson and Bogdan 2001) can only be passed if the alternatives plainly differ.
- *Advice:* In the beginning, succinctly and lucidly state the theme of each Alternative. Forthrightly state the actions, standards and guidelines to execute each Alternative.

Clearly state the actions in the Framework, Mediated Settlement, etc. that are the bases and benchmarks of Alternatives "No Action" and "Proposed Action." Describe them so clearly that the reader can grasp them from the Draft Environmental Impact Statement alone. In this way the Alternative will survive any shift in benchmarks.

References

Bass, R. E., A. I. Herson and K. M. Bogdan 2001. The NEPA book. Solano Press Books, Point Arena CA. p. 94. The range of alternatives in an EIS should be governed by the "rule of reason". Courts have found ranges both reasonable and unreasonable.

Council on Environmental Quality. 1979. For effective date of NEPA regulations, see question 12a of the Forty Most Asked Questions Concerning CEQ NEPA regulations 47 Fed. Reg. 18026 (March 23, 1981), as amended, 51 Fed. Reg. 15618 (April 25, 1986). Regulation 1502.8 states, "Environmental Impact Statements shall be written in plain language … so that decision makers and the public can readily understand them." Regulation 1502.14 states that the Environmental Impact Statement "should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public."

Council on Environmental Quality. 1997. Annual Report on Environmental Quality. In the Report, President Clinton stated, "[Thanks to NEPA] the American public today have the benefit of a wealth of information on the state of the environment and on the potential environmental impacts of major federal actions proposed by the Federal Government. The NEPA is at its core, a mandate for informed, democratic decision making and its contribution to environmental protection is incalculable."

Return to top of page.

Appendix G

Proclamation

THE WHITE HOUSE Office of the Press Secretary (Bakersfield, California)

For Immediate Release April 15, 2000

ESTABLISHMENT OF THE GIANT SEQUOIA NATIONAL MONUMENT BY THE PRESIDENT OF THE UNITED STATES OF AMERICA A PROCLAMATION The rich and varied landscape of the Giant Sequoia National Monument holds a diverse array of scientific and historic resources. Magnificent groves of towering giant sequoias, the world's largest trees, are interspersed within a great belt of coniferous forest, jeweled with mountain meadows. Bold granitic domes, spires, and plunging gorges texture the landscape. The area's elevation climbs from about 2,500 to 9,700 feet over a distance of only a few miles, capturing an extraordinary number of habitats within a relatively small area. This spectrum of ecosystems is home to a diverse array of plants and animals, many of which are rare or endemic to the southern Sierra Nevada. The monument embraces limestone caverns and holds unique paleontological resources documenting tens of thousands of years of ecosystem change. The monument also has many archaeological sites recording Native American occupation and adaptations to this complex landscape, and historic remnants of early Euro-american settlement as well as the commercial exploitation of the giant sequoias. The monument provides exemplary opportunities for biologists, geologists,

paleontologists, archaeologists, and historians to study these objects.

Ancestral forms of giant sequoia were a part of the western North American landscape for millions of years. Giant sequoias are the largest trees ever to have lived, and are among the world's longest-lived trees, reaching ages of more than 3,200 years or more. Because of this great longevity, giant sequoias hold within their tree rings multi-millennial records of past environmental changes such as climate, fire regimes, and consequent forest response. Only one other North American tree species, the high-elevation bristlecone pine of the desert mountain ranges east of the Sierra Nevada, holds such lengthy and detailed chronologies of past changes and events.

Sequoias and their surrounding ecosystems provide a context for understanding ongoing environmental changes. For example, a century of fire suppression has led to an unprecedented failure in sequoia reproduction in otherwise undisturbed groves. Climatic change also has influenced the sequoia groves; their present highly disjunct distribution is at least partly due to generally higher summertime temperatures and prolonged summer droughts in California from about 10,000 to 4,500 years ago. During that period, sequoias were rarer than today. Only following a slight cooling and shortening of summer droughts, about 4,500 years ago, has the sequoia been able to spread and create today's groves.

These giant sequoia groves and the surrounding forest provide an excellent opportunity to understand the consequences of different approaches to forest restoration. These forests need restoration to counteract the effects of a century of fire suppression and logging. Fire suppression has caused forests to become denser in many areas, with increased dominance of shade-tolerant species. Woody debris has accumulated, causing an unprecedented buildup of surface fuels. One of the most immediate consequences of these changes is an increased hazard of wildfires of a severity that was rarely encountered in pre-Euroamerican times. Outstanding opportunities exist for studying the consequences of different approaches to mitigating these conditions and restoring natural forest resilience.

The great elevational range of the monument embraces a number of climatic zones, providing habitats for an extraordinary diversity of plant species and communities. The monument is rich in rare plants and is home to more than 200 plant species endemic to the southern Sierra Nevada mountain range, arrayed in plant communities ranging from low-elevation oak woodlands and chaparral to high-elevation subalpine forest. Numerous meadows and streams provide an interconnected web of habitats for moisture-loving species.

This spectrum of interconnected vegetation types provides essential habitat for wildlife, ranging from large, charismatic animals to less visible and less familiar forms of life, such as fungi and insects. The mid-elevation forests are dominated by massive conifers arrayed in a complex landscape mosaic, providing one of the last refugia for the Pacific fisher in California. The fisher appears to have been extirpated from the northern Sierra Nevada mountain range. The forests of the monument are also home to great gray owl, American marten, northern goshawk, peregrine falcon, spotted owl, and a number of rare amphibians. The giant sequoias themselves are the only known trees large enough to provide nesting cavities for the California condor, which otherwise must nest on cliff faces. In fact, the last pair of condors breeding in the wild was discovered in a giant sequoia that is part of the new monument. The monument's giant sequoia ecosystem remains available for the return and study of condors.

The physiography and geology of the monument have been shaped by millions of years of intensive uplift, erosion, volcanism, and glaciation. The monument is dominated by granitic rocks, most noticeable as domes and spires in areas such as the Needles. The magnificent Kern Canyon forms the eastern boundary of the monument's southern unit. The canyon follows an ancient fault, forming the only major north-south river drainage in the Sierra Nevada. Remnants of volcanism are expressed as hot springs and soda springs in some drainages.

Particularly in the northern unit of the monument, limestone outcrops, remnants of an ancient seabed, are noted for their caves. Subfossil vegetation entombed within ancient woodrat middens in these caves has provided the only direct evidence of where giant sequoias grew during the Pleistocene Era, and documents substantial vegetation changes over the last 50,000 or more years. Vertebrate fossils also have been found within the middens. Other paleontological resources are found in meadow sediments, which hold detailed records of the last 10 millennia of changing vegetation, fire regimes, and volcanism in the Sierra Nevada. The multi-millennial, annual- and seasonal-resolution records of past fire regimes held in giant sequoia tree-rings are unique worldwide.

During the past 8,000 years, Native American peoples of the Sierra Nevada have lived by hunting and fishing, gathering, and trading with other people throughout the region. Archaeological sites such as lithic scatters, food-processing sites, rock shelters, village sites, petroglyphs, and pictographs are found in the monument. These sites have the potential to shed light on the

roles of prehistoric peoples, including the role they played in shaping the ecosystems on which they depended.

One of the earliest recorded references to giant sequoias is found in the notes of the Walker Expedition of 1833, which described "trees of the redwood species, incredibly large...." The world became aware of giant sequoias when sections of the massive trees were transported east and displayed as curiosities for eastern audiences. Logging of giant sequoias throughout the Sierra Nevada mountain range began in 1856. Logging has continued intermittently to this day on nonfederal lands within the area of the monument. Early entrepreneurs, seeing profit in the gigantic trees, began acquiring lands within the present monument under the Timber and Stone Act in the 1880s. Today our understanding of the history of the Hume Lake and Converse Basin areas of the monument is supported by a treasure trove of historical photographs and other documentation. These records provide a unique and unusually clear picture of more than half a century of logging that resulted in the virtual removal of most forest in some areas of the monument. Outstanding opportunities exist for studying forest resilience to large-scale logging and the consequences of different approaches to forest restoration.

Section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431) authorizes the President, in his discretion, to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the Government of the United States to be national monuments, and to reserve as a part thereof parcels of land, the limits of which in all cases, shall be confined to the smallest area compatible with the proper care and management of the objects to be protected. WHEREAS it appears that it would be in the public interest to reserve such lands as a national monument to be known as the Giant Sequoia National Monument:

NOW, THEREFORE, I, WILLIAM J. CLINTON, President of the United States of America, by the authority vested in me by section 2 of the Act of June 8, 1906 (34 Stat. 225, 16 U.S.C. 431), do proclaim that there are hereby set apart and reserved as the Giant Sequoia National Monument, for the purpose of protecting the objects identified in the above preceding paragraphs, all lands and interests in lands owned or controlled by the United States within the boundaries of the area described on the map entitled "Proposed Giant Sequoia National Monument" attached to and forming a part of this proclamation. The Federal land and interests in land reserved consist of approximately 327,769 acres, which is the smallest area compatible with the proper care and management of the objects to be protected as identified in the above preceding paragraphs.

All Federal lands and interests in lands within the boundaries of this monument are hereby appropriated and withdrawn from entry, location, selection, sale, leasing, or other disposition under the public land laws including, but not limited to, withdrawal from locating, entry, and patent under the mining laws and from disposition under all laws relating to mineral and geothermal leasing, other than by exchange that furthers the protective purposes of the monument. Lands and interests in lands within the boundaries of the monument not owned by the United States shall be reserved as a part of the monument upon acquisition of title thereto by the United States. The establishment of this monument is subject to valid existing rights.

Timber sales under contract as of the date of the proclamation and timber sales with a decision notice signed after January 1, 1999, but prior to December 31, 1999, may be completed consistent with the terms of the decision notice and contract. No portion of the monument shall be considered to be suited for timber production, and no part of the monument shall be used in a calculation or provision of a sustained yield of timber from the Sequoia National Forest. Removal of trees, except for personal use fuel wood, from within the monument area may take place only if clearly needed for ecological restoration and maintenance or public safety.

The Secretary of Agriculture shall manage the monument, along with the underlying Forest, through the Forest Service, pursuant to applicable legal authorities, to implement the purposes and provisions of this proclamation. The Secretary of Agriculture shall prepare, within 3 years of this date, a management plan for this monument, and shall promulgate such regulations for its management as deemed appropriate. The plan will provide for and encourage continued public and recreational access and use consistent with the purposes of the monument.

Unique scientific and ecological issues are involved in management of giant sequoia groves, including groves located in nearby and adjacent lands managed by the Bureau of Land Management and the National Park Service. The Secretary, in consultation with the National Academy of Sciences, shall appoint a Scientific Advisory Board to provide scientific guidance during the development of the initial management plan. Board membership shall represent a range of scientific disciplines pertaining to the objects to be protected, including, but not necessarily limited to, the physical, biological, and social sciences.

The Secretary, through the Forest Service, shall, in developing any management plans and any

management rules and regulations governing the monument, consult with the Secretary of the Interior, through the Bureau of Land Management and the National Park Service. The final decision to issue any management plans and any management rules and regulations rests with the Secretary of Agriculture. Management plans or rules and regulations developed by the Secretary of the Interior governing uses within national parks or other national monuments administered by the Secretary of the Interior shall not apply within the Giant Sequoia National Monument.

The management plan shall contain a transportation plan for the monument that provides for visitor enjoyment and understanding about the scientific and historic objects in the monument, consistent with their protection. For the purposes of protecting the objects included in the monument, motorized vehicle use will be permitted only on designated roads, and non-motorized mechanized vehicle use will be permitted only on designated roads and trails, except for emergency or authorized administrative purposes or to provide access for persons with disabilities. No new roads or trails will be authorized within the monument except to further the purposes of the monument. Prior to the issuance of the management plan, existing roads and trails may be closed or altered to protect the objects of interest in the monument, and motorized vehicle use will be permitted on trails until but not after December 31, 2000.

Nothing in this proclamation shall be deemed to diminish or enlarge the jurisdiction of the State of California with respect to fish and wildlife management.

There is hereby reserved, as of the date of this proclamation and subject to valid existing rights, a quantity of water sufficient to fulfill the purposes for which this monument is established. Nothing in this reservation shall be construed as a relinquishment or reduction of any water use or rights reserved or appropriated by the United States on or before the date of this proclamation. Laws, regulations, and policies pertaining to administration by the Department of Agriculture of grazing permits and timber sales under contract as of the date of this proclamation on National Forest System lands within the boundaries of the monument shall continue to apply to lands within the monument.

Nothing in this proclamation shall be deemed to affect existing special use authorizations; existing uses shall be governed by applicable laws, regulations, and management plans.

Nothing in this proclamation shall be deemed to revoke any existing withdrawal, reservation, or appropriation; however, the national monument shall be the dominant reservation.

Warning is hereby given to all unauthorized persons not to appropriate, injure, destroy, or remove any feature of this monument and not to locate or settle upon any of the lands thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this fifteenth day of April, in the year of our Lord two thousand, and of the Independence of the United States of America the two hundred and twenty-fourth.

WILLIAM J. CLINTON # # #

Return to top of page.

Appendix H

Overview of Modeling and Prescriptions

Part 1: Modeling

The computer modeling used for this DEIS is based upon the modeling protocol used by the Framework. Full documentation of the approach is found in Appendix B, Volume 4 of the Framework EIS. The Framework appendix also includes descriptions and graphical representations of prescriptions used to model treatments. This appendix provides a description of prescriptions which were developed for this management plan, and which were not included in the Framework. Definitions of the general treatments are found in the glossary for this DEIS (Appendix A). Where appropriate, data that were specific to the Sequoia National Forest were used during modeling. These included, but are not limited to, the desired future conditions, standards and guidelines specific to each alternative, and estimated treatment amounts per decade for each alternative.

The outputs provide an estimate of landscape-level predictions of effects, and also predict a

general amount of acres that might be treated by decade for broad activities (prescribed fire, thinning, etc). Certain assumptions are provided in order for the model to produce its outputs. These outputs are used by the analysis team to help identify major effects for each alternative and also to distinguish differences between alternatives. The following is a general list of key information used to fine-tune the analysis to reflect the alternatives and conditions in the Monument.

I. Treatment amounts (feasible programs based upon program manager recommendations): these are used as upper limit treatment amounts during the modeling process:

Alternatives 3 and 4: 6,000 acres per year (prescribed burning as primary treatment method)

Alternatives 5 and 6: 8,000 acres per year (prescribed burning and mechanical treatments as primary treatment methods)

Alternatives 1 and 2: Approximately 3,500 acres/year (based on Framework's implementation assumptions of completing protection strategy over a 25-year period)

II. Treatment priorities: General priorities for treatment are as follows:

completion of initial treatments for protection of urban areas;

protection of special features and critical habitat, such as giant sequoia groves, protected wildlife activity centers, and riparian areas;

reducing risk of wildfire in areas of high or moderate fire susceptibility;

restoring a more frequent fire return interval.

Many areas of the monument have both protection and restoration objectives, and treatments will be designed to the extent practical to meet both objectives. Specific treatment priorities will be determined through the landscape analysis process.

III. Resource constraints and allocations:

See the description of alternatives for other Framework allocations and/or management strategies that are used in the modeling process.

1. Follow Aquatic Management Strategy consistent with Framework for Alternatives 1, 2, 3, 4, and 5; for alternative 6, follow AMS <u>except</u> reduce buffer along ephemeral drainages to 50" on either side.
2. Strategically placed fuel treatment areas (SPLATs) are located in areas of high susceptibility. Within SPLATs, approximately 1/3 of the area would be treated during implementation.

Part 2: Treatment Prescriptions

This section provides an overview of the prescriptions that were developed to model the general effects of treatments under each of the alternatives. A complete description of all the prescriptions is found in Appendix B, Chapter 4 of the Framework. In addition to those developed and modeled under the Framework, one additional management prescription (Gap_Thin) was developed to model the treatments.

A prescription is a group of management practices applied to a specific land area. The planning process concerns the allocation of land to various prescriptions. The range of prescriptions describes the possible activities for a given analysis area. SPECTRUM allocates land to prescriptions based on forest constraints, the given management alternative, and the objective function.

GENERAL MANAGEMENT PRESCRIPTIONS USED TO MODEL TREATMENTS:

Terms

Re-treatment: A second associated treatment applied in the same decade.

Re-entry – A second and similar treatment applied on the same place in a different decade or planning period.

LET-GROW

The objective of the management prescription is to let stands grow naturally over time without any fuel treatments, timber harvests or wildfire. Stands conditions are projected without treatments using the Forest Vegetation Simulator. The only tree mortality is associated with inter-tree competition.

UNDER-BURN

The objective of this prescription is to restore fire as an ecosystem process. While the prescription is successful in restoring fire as an ecosystem process, it has little or no effect in meeting fuel reduction objectives necessary to modify wildfire behavior, either within the individual stand or across a broader landscape. However, meeting Finney height to live crown (HLC) targets though this prescription may occasionally occur. In simulating the under-burn prescription, estimates of mortality are made for each individual tree within a stand. The factors that affect tree mortality include scorch height and bark thickness. Scorch height was based on estimated flame-length.

When an area is treated with an under burn, the burning was assumed to be successful on 75% of the area. This is due to the fact that under burning frequently does not occur evenly throughout the area. Each subsequent time the area is burned again on a re-entry, a different 75% of the area is randomly selected. Some of the results of applying this prescription include:

An average flame length of 2 feet.

Dead and down material < 3.0" is reduced by 25%, dead and down material >= 3.0" is reduced by 25%.

Snags numbers are reduced by 10%

Shrub density is reduced by 100%.

PRESCRIBED FIRE

The objective of this management prescription is to remove surface and ladder fuels and return fire to the ecosystem. The prescription results are expected to be highly variable. In simulating the prescribed fire prescription, estimates of mortality are made for each individual tree within a stand. The factors that affect tree mortality include scorch height and bark thickness.

Scorch height was based on estimated flame-length. When an area is treated with prescribed fire, the burning was assumed to be successful on 75% of the area. This is due to the fact that prescribed fire frequently does not occur evenly throughout the area. Each subsequent time the area is burned again on a re-entry, a different 75% of the area is randomly selected. Some of the results of applying this prescription include

An average flame length of 4 feet.

Dead and down material < 3.0" is reduced by 90%, dead and down material >= 3.0" is reduced by 50%.

Snags numbers are reduced by 50%.

Shrub density is reduced by 100%.

The prescription is effective in changing wildfire behavior both within the stand itself, and across the landscape as well. Therefore this management prescription is considered to meet the Finneycondition.

Re-entries occur every 20 years.

In re-entries, the height of shrubs is ½ of initial effective shrub height or 2-ft, whichever is smaller.

For re-entries, subsequent treatments include:

Prescribed fire only.

Prescribed fire followed by chain saw cutting, manual piling, and burning.

MECHANICAL BRUSH TREATMENT

The objective of this management prescription is to reduce risk of catastrophic fire (both

on-site and to upslope resources); return fire to the ecosystem; improve wildlife habitat; and remove surface and ladder fuels When an area is treated with mechanical methods, the treatment is assumed to be successful on approximately 35% of the area. This is due to the fact that a mosaic of age classes is desired, and mechanical treatment allows for flexibility and some precision in determining the amount and location of areas to be either burned or left untreated. Each subsequent time the area is burned again on a re-entry, a different 35% of the area would be treated. Some of the results of applying this prescription include

An average flame length of 4 feet.

Dead and down material < 3.0" is reduced by 90%, dead and down material >= 3.0" is reduced by 50%.

Shrub density is reduced by 100% in the treated area.

The prescription is effective in changing wildfire behavior both within the stand itself, and across the landscape as well. Therefore this management prescription is considered to meet the Finney condition.

Re-entries occur every 20 to 40 years.

LIGHT THIN FROM BELOW

The objective of this prescription is fire hazard reduction. The prescription results are less variable compared to the prescribed fire prescription. Variation will be designed into site-specific prescriptions. This prescription may require a service contract to accomplish. Material will either be disposed of on-site or removed for products. Some of the results of applying this prescription include:

Stands are thinned from below until the height to live crown is 8.5’ above effective shrub height and the fuel ladder tree non-overlapping canopy cover is less than 10%. Tree selection is in order of increasing height to bottom of crown base.

Treatments are applied to 95% of sample points. On re-entry, a different set of sample points is randomly selected.

A post-thinning (re-treatment) Rx-fire [model using a 2.0’ flame length] will occur within 10 yrs.

Dead and down material < 3.0" is reduced by 75%, dead and down material >= 3.0" is reduced by 25%.

Snag numbers are not reduced.

Shrub density is reduced by 75%.

Re-entries occur every 20 years.

For re-entries, subsequent treatments include:

Thinning (for disposal or for chips) only

Thinning followed by prescribed fire

MODIFIED MEDIUM THIN FROM BELOW

This management prescription applies commonly to plantations. It has the objective of a moderate level of fire hazard reduction and protection from drought related mortality. Plantations are thinned using this prescription to accomplish these objectives. As plantations age, other prescriptions would apply. This prescription may be accomplished with a timber sale. Chips and other material may either be removed or disposed of on-site. Some of the results of applying this prescription include:

Approximately 95% of the stand will be treated. On re-entry, a different 95% will be treated.

The stand will be treated once it is at or above 55% of maximum stand density index (SDI) and the harvest volume exceeds 3 mbf/ac. During treatment the basal area will be reduced by 35%.

Dead and down material < 3.0" is reduced by 75%. Dead and down material >= 3.0" and snags are reduced by 25%.

Snags numbers are reduced by 25%.

Shrub density is reduced by 50%.

Re-entry will occur every 20 years after initial treatment.

MEDIUM THIN FROM BELOW

The objective of this management prescription is a moderate level of fire hazard reduction and protection from drought related mortality. A byproduct of this prescription may include wood products. Results of this prescription will be less variable compared to the prescribed fire prescription. What variation there is will be designed into site-specific prescriptions. This prescription may be accomplished with a timber sale. Both chip and sawtimber removals may occur in the first entry. Some of the results of applying this prescription include:

Approximately 90% of the stand will be treated on the first entry. On re-entry, a different 90% will be treated.

No trees greater than 30" dbh will be harvested.

The stand will be thinned from below to 50% canopy cover (or more if all residual trees are over 30" dbh). Tree selection will be in order of increasing height to live crown.

After thinning, prescribed fire will be used in the stand every 20 yrs.

Dead and down material < 3.0" is reduced by 75%, dead and down material >= 3.0" and is reduced by 25%.

Snags are reduced by 25%.

Shrub density is reduced by 50%.

For re-entry, subsequent treatments include:

Thinning only

Thinning followed by prescribed fire

SINGLE-TREE SELECTION

The objective of this management prescription is to move stands towards the averaged characteristics found in California Spotted Owl foraging areas and maintain those conditions for the longest time possible. As a byproduct this prescription may also have wood products. This prescription will be accomplished with a timber sale. Some saw timber removal may be required. Chips may either be removed or disposed of on-site. While either single tree selection or group-selection would be used in practice, the single-tree selection silvicultural system best responds to this objective because it has the potential to maintain conditions for the longest time possible.

Some results of applying this prescription include:

Re-entries treatments will occur when the basal area in trees greater than 10" dbh exceeds 136 square feet per acre.

Only those trees in excess of California Spotted Owl foraging needs will be harvested.

Dead and down material < 3.0" is reduced by 75%, dead and down material >= 3.0" is reduced by 25%.

Shrubs density is reduced by 50%.

HEAVY THIN FROM BELOW

The objective of this management prescription is a high level of fire hazard reduction and protection from drought related mortality. As a byproduct of this prescription there may be some wood production. The prescription results will be less variable compared to the prescribed fire prescription. Variation will be designed into site-specific prescriptions. This prescription may be accomplished with timber sales. Both chip and saw timber removal may occur. Some of the results of applying this prescription include:

Approximately 95% of the stand will be treated. Subsequent treatments on re-entry will treat a different 95%.

No trees greater than 30" dbh will be harvested.

Stands will be thinned from below to a 40% canopy cover (or more if all residual trees are over 30" dbh). The treatment will be repeated every 20 years or when height to live crown is less than 8.5-feet.

After each thinning, an under burning will occur within 10 years to maintain the stand conditions.

Dead and down material < 3.0" is reduced by 90%.

Dead and down material >= 3.0" and snags are reduced by 90%.

Shrub density is reduced by 90%.

Subsequent treatments may involve:

Thinning only

Thinning followed by prescribed fire

GAP THIN

The objectives of this management prescription are three-fold: 1) to encourage the creation of gaps in the forest canopy that are consistent with the desired conditions for giant sequoias and associated mixed conifer vegetation, and that lead to the establishment of young seral stage vegetation; 2) to thin the remaining portion of the stand to promote healthy growing conditions and protect against drought-related mortality and 3) reduction in fire hazard. When using mechanical methods, emphasize gap location in areas of the stands with the lowest existing stocking levels (in order to minimize impacts to existing overstory canopy). In the remainder of the stand outside of gaps, thin from below in the "matrix" (the areas between the gaps). This prescription may lead to an opportunity for removal of biomass material or commercial sale of wood products. The prescription results will be less variable compared to the prescribed fire prescription. Some of the results of applying this prescription include:

Between 5% and 10% of the stand will be treated to create gaps by mechanical methods. Subsequent treatments on re-entry would treat a different 5%.

No trees greater than 30" dbh will be removed.

The remainder of the stand will be thinned from below

After each entry, a prescribed fire will occur within 10 years to continue to move the stand toward desired condition or to maintain the desired conditions once they are achieved.

For modeling purposes, apply this prescription only during the first 2 to 3 decades of implementation. Transition to prescribed fire as the primary method for continuing to develop desired conditions.

Return to top of page.

Appendix I

Alternative Transportation Plans

Transportation plans are described below for each of the alternatives in the Giant Sequoia National Monument Plan. The transportation plans display the transportation desired condition, strategy, management goals, management emphases, and standards and guidelines found in the description of alternatives in Chapter 2 of the DEIS. The transportation plans incorporate by reference the Road Analysis Process found in Appendix D, Rap Report.

Transportation System Desired Condition (Common to All Action Alternatives)

The road and trail network is commensurate with the level of management activities occurring

in the Monument and supplies the transportation system needed for public use related to recreation, special uses, private land access, fire protection, as well as the enjoyment, proper care, and management of the objects of interest. Roads and trails needed to meet management goals are maintained to provide safe use and limited impacts to aquatic and terrestrial habitats. Roads not needed to meet management goals are decommissioned and stabilized.

Alternatives 2, 5, and 6

The transportation system would provide high levels of access for public and management use, consistent with protection and restoration of the Monument. New roads could be constructed to meet management goals such as to provide access to new recreation facilities, to provide access to new administrative sites, to replace roads that have unacceptable resource impacts, or to provide access for research.

Transportation Strategy

Alternative 2 would emphasize retaining road access for public use and for management activities similar to current access levels. For public access, emphasis would be on maintaining roads to recreation sites, dispersed areas, special use sites, and private land. An extensive road system would be available for recreation driving and off-highway vehicle use. For management access, emphasis would be on ecosystem restoration and fire protection. Roads with high risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on unclassified roads and those classified roads producing unacceptable impacts where repair or relocation is unreasonable. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to administrative sites, to replace roads producing unacceptable resource impacts, or to provide access for research. The maintenance strategy would be to continue to request funds to reduce the maintenance backlog and keep the road system in acceptable condition.

Transportation System Goals

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all action alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Provide enjoyable and safe opportunities for riding off-highway vehicles, including snowmobiles, on designated roads within the Monument (common to Alternatives 2, 4, 5, and 6).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Consult with local tribal governments and Native Americans in the planning of projects in the Monument. Ensure access to culturally important sites and resources for use by Native Americans.

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, for hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Management Emphases for All Management Areas

Maintain current levels of access for public and administrative use consistent with protection of

the objects of interest.

Prior to decommissioning roads, consider opportunities for their use as recreation trails.

Emphasize the following types of areas for the development of new recreation facilities or opportunities: existing travel corridors, existing sites that can tolerate additional use or development, dispersed sites that are already impacted and can tolerate additional or different types of use, and areas of special interest.

Alternative 3

Road closures, road decommissioning, and elimination of some dispersed recreation sites would occur to reduce the environmental impacts from compacted surfaces and to provide more areas isolated from the effects of motorized traffic. Use of unlicensed off-highway vehicles would not be allowed on roads or trails. Recreational opportunities would increase for day use activities, education, and interpretation, but overnight and dispersed opportunities would be reduced or stay the same. These proposals are in response to the Recreation and Watershed issues.

Transportation Strategy

Alternative 3 would emphasize reducing environmental impacts from roads. For public access, emphasis would be on maintaining road access to recreation sites, high profile giant sequoia groves, special use sites, and private land. Roads not needed for these purposes would be closed to public access. No off-highway vehicle use would be allowed on the road system. For management access, emphasis would be on ecosystem restoration and fire protection. Roads for restoration or fire protection would be decommissioned in areas where natural conditions are re-established. Roads with risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on reducing road mileage and would include reductions of classified and unclassified roads with moderate to high risk for producing unacceptable resource impacts. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to new administrative sites, to relocate roads that produce unacceptable impacts, or to provide access for scientific research. The maintenance strategy would be to reduce maintenance costs by closing and decommissioning roads.

Alternative 3 would reduce the number of roads and extent of the road system, as well as reduce the impacts from compacted areas in the Monument. Alternative 3 would increase the feeling of isolation from motorized use by eliminating OHV use in the Monument. Primitive and semi-primitive recreation opportunities and trails would be increased.

Transportation System Goals

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Reduce impacts from roads.

Consult with local tribal governments and Native Americans in the planning of projects in the Monument. Ensure access to culturally important sites and resources for use by Native Americans.

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Expand the trail system to connect recreation facilities and interpretive sites and increase opportunities for primitive and semi-primitive recreation experiences and isolation from the sounds and sites of motorized vehicles.

Management Emphases for All Management Areas

Seek to reduce areas of heavily impacted surfaces or large areas of hardened surfaces including, but not limited to, areas of overnight use, recreation residence tracts, and roadways.

Prior to decommissioning roads, consider opportunities for their use as recreation trails.

Emphasize decommissioning or closing to public use those roads that do not provide access to high profile giant sequoia groves, restoration activities, recreation sites, private land, or sites under special use permit.

Emphasize the following types of areas for the development of new recreation facilities or opportunities: existing travel corridors, existing sites that can tolerate additional use or development, dispersed sites that are already impacted and can tolerate additional or different types of use, and areas of special interest.

Management Emphasis for Management Area, High Profile Groves

Repair and maintain roads with high or moderate access needs.

Standards and Guidelines for All Management Areas

Use heavy equipment off of roads only in the following circumstances:

-To construct, reconstruct, or decommission roads.

-To construct, maintain, or enhance recreational or administrative facilities, including trails.

Do not permit OHVs except for administrative or emergency use.

Alternative 4

Roads or other impacted areas would be eliminated when necessary to reduce impacts to riparian areas, wildlife habitat, or other sensitive resources. New roads could be constructed to meet management goals such as to provide access to new recreation facilities, to provide access to new administrative sites, to replace roads that have unacceptable resource impacts, or to provide access for research. The transportation system would provide high levels of access consistent with the restoration of monument lands. The trail system would be expanded to increase dispersed recreation opportunities.

Transportation Strategy

Alternative 4 would emphasize reducing environmental impacts from roads while providing for public access. For public access, emphasis would be on maintaining road access to recreation sites, special use sites, and private land. The road system would be available for recreational driving and off-highway vehicle use. For management access, emphasis would be on ecosystem restoration and fire protection. Roads with high risks for causing unacceptable impacts to natural resources would be repaired, relocated, closed, or decommissioned to reduce impacts. Road decommissioning would focus on unclassified and classified roads with high risks of producing unacceptable impacts. New roads could be constructed to meet management goals to provide access to new recreation facilities, to provide access to new administrative sites, to relocate roads producing unacceptable impacts, or to provide access for scientific research. The maintenance strategy would be to continue to request funds to reduce the maintenance backlog and keep the road system in acceptable condition. Roads that cannot be retained to acceptable standards would receive priority for decommissioning. Alternative 4 focuses on restoring roads to natural conditions.

Alternative 4 would protect communities and other sites occupied by people by establishing a 200-foot wide defense zone around communities and a 100-foot defense zone on either side of

major roads. The purpose of the defense zone is to provide for human health and safety and reduce the fire hazard around existing structures, major roads, developed campgrounds, and developed public use areas within the Human Influence Zone. Removal of trees along roads in the General Forest Zone would generally be limited to trees less than 12 inches in diameter that pose a risk to public health and safety.

Transportation System Goals

Provide safe and well-maintained roads for public access to national forest system lands within the Monument while minimizing adverse resource impacts (common to all action alternatives).

Maintain roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems (common to all action alternatives).

Allow access to private lands and facilities within the Monument (common to all alternatives).

Consult with and provide for access needs of the Tule River Indian Tribe (common to all action alternatives).

Provide a system of well-maintained roads to allow efficient and effective fire suppression, fuels treatment, restoration work, and other management use (common to all action alternatives).

Provide enjoyable and safe opportunities for riding off-highway vehicles, including snowmobiles, on designated roads within the Monument (common to Alternatives 2, 4, 5, and 6).

Coordinate transportation planning, management, and road decommissioning with the Sequoia and Kings Canyon National Parks; other federal, state, and county agencies; and the Tule River Indian Tribe, to reduce traffic congestion and safety hazards, especially along major travelways (common to all action alternatives).

Consult with local tribal governments and Native Americans in the planning of projects in the Monument. Ensure access to culturally important sites and resources for use by Native Americans.

Provide a wide range of trail opportunities, including accessible trails for persons with disabilities, for hiking, horseback riding, bicycling, and cross-country skiing (common to all action alternatives).

Reduce impacts from roads to wildlife habitat, aquatic habitat, and the soil resource.

Expand the trail system to connect recreation facilities and interpretive sites and provide opportunities for primitive and semi-primitive recreation experiences.

Restore to the extent practical the historic locations and conditions of trails that have been disturbed by past practices such as logging or road construction.

Promote the restoration of natural processes, structure, and vegetation on existing permanent and temporary roads that are not necessary for the proper care of the objects of interest, public use, and management of the Monument. Maintain remaining roads with effective road drainage and erosion controls to reduce effects to adjacent riparian and aquatic systems.

Management Emphases for All Management Areas

Prior to decommissioning roads or otherwise eliminating general public access on roads, consider opportunities for their use as recreation trails or for other recreational experiences.

Provide road access for the public and for management activities without compromising the restoration and protection of the giant sequoia groves, their associated ecosystems, and aquatic and riparian habitat.

Emphasize the following types of areas for the development of new recreation facilities or opportunities: existing travel corridors, existing sites that can tolerate additional use or development, dispersed sites that are already impacted and can tolerate additional or different types of use, and areas of special interest.

Management Emphasis for Management Area, Human Influence Zone

Reduce areas of heavily impacted surfaces or large areas of hardened surfaces that are

negatively impacting giant sequoia groves, their surrounding ecosystems, riparian habitat, or other special features.

Management Emphasis for Management Area, General Forest Zone

Re-establish native vegetation and natural hydrologic function on temporary roads and landings.

Standards and Guidelines for all Management Areas

Use heavy equipment off of roads only in the following circumstances. To construct, reconstruct, or decommission roads or to construct, maintain, or enhance recreational or administrative facilities, including trails.

Limit hazard tree removal along roads to those trees that are taller than their distance to the road and where the hazard to public safety is clearly demonstrated.

Standards and Guidelines for Management Area, Human Influence Zone

Establish and maintain defense zones by applying fuel reduction strategies within 200 feet of structures used primarily for human habitation and within 100 feet directly adjacent to major roads, developed campgrounds, and other developed public use areas.

Return to top of page.

Appendix J

Recreation Demand Analysis

The Sequoia National Forest is unique in its juxtaposition to Los Angeles, San Bernardino, San Francisco, and San Diego, and the metropolitan areas of Fresno, Sacramento, Bakersfield, and Las Vegas, Nevada. Over 28 million people live within a half day's drive of this urban forest. The San Francisco Bay Area, Sacramento, San Diego, and Las Vegas are all located within a half day's drive. Approximately sixty percent of the forest's visitors are estimated to come from the Los Angeles Basin, which is located within a 3-hour drive. More than two million people live within an hour's drive from the forest. While all of these people are potential visitors to the Giant Sequoia National Monument, numerous other recreation opportunities in these areas may also attract this population base.

Recreation use of the Sequoia National Forest has been estimated at 10-13 million visits a year, which is more than Sequoia-Kings Canyon and Yosemite national parks combined. Use at the three districts that comprise the Giant Sequoia National Monument was over half of the forest total, according to one estimate in 1996 (use in the monument would be less than this, because some district lands are not included in the monument). The National Visitor Use Monitoring methodology will be employed on the forest in 2003, which should yield more accurate visitation figures.

The Sequoia, Inyo, and Sierra national forests account for 45% of all recreation visitor days on National Forest System lands in the Sierra Nevada. Together with the adjacent national parks, this portion of the Sierra Nevada probably has one of the highest recreation activity levels in the world (SNEP). This area of the Sierra Nevada will also experience the largest population growth in nearby urban areas, particularly Bakersfield and Fresno, during the next few decades.

The Sequoia sees a great deal of diversity in its visitors. The forest's large number of visitors are multicultural, especially Hispanic and Southeast Asian, many of whom are locally based. International visitors, who are drawn to the giant sequoia groves, frequently tour the forest. Recent school studies found that people in this area speak over 26 languages. A few of the cultures within the forest's zone of influence include Native American, Hmong, Laotian, Filipino, Japanese, Chinese, and numerous cultures related to Spanish speaking countries, ranging from Mexico to South America. Each of these cultures has unique demands for and values toward the use and management of the Sequoia National Forest.

Visitor use patterns vary tremendously from the north end of the forest to the south. More people from the Bay Area and international visitors tend to visit the Hume Lake District than other parts of the forest. People from the Los Angeles Basin visit the forest's southern portions, especially the Kern Canyon, Lake Isabella, and the Kern Plateau. The Kern Valley is beginning to market itself as a gateway to the national monument, which will increase the likelihood of

more monument vistation from the Los Angeles Basin. A German tourist guide leads visitors up the Kern Canyon into the monument, along the Western Divide Highway to the Trail of 100 Giants (an accessible interpretive trail in a giant sequoia grove), and then to other tourist destinations outside the forest. Local residents tend to visit portions of the forest and monument that are closest to their residences.

The multinational forest users have different expectations for their recreation experiences than those of the traditional forest user. These expectations vary from place to place, because of the different use patterns. What works in one area of the forest cannot be assumed to work in other areas. The multinational visitors also provide a challenge in effective communications.

The monument is located both north and south of Sequoia-Kings Canyon National Parks. Visitors to the Hume Lake District must drive through the national parks, in order to access much of the district. People frequently do not realize if they are in the park or the forest and are confused when confronted with the different policies and types of facilities found in each place. Some people are attracted to the park, but camp in the forest, because they prefer the forest's facilities.

In determining demand for recreation in the future, it is useful to look at current recreation participation patterns. What is currently occurring forms a baseline for estimating what might happen in the future. In addition, when people are asked what activities they would participate in if opportunities were available, comparing those responses to current behavior can be useful. What people say they would participate in does not necessarily equate to what they actually do. For example, if people say they would go camping if more opportunities were available, but do not camp now, even though opportunities are currently available, they still may not camp in the future if more opportunities are provided. The difference between what someone says they would do and what they actually do can be attributed to a number of reasons. First, people may simply think it would be nice to do something, but never actually follow through with the action. Limitations on time, disposable income, transportation, health, family needs, and traveling companions, as well as fear of the unknown or perceived crowding are some of the factors that could affect a person's recreation participation.

Crowding can affect how and when people visit an area. Some people do not mind crowds and, in fact, crowds can positively influence their recreation experiences. Many others, however, find that crowding adversely affects their recreation experiences. Consequently, they may avoid visiting areas when they perceive the areas will be more crowded and shift their visits to other areas, other times of the week, or seasons of the year. If people perceive that areas are always crowded, they may simply avoid visiting them altogether.

More people are becoming interested in outdoor recreation activities. Recreation is a prime lure for attracting visitors from overseas, and it is a growing factor in travel and residency patterns. The availability and proximity of recreation opportunities affects how much people recreate, as well as their choice of activities.

California is the most visited state and is the eighth most visited place in the world. International tourism is expected to increase in the future. Natural resources and outdoor recreation play an important role in tourism, as they provide the settings for travel activities and experiences. The monument already sees a substantial number of international visitors, and they are expected to increase in the future.

Various studies have found that recreationists are generally satisfied with their available recreation opportunities. However, they continue to be concerned with the availability of clean restrooms, safe drinking water, and information (directional signs, information on conditions and hazards, and interpretive information). Safety and security are of more concern in some areas and among some populations, such as Hispanics.

Outdoor Recreation in America, 2001, is a report on the eighth national survey in an annual series for the Recreation Roundtable by Roper Starch Worldwide. The survey is not specific to recreation on national forest lands. The survey found a broad increase in outdoor recreation participation, with 20 of 37 activities showing a percentage increase over the past twelve months. The sharpest climbs were in wildlife viewing (up 4%), hiking, running/jogging, and motorboating (each up 3%). Half reported a visit to a federal recreation site over the past two years.

The 2001 Roper Starch survey shows a decrease in the frequency of participation. The 2000 survey showed that 78% of all American adults took part in an outdoor recreation activity at least monthly, and 34% did so several times each week. The 2001 survey shows a drop to 70% taking part at least monthly and only 26% several times weekly.

The reduction in frequency is roughly balanced by gender, according to the 2001 Roper Starch

survey. The reduction is more pronounced in the 18-29 age group, where participation dropped to nearly the same as 30-44 year-olds. This statistic is important, because, historically, individuals in the 18-29 age bracket are much more active outdoors than those who are older. If those born between 1972 and 1982 continue to live a less active life, their lifestyles will affect not only their health, but also business and government serving their needs. The drop was also greater among higher income Americans (43% to 31%). The decline in frequency of participation was very strong among Internet users, who reported a several times weekly participation drop of 17%, versus an 11% drop for the public overall. Households with children showed a less pronounced drop.

The 1994-1995 National Survey on Recreation and the Environment (NSRE) is one of a continuing series of national recreation surveys, conducted periodically by the federal government since 1960. The survey is not specific to recreation on national forest lands. Outdoor recreation activities were grouped into 13 basic types for the survey. People 16 years and older were surveyed. Over the years, the survey has noted an increase in participation, although participation rates vary greatly across different demographic strata. In the 1994-1995 survey, 94.5% of the population participated in some activity during the previous 12 months. The most popular activities were walking (66.7%), viewing a beach or waterside (62.1%), outdoor family gatherings (61.8%), and sightseeing (56.6%). The most popular types of recreation included viewing and learning activities, such as birdwatching; trail, street, and road activities, such as biking; social activities, such as picnicking; spectator activities, such as attending an outdoor concert; and swimming. Similar to a 1997 California survey, for the most part, these activities are relatively low cost, can be pursued without a great deal of physical exertion, and do not require special equipment or skills. Most of these activity types remain popular with Americans past the age of 60.

Places that can be used for casual activities, such as walking, family gatherings, sightseeing, and visiting beaches, historic sites, and other sites of interest are most in demand for a broad spectrum of Americans. Viewing and learning, socially oriented activities, and swimming are the most popular forms of recreation, with natural and historic settings contributing significantly to recreationists' expectations. Participation is increasing at all types of settings and for all segments of the population, with some more than others. Growth seems particularly strong for viewing and learning activities and for new activities (Cordell, et al.). More uses continually come into vogue which must compete with existing uses for a limited land base.

The trend is generally away from consumptive uses (e.g., hunting, fishing) to non-consumptive uses (e.g., wildlife viewing). Water-based recreation is increasing. Heritage, nature, and educational travel are increasing. Scenic driving, which is always popular, continues to increase.

In the Pacific Coast region, which includes California, participation is expected to increase over the next 10-20 years in all activity groupings (winter, water, wildlife, dispersed land, and developed land). An exception within those groupings is hunting, which is expected to have decreasing participation. Although fewer people are expected to participate in hunting, the number of days that people hunt may increase slightly (Cordell, et al.).

Of all the regions nationally, the Pacific Coast will see the largest number of activities for which primary purpose recreation trips grow faster than the rate of increase predicted for the population (about 13 out of 22) from now until 2050. This region will also have the most activities (75%) for which participants grow at a rate faster than the population. Activity days should also increase faster than population growth for about 60% of the activities (Cordell, et al.).

The state of California conducted a survey on recreation in 1997 (*Public Opinions and Attitudes on Outdoor Recreation in California 1997*; An Element of the California Outdoor Recreation Planning Program, March, 1998.) The survey results apply to recreation areas operated by all levels of government and are not specific to the Forest Service. 82% of Californians believe that outdoor recreation areas and facilities are "important" or "very important" to their quality of life, although 37.1% spend less time in outdoor recreation activities than they did five years ago.

The 1997 California survey asked about five broad types of outdoor recreation areas: natural and undeveloped areas; nature oriented parks and recreation areas; highly developed parks and recreation areas; historical or cultural buildings, sites, or areas; and private, not public outdoor recreation areas and facilities. The largest percentage of respondents visited nature oriented parks and recreation areas, followed closely by natural and undeveloped areas. Highly developed areas are visited with the greatest frequency.

In the 1997 California survey, 92.5% expressed agreement (moderately agree or strongly agree) with the statement, "Protection of the natural environment is an important aspect of outdoor

recreation areas." 94.2% expressed agreement with the statement, "The quality of the natural setting is an important factor in my enjoyment of outdoor recreation areas." 60.7% expressed agreement with the statement, "Additional campgrounds should be constructed that are more developed and have hot showers, including campsites for which there would be an extra fee with hook-ups for electricty and water."

The 1997 California survey reported that almost 60% of respondents indicated facilities are too crowded when they want to use them. Within the monument, we know that some areas are filled to capacity, at times, especially on holiday weekends.

The 1997 California survey questioned people on their participation in 43 activities. Participation appears to be higher for activities that are less expensive, require less equipment, and need fewer technical skills. The largest percentage (84.8%) engaged in walking, while the lowest (2.5%) participated in snowmobiling. Other activities which typically occur on national forests and their rankings include:

Visiting museums, historic sites (2);

Driving for pleasure (4);

Beach activities, including sunning and games (5);

Picnicking in developed sites (7);

Trail hiking (8);

Attending outdoor cultural events, like concerts, theater, etc. in outdoor settings (10);

General nature study, wildlife viewing (11);

Camping in developed sites with tent or vehicle (13);

Fishing—freshwater (17);

Camping in primitive areas and backpacking (20);

Other non-mechanized winter sports activities—sledding, snow play, ice skating (21);

Mountain biking (not on paved surfaces) (27);

4-wheel drive vehicles used off paved roads (31);

Horseback riding (32);

Mountain climbing (36);

Motorcycles, dirt bikes, ATVs, dune buggies used off paved roads (37);

Hunting (38);

Cross-country skiing (40).

The number of days people participated in activities was also recorded in the 1997 California survey. People participated in walking for the most number of days (74.3 days). Other activities with frequent participation included driving for pleasure, use of open grass areas, bicycling, and nature study/wildlife viewing. Many of the activities with low participation rates appear to have avid participants. For example, 8.7% participate in hunting, but they do it for an average of 20.9 days.

In order to determine unmet demand, the 1997 California survey asked respondents to identify and rank the top 10 activities in which they would most probably increase participation if good opportunities were available. The rankings were weighted and grouped into high, medium, and low. Thirteen activities were ranked as having high unmet or latent demand. Of those that ranked high, the following activities typically occur on national forest lands: trail hiking, general nature study, freshwater fishing, beach activities, visiting historic sites, attending outdoor cultural events, camping in primitive areas, and picnicking in developed sites. Unmet demand was moderate for horseback riding and low for driving for pleasure, mountain biking, hunting, motorcycling, 4-wheel driving, other non-mechanized winter sports, cross-country skiing, and snowmobiling.

The 1997 California survey respondents were also asked to rank the top 10 activities to which the government should give the highest priority when spending public money (public support). The results were again weighted and grouped into high, medium, and low. A number of activities that typically occur on national forest lands ranked in the high category. Camping in developed sites ranked highest, followed by trail hiking. General nature study/wildlife viewing, visiting historic sites, picnicking in developed sites, and camping in primitive areas/backpacking also ranked high. Public support was moderate for attending outdoor cultural events, beach activities, and freshwater fishing. Support was low for motorcycling, mountain biking, driving for pleasure, horseback riding, hunting, 4-wheel driving, other non-mechanized winter sports, cross-country skiing, and snowmobiling.

In order to assess recreation needs, the 1997 California survey combined the results of the unmet demand question with the results of the question on which activities should have the highest priority for the expenditure of public funds (public support), with more importance given to the public support aspect. The result was a matrix, with each activity given one of nine rankings. Nine activities were in the top priority level; those that typically occur on national forest lands include trail hiking, camping in developed sites, camping in primitive sites, general nature study, picnicking in developed sites, and visiting historic sites. The need for additional opportunities for the following activities was ranked quite low (8 or 9): mountain biking, driving for pleasure, horseback riding, hunting, cross-country skiing, other non-mechanized winter sports, snowmobiling, motorcycling, and 4-wheel driving.

Given limited agency budgets, the 1997 California survey respondents were asked what were priority items for changes in funding. Californians want increased spending for rehabilitation and modernizing existing facilities (68.3%); for protection and management of the area's natural and cultural resources (67.6%); for basic maintenance of existing facilities (64.8%); building new facilities (57.5%); acquiring additional land for recreation (57.1%); and providing educational and activity programming (53.2%).

People's attitudes toward changes in facilities and services were also surveyed in the 1997 California survey. People wanted more educational programs (68.6%); more simple campgrounds (with picnic tables, cold water, and restrooms) (76.9%); more intensely developed campgrounds with hot showers (59.8%); and more horseback riding, hiking, and/or mountain biking areas where no motorized vehicles are allowed (76.0%). 36.8% wanted more areas for the legal use of off-highway vehicles; 37.6% wanted more RV sewage dump stations; 47.4% wanted more picnic sites that can handle large groups; and 51.9% wanted more parking areas at day use picnic areas. More Hispanics wanted additional picnic sites for large groups (76.8%) and more parking at picnic sites (83.9%).

People have a number of motivations for participation, which influence enjoyment of their recreation experiences. In the 1997 California survey, the factor considered most important to most people (86.9%) was just being outdoors. Relaxing, releasing and reducing tension, beauty, and quality of the natural setting were also very important for enjoyment. Meeting new people was the least important factor, except for Hispanics.

The Hispanic population will continue to grow during this century, which will greatly influence recreation participation. According to a 1995 census report, 10 million international immigrants will come to California by the year 2020, which would be about 60% of the state's population increase during this period. The state's Hispanic population will increase from 8 million to 17 million people. If these projections are accurate, approximately 30%-35% of California's population will be Hispanic at the end of this period. According to one researcher (Dwyer, 1994), minorities are projected to account for 75% of participation growth in backpacking, birdwatching, hunting, day hiking, tent camping, walking for pleasure, and picnicking.

Hispanic recreation participation patterns are somewhat different from predominantly Anglo populations. Hispanics have different preferences in activities and types of areas visited. According to the 1997 California survey, they are more likely to prefer highly developed areas, excluding historic and cultural areas. Fewer Hispanics visited natural undeveloped areas than members of other ethnic groups; 20.6% of Hispanics did not visit such areas at all, while only 7.7% of the rest of the population did not visit them.

Motivations for participation may also be different for Hispanics. As noted previously, the 1997 California survey found that meeting new people was more important to them (45.7% versus 15.8% for other ethnic groups). Being with family and friends was very important (83%); a variety of studies have indicated that recreation opportunities which promote family affiliation are important to Hispanics. Feeling in harmony with nature and achieving spiritual fulfillment were also important to more Hispanics than to other ethnic groups.

Several factors, relating to societal, lifestyle, and demographic trends, can affect recreation participation. The aging of the baby boomer generation, income changes, time constraints,

changes in family structure, and immigration are examples. For example, people are tending to take more frequent, shorter trips, rather than the traditional 2-week vacation. Many people are looking for opportunities that are close to home. More families and singles are recreating.

As the baby boomer generation ages, the proportion of the population that is elderly will increase. There is a general changing attitude that leisure time is not a privilege, but a right earned by years of hard work. Improved health care, greater emphasis on maintaining lifelong physical fitness, and a changing image of what "old" people can or cannot do are also factors that contribute to greater participation in outdoor recreation and leisure activities. They have more free time available for activities. Some are interested in continuing education and have a strong desire to learn about nature, wildlife viewing, and history/culture, for example. Some people are interested in high risk activities, and a number of people over the age of 40 are beginning such activities as rock climbing. Not all older people will increase their recreation participation, as health concerns and mobility problems will affect their ability and desire to participate.

Baby boomers are a diverse group. Although seven are turning 50 evey minute until the year 2014, millions are still in their thirties. They are entering their prime travel years; 80% of leisure travel is by people over 50 years old. As a group, they are wealthy; in 2010, they will control 50% of disposable income.

Income can affect participation. An example is activities that have a high cost investment in recreation equipment. Some researchers have also noticed that participation is lower in households with very low or very high incomes. Economic recession or prosperity will also affect participation patterns, as equipment sales, travel distance, travel frequency, and activity choices can all be affected by the amount of disposable income available.

The diversity of "family" has greatly changed over the past several years and will continue to do so. Whether by choice or economic necessity, two income households with or without children have become the rule. An increasing divorce rate has created greater numbers of single parent households. Families increasingly may be a blend of adults and children, who may be related by marriage, but not necessarily blood. The number of households with multiple generations is also increasing. A greater number of persons are also living alone, by personal choice, death of a spouse, or divorce.

People have a continuing desire to get away from the stress of everyday life and to enjoy the outdoors. Interest and concern for overall physical fitness, wellness, and improving health are substantial, although a recent report from the Surgeon General found that 60% of Americans are not regularly active, while 25% are not active at all. For young people, physical activity declines dramatically during adolescence. The same report concludes that a variety of medical conditions can be prevented or improved through lifelong moderate physical activity, which will improve the quality of life. The Recreation Roundtable's *Outdoor Recreation in America* says that Americans see outdoor recreation as a potent tool in attacking societal problems. Those who participate in outdoor recreation are markedly more content with their lives, in general, their families, their jobs, and their physical well-being.

People will continue to have an increasing number of choices on how to spend their leisure time. Recreation areas face competition from a myriad of leisure opportunities, both at home and away. At the same time, the public is developing higher expectations for quality and service. Convenient products and services that give people more time will continue to proliferate. As more people work, they have less time available to do anything else. The importance of convenience will extend to all areas of life, even recreation, as close-to-home recreation will increase in importance. Visitors will be interested in a diversity of activities and conveniences/amenities.

Conclusion

The various surveys referenced found similar results, although the actual percentages were somewhat different (differences could result from the makeup of the sample, differences in activity groupings and definitions, and differences in the wording of questions). However, all surveys project increases in participation for most activities, at varying rates. Participation is expected to increase, at varying rates, across all demographic strata, for all ages and abilities, including persons with disabilities. All surveys seem to indicate a growing interest in viewing/learning activities.

The California survey indicated a need for additional opportunities for specific activities and a desire for greater expenditures for particular purposes.

The diversity of recreationists will continue to increase, as the American population becomes more diverse, and international visitors will increase.

The variety of activities is expected to continue to grow. Some will be determined to be suitable uses for national forest land, and some will not. As more recreation uses occur, they must compete with existing uses for a limited land base.

Participation in many activities that currently occur in the monument is expected to grow in the future, so that the need will exist to create additional opportunities for them. Whatever additional opportunities are provided, they must be provided in such a way that lifestyle and demographic trends are taken into account, in facility design and recreation management, in order to truly serve the needs of the recreating public.

References

Public Opinions and Attitudes on Outdoor Recreation in California 1997; An Element of the California Outdoor Recreation Planning Program; California State Parks, March, 1998.

Outdoor Recreation in America, 2001, a report on the eighth national survey in an annual series for the Recreation Roundtable by Roper Starch Worldwide

Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends; H. Ken Cordell, principal investigator, 1999

1994-1995 National Survey on Recreation and the Environment; periodically conducted by the federal government since 1960

Sierra Nevada Ecosystem Project (SNEP): Final report to Congress, vol. II, Assessments and scientific basis for management options. Davis: University of California, Centers for Water and Wildland Resources, 1996

Return to top of page.

DEIS Contents

Summary
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
List of Preparers and Consultants
Document Recipients
Appendices

Alternate format

Acrobat PDF

· The free Acrobat Reader® software is needed to view and print Adobe PDF files.

DEIS Home

Giant Sequoia National Monument DEIS August 2002

Map Packet

Figure II-1: Alternative 1, No Action, Framework Allocations

Figure II-2: Management Areas for Alternative 2

Figure II-5: Management Areas for Alternative 3

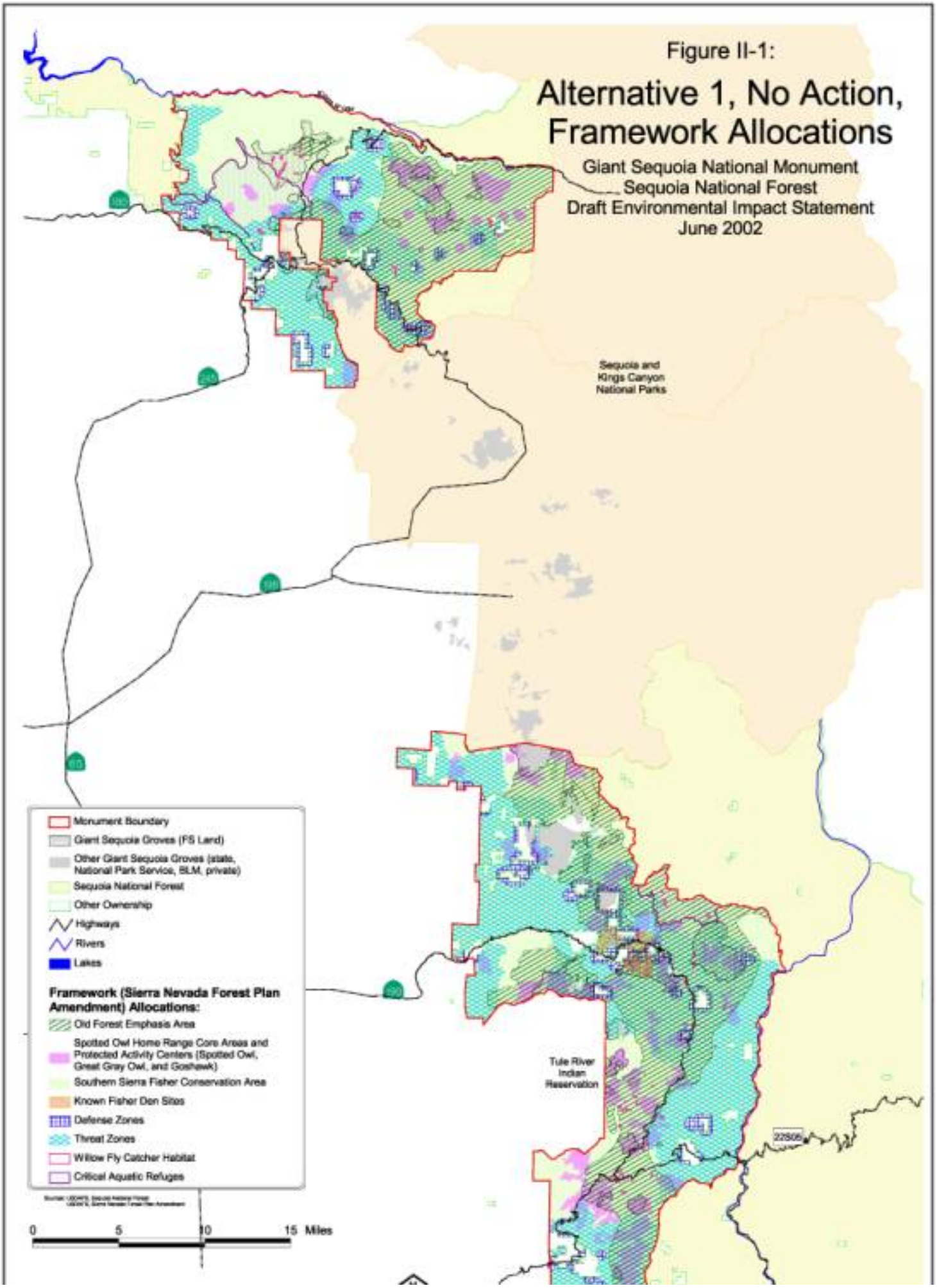
Figure II-6: Management Areas for Alternative 4

Figure II-7: Management Areas for Alternative 5 and 6

Figure III-5: Fire Susceptibility

Figure III-6: Fire Return Interval

Figure II-1: Alternative 1, No Action, Framework Allocations



Close Window

Table III-7: Acres of Fire Susceptibility

(approximate acres: includes all Ownerships within Monument boundary)

Fire Susceptibility	High	Moderate	Low	Barren	Total
Wildlife Habitat	16,160	26,595	3,355	160	46,270
Monument	110,840	204,765	29,575	8,935	354,115

Close Window

Return to DEIS Home

File Code: 1920-2-1
Date: December 2, 2002

Dear Reviewer:

I enclose a copy of the Draft Environmental Impact Statement (DEIS) for the Giant Sequoia National Monument (Monument) Management Plan for your review and comment. To be most useful, please send your comments no later than March 17, 2003.

Six alternatives are considered in this DEIS. Alternative 1, the No Action Alternative, would continue current management, implementing the Presidential Proclamation and the Forest Plan as amended by the Sierra Nevada Forest Plan Amendment (Framework). Alternative 2 is the Proposed Action as described in the Notice of Intent published in the Federal Register in June of 2001; it would protect and restore giant sequoia ecosystems within their zones of ecological influence. Alternative 3 proposes to move resources toward desired conditions by emphasizing natural processes, primarily fire. Alternative 4 would manage the ecosystems conservatively and encourage recreation. Alternative 5 would manage groves with a wide range of management strategies to promote characteristics for giant sequoia regeneration. Alternative 6 is the preferred alternative. It proposes management of the entire Monument with the widest range of management strategies.

In July of this year, the forest experienced a catastrophic fire event. The McNally Fire began on July 21, 2002 and burned an estimated 151,000 acres in the Sequoia and Inyo National Forests. It burned approximately 5%, or an estimated 16,800 acres, of the Monument. No giant sequoias were burned, though the fire did get within one mile of the Packsaddle Grove in the southern portion of the Monument. Accompanying this letter is a document that evaluates the effects of the McNally Fire on the resources within the Monument and the DEIS. I have reviewed the evaluation and feel that no modification of the management direction in the DEIS is necessary at this time.

If your enclosed copy of the DEIS is on a compact disk (CD), the documents can be read by opening your internet browser, by starting Adobe Acrobat Reader, or installing the copy of Adobe Acrobat Reader that is contained on the CD. Links to maps and charts are embedded in the text; each map, table, or chart will open in a new window. The DEIS, both on the CD and on the web, has been formatted to meet accessibility standards for electronic and information technology, required in Section 508 of the Rehabilitation Act (29 U.S.C. 794d), as amended by the Workforce Investment Act of 1998 (P.L. 105-220), August 7, 1998.

Reviewers of the DEIS should provide the Forest Service with their comments during the 90-day review period. This will enable the Forest Service to analyze and respond to the comments at one time and to use this acquired information in the preparation of the Final Environmental Impact Statement (FEIS), thus avoiding undue delay in the decision-making process. The resulting FEIS and Record of Decision will amend the existing Forest Land and Resource Management Plan (Forest Plan) for the Sequoia

National Forest, as previously amended by the Framework. Together they will provide management direction for the Monument.

I remind you that reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553, (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the FEIS. City of Angoon v. Hodel (9th Circuit, 1986) and Wisconsin Heritages, Inc. V. Harris, 490 F. supp. 1334, 1338 (E.D. Wis. 1980). Comments on the DEIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed. Specifically, I am looking for comments regarding the adequacy of the preferred alternative (Alternative 6). In addressing these points, reviewers may wish to refer to the Council of Environmental Quality Regulations for implementing the procedural provisions of the National Environmental Policy Act at 40 CFR 1503.3. You can also access these regulations on the web by using the CEQ Regulations link on our website (http://www.r5.fs.fed.us/giant_sequoia).

Your comments are important in making this decision. Please address your written comments regarding this DEIS and the preferred alternative to:

Jim Whitfield, Team Leader
Giant Sequoia National Monument
900 West Grand Avenue
Porterville, CA 93257

Comments may also be sent via e-mail to GSNM_Public@fs.fed.us or by clicking on the e-mail link on the website. The full DEIS is also available for review on the World Wide Web at http://www.r5.fs.fed.us/giant_sequoia.

Again, to be considered, your comments must be postmarked or otherwise received by March 17, 2003. Comments received, including the names and addresses of those who comment, will be considered part of the public record for this project and will be available for public inspection. For additional information, please contact Jim Whitfield at (559) 784-1500. Thank you for your interest in the management of the Giant Sequoia National Monument.

Sincerely,

/s/Arthur L. Gaffrey

ARTHUR L. GAFFREY
Forest Supervisor