Fire Management Plan

Environmental Impact Statement
Whiskeytown National Recreation Area
Whiskeytown, California

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Whiskeytown National Recreation Area
P.O. Box 188
Whiskeytown, California 96095

Produced by the Division of Publications
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Abstract

This document presents three action alternatives and a no action alternative for a revised Fire Management Plan at Whiskeytown National Recreation Area. Revisions to the current fire management plan are needed to meet public and firefighter safety, natural and cultural resource management, and wildland urban interface objectives of the park. The action alternatives vary in the emphasis they place on the eight fire management goals developed by the park. The current program has been effective in fire suppression, but is not able to restore large portions of the park to landscapes approximating the mid 1800s as required by the park's General Management Plan. Each action alternative contains an amendment to the park's General Management Plan to clarify that the park headquarters may be rebuilt in its current location as a part of the fire cache relocation to the Oak Bottom Campground.

Whiskeytown National Recreation Area straddles California Highway 299 eight miles west of Redding, California and encompasses 42,500 acres—including the 3,000 acre Whiskeytown Lake. This reservoir was created by damming Clear Creek and importing water from the Trinity River basin for hydroelectric power production, recreation and irrigation needs. Wildland fire has occurred naturally throughout the park as an important ecosystem process that kept forest fuels and vegetation community structures within their natural range of variability. Mining, logging, and past fire suppression activities have lead to increases in fuel loads and changes in vegetation community structure, and to the increasing potential for large high-intensity wildland fire within the park, affecting developed zones, the park's natural and cultural resources, and neighboring land owners and communities. The risk of severe fire behavior is most prevalent in areas where vegetation has been modified by past land uses and where fire has been excluded. The treatments proposed in this Environmental Impact Statement would be guided by restoration of historic landscapes and processes and reducing fuels in the wildland urban interface zone.

The National Park Service has analyzed the environmental impacts of four alternatives. Alternative I is the No Action Alternative and would continue the current fire management program. Alternative II would primarily rely on prescribe fire as a method to achieving program goals. Alternative III would primarily rely on fire suppression as the approach for achieving program goals. Alternative IV: Multiple Strategy is the agency preferred and environmentally preferred alternative because it promotes the greatest flexibility in achieving the goals set out in the park's General Management Plan. Alternative IV was modified from the Draft Environmental Impact Statement by the removal of limited wildland fire use as a management option.

Dear Friends,

The *Environmental Impact Statement* for the *Whiskeytown Fire Management Plan* has been prepared to update the park's fire management program. The National Park Service has been directed by Congress to address, in an up-to-date manner, the way hazardous fuels accumulate in relation to the safety of fire fighters, the public, and our neighbors in surrounding communities. The mission of the National Park Service is

> *"…to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations…"*

Whiskeytown's recently published General Management Plan identified a goal of returning the undeveloped landscapes of the park to circa 1850s condition. Wildland fire suppression, mining and logging have all contributed to safety and ecological hazards that must be addressed.

This Environmental Impact Statement presents four alternatives (including a no action alternative) that propose to deal with the complex problems of fire hazard reduction in the wildland urban interface and restoring some forest conditions to reflect the circa 1850s landscape. We can achieve this goal while continuing to meet the mission of the National Park Service. The overriding concerns of each of these alternatives are the safety of fire fighters, the protection of property, natural resources and historic properties. In addition, an element common to all action alternatives is an amendment to the park's General Management Plan about retaining the park headquarters Administrative building in its current location.

No sooner than 30 days after the Environmental Protection Agency publishes a Notice of Filing of this document in the Federal Register, a Record of Decision will be prepared and signed by the National Park Service Pacific West Regional Director. Information on the posting of the Notice of Availability in the Federal Register will be posted on the park's website: http://www.nps.gov/whis. The Record of Decision will formally identify the direction that Whiskeytown National Recreation Area will take to manage its fire program for the next ten years.

Hard copies of this document are available at the park's Visitor Center; digital copies are available on CD-ROM and through the park website.

On behalf of the park staff, I would like to thank those of you who were involved in the public planning process. Over the past few years, many people attended the several public meetings and tours arranged to discuss and demonstrate some of the issues and concerns mentioned in this document. Additionally, verbal and written comments received during the public review of the Draft Environmental Impact Statement greatly assisted the park in refining the alternatives as well as the environmental analysis. Through your efforts, the National Park Service will be making a decision that is supported by the communities around the park and by the communities that use the park. I encourage your continued interest in the management of Whiskeytown National Recreation Area.

Sincerely,

Jim F. Milestone
Superintendent

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Introduction

National Park Service policy requires that each park with vegetation capable of burning prepare a plan to guide a fire management program responsive to natural and cultural resource objectives, protection of developed facilities, and safety considerations for park visitors and staff. Whiskeytown National Recreation Area is currently operating under a Fire Management Plan that was written in 1985 and revised in 1993. The existing plan addresses various fire management techniques, including fire suppression, prescribed fire, and the limited use of mechanical treatment to reduce forest fuels. The National Park Service proposes to revise Whiskeytown's Fire Management Plan to expand the use of prescribed fire and mechanical treatment at varying levels of complexity to meet fire management goals at Whiskeytown

Purpose and need for the Fire Management Plan

Wildland fire management activities in National Park sites are essential to the protection of human life, personal property and irreplaceable natural and cultural resources. Safety is critical when considering the park's seven in-holders, numerous National Park structures, and the fact that the majority of the park's visitation takes place in flammable plant communities and associated irregular fire regimes. It is because of this, and the proximity to communities like French Gulch, Old Shasta, Centerville, Igo, and Redding, that the National Park Service has identified Whiskeytown National Recreation Area as being at high risk for high severity wildland fire.

The means by which we need to provide for safety while restoring and sustaining these ecosystems are sometimes controversial. Letting nature take its course may be appropriate in some areas that have been relatively unaffected by human activities, and disturbance regimes (i.e. fire return intervals) have remained relatively intact. Yet, this approach cannot be carried over to where life and property are threatened, as well as where forests have been logged and deprived of fire for what is, in some cases, estimated to be over seventy years. Given these conditions, continued fire suppression will be required, but suppression alone will only exacerbate a growing problem of hazardous fuel build up, particularly in areas of overly dense stands and excessive vegetation.

This final Environmental Impact Statement analyzes four alternative approaches to managing fire in the park. The alternative that is selected would be adopted as the new Fire Management Plan to guide the fire management program. Authority to develop a fire management program is derived from the National Park Service Organic Act (16 U.S.C. 1 et seq.), and in delegations of authority found in Part 245 of the Department of the Interior Manual. Director's Order 18 also provides guidance to National Park Service wildland fire management and Director's Order 12 guides National Park Service implementation of the National Environmental Policy Act (NEPA).

The Fire Management Plan for Whiskeytown National Recreation Area is being developed in coordination with other park planning documents, including the General Management Plan, completed in 2001. The General Management Plan states that the purpose of the fire management program would be expanded to improve wildlife habitat, stimulate biodiversity, maintain healthy watersheds, reduce exotic species, and restore circa 1800 landscape conditions.

This Environmental Impact Statement analyzes four alternative approaches to fire management at Whiskeytown National Recreation Area. The park superintendent, has used the information provided in this document (which incorporates input received during a 60 day public comment period), to recommend to the Pacific West Regional Director of the National Park Service which alternative should be selected. The park's preferred selection is Alternative IV: Multiple Strategy Program. The selected alternative will guide fire management in the park over the next ten years.

Planning issues considered

Issues are the concerns raised by park staff, other government agencies, and the public that were used to develop and evaluate the alternatives in this document. Concerns ranged from the impacts of wildland fire to the impacts associated with management actions taken to fight fire and reduce fuels. Planning issues discussed in this document include impacts to the biological environment (vegetation, wildlife), the physical environment (soils, geologic resources, water quality, wetlands/floodplains, and air quality), the cultural environment (cultural resources, sacred sites), and the social environment (health and safety, community economics, recreation, and visual resources).

Alternatives

Formulation of alternatives. An interdisciplinary team of National Park Service staff developed the alternatives described in this document with input from the public and other agencies. The interdisciplinary team was comprised of staff with expertise in fire management, wildlife, biology, botany, ecology, geology, safety, recreation, cultural resources, and public land policy and regulations. Public and interagency input was solicited and received through a scoping process. Four different approaches to managing fire at Whiskeytown were identified through this process and analyzed.

Alternative I: No Action (Current Program). The National Environmental Policy Act requires that environmental analysis documents include a No Action alternative. The No Action alternative for plan modifications, such as the proposed update of Whiskeytown's Fire Management Plan, assumes that no new actions would be taken. The current fire management program utilizes a limited range of fire management strategies - including prescribed fire, Level 1 mechanical treatment, and suppression of all wildland fires (including natural ignitions). Implementation of these strategies specific to this alternative is described below.

Prescribed fire: The current program includes both broadcast and pile burning components, with prescribed fire projects range in size from 0.5 to 1000 acres occurring in all vegetation types. Projects located within prescribed fire burn units occur during the nondormant season from 0-5% of the time. Projects located in shaded fuel breaks occur during the nondormant season 20-30% of the time. Maximum burning in a given year under this alternative would be 1400 acres.

Mechanical treatment: Level 1 mechanical treatment would be utilized to reduce hazardous fuel levels in the park. This would include the use of chain saws, weed-eaters, hand crews, and chippers to clear around buildings, to install and maintain shaded fuel breaks, and to clear along roadways. The existing Wildland Urban Interface program would continue under this alternative. Total maintained shaded fuel break acres would be 850 acres, with as needed maintenance based on site evaluations occurring at least every three years. Annual average maintenance of all mechanically treated areas under this alternative would be 275 acres.

Among the beneficial impacts of this alternative are the ability to pre-plan for prescribed burns, mechanical treatments and shaded fuel break construction and maintenance. On the other hand, at the proposed treatment level, reduction of hazardous fuels would take several decades, increasing the possibility that high severity wildland fires could occur and result in major and permanent adverse impacts to cultural resources.

Alternative I is compatible with adjacent fire agency planning effort—the shaded fuel break system currently being implemented by Whiskeytown is a component of these plans. Any actions taken on surrounding lands would result in effects similar to fire management activities in the national park, with the same types of risks. The moderate effects of the treatments in the Whiskeytown wildland urban interface under Alternative I would potentially become beneficial, short-term and moderate.

Alternative II: Prescribed Fire Dominated. Under Alternative II, the fire program would focus on the intentional use of fire through the application of prescribed fire to meet ecological restoration and maintenance objectives, and to reduce hazardous fuels throughout the park. All other fires would be suppressed including natural ignitions. Mechanical treatment would only be used to construct prescribed burn unit boundaries and to reduce fuels around developed areas. Implementation of these strategies specific to this alternative is described below.

Prescribed fire: This alternative would include pile burning and broadcast burning. Projects under Alternative II would include areas up to 1,000 acres in size to simulate, to the greatest extent feasible, the scale and pattern of natural fire events. Up to 3,000 acres would be burned during each year of implementation. Due to the limited available prescription windows during the dormant season, alternative II would implement prescribed burns during the nondormant season from 10%-20% of the time to maximize all available prescription windows for execution of prescribed fire projects.

Mechanical treatment: Level 1 mechanical treatment would be used to accomplish hazard fuel and resource management objectives in developed areas or other improvements. It would also be used to prepare shaded fuel breaks for use as prescribed fire burn unit's boundaries. Total average mechanical treatment level 1 acres would be 80 annually.

This alternative meets several of the park's stated fire management objectives. Reliance on prescribed fire as the primary tool for landscape vegetation restoration would require a longer period of time than other alternatives with a broader range of fire management tools. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of large, unmanageable, and severe wildland fires.

Alternative II conflicts with adjacent land use plans because of the elimination of the shaded fuel break system. The West Redding shaded fuel break system, developed by the local cooperating agencies, includes the lands in Whiskeytown—they are strategic areas that are essential to the effectiveness of the program. The emphasis on reducing fire risk is compatible with adjacent land plans. The implications for suppression would be mixed—a beneficial reduction in fuels is countered by reduced access for fire fighters due to lack of shaded fuel break system during holding actions. Reduced holding action capacity can mean increased risk in escaped prescribed fires.

In summary, Alternative II would address the fire management program goals outlined earlier, however relying on the limited tool of prescribed fire could be problematic for the fire management staff. By limiting the types of tools available for the fire program, this alternative indirectly increases involvement of outside agencies in accomplishing fire management treatment targets. This alternative may end up requiring a great deal of planning to occur with limited implementation ability.

Alternative III: Suppression Dominated. Under Alternative III, all natural and human-ignited wildland fires would be suppressed. Prescribed burning would only occur in conjunction with mechanical fuel treatments around developments and on shaded fuel breaks. Mechanical treatment level 1 and level 2 would be utilized with fuel reduction as the primary goal of projects implemented under this alternative. Implementation of these strategies specific to this alternative is described below.

Prescribed fire: Alternative III would consisting of pile burning and a few prescribed fire projects to strengthen and widen by up to ¼ to ½ mile shaded fuel breaks for tactical purposes in the case of suppression fire events. No large, broadcast burns would be conducted. Up to 250 acres would be burned during each year of implementation.

Mechanical treatment levels 1 and 2: This alternative would use both mechanical treatment levels 1 and 2. Mechanical treatment would be used to reduce forest fuels in and around developed areas, and to install new shaded fuel breaks, and widen existing shaded fuel breaks. Annual program levels would be up to 225 acres for each of the two mechanical treatment levels proposed in this alternative.

Alternative III is generally compatible with adjacent land use plans. Its emphasis on preparedness, suppression, and hazard fuel reduction is especially complements the California Department of Forestry and Fire Protection plan, and area plans. The expanded use of mechanical treatment is compatible with land use plans. Its lack of emphasis on forest health is slightly at odds with the Bureau of Land Management plan. A fuels buildup in the interior portions of the park would make suppression difficult, raising fire risk. Wildland fires could grow rapidly.

In summary, Alternative III would address the fire management program goals outlined earlier; however the emphasis on mechanical treatment, with its associated equipment accessibility limitations in large sections of the park, would increase the risk of high frequency, high intensity wildland fires in areas most inaccessible to fire fighters.

Alternative IV: Multiple Strategy Program (Preferred Alternative). This alternative would focus on restoring high elevation logged plant communities and reducing the risk of high severity wildland fire by decreasing forest stand density, reducing surface fuels, and attempting to restore fire as a natural disturbance process to the greatest extent feasible. Implementation of these strategies specific to this alternative is described below. Readers should note that Wildland Fire Use, or managing naturally ignited fires, has been removed from this alternative. Comments from the public and from surrounding agencies, along with consultation with National Park Service personnel recommended removal of this method of fire management.

Prescribed fire: This alternative would include both pile and broadcast burns. Project size for Alternative IV would range from 0.5 to 1,000 acres, and would occur in all vegetation types. Up to 2,200 acres would be treated in each year of implementation. Projects located within prescribed fire burn units would occur during the nondormant season from 0-15% of the time. Projects located in shaded fuel breaks would occur during the nondormant season 50% of the time.

Mechanical treatment levels 1, 2 and 3: All three levels of mechanical treatment would be utilized to reduce fuel levels and mimic the effects of fire on structural patterns of woody vegetation. Mechanical treatment would be used to reduce forest fuels in and around developed areas, and to install and widen new and existing shaded fuel breaks, respectively. Totals of mechanical treatment would be up to 1075 acres/year.

Alternative IV is generally compatible with adjacent land use plans. The increased focus on the shaded fuel break system, and mechanical treatments for fuels is emphasized on neighboring lands. The additional emphasis on mechanical treatments, including the use of mechanized equipment to reduce brush and small sized trees, is compatible with adjacent land use plans, which currently call for mechanized equipment to reduce hazard fuels and restore landscapes.

In summary, Alternative IV would address the fire management program goals outlined earlier, using the broadest set of fire management tools available to potentially accomplish more than any of the other alternatives offered in this document.

Actions common to all action alternatives. The actions described in the subsections below are a component of each of the four alternatives considered in this document.

Fire Management and Coordination: All fire management activities at Whiskeytown are coordinated and implemented by a professional fire management staff in coordination with natural and cultural resource specialists. Other agencies are involved in the planning and execution of fire management actions in the park These include the United States Forest Service, the Bureau of Land Management, the California Department of Forestry and Fire Protection, and the Western Shasta Resource Conservation District. Work crews from the California Conservation Corps are utilized, as are additional crews that are hired on contract.

Suppression: Suppression is the activity most people associate with fire management and includes all actions taken to put out an active fire, and is defined as the restriction of the spread of a wildland fire and the elimination of all threats from that fire. Alternatives that include fire risk reduction treatments and shaded fuel breaks will provide for a greater range of suppression options.

Prescribed fire: Prescribed Fire is the use of management-ignited fire to meet specific resource goals and objectives under predefined fuel and weather conditions. It is a component of each of the alternatives analyzed in this document, although significant differences do exist among the alternatives. The specific use of prescribed fire, ranging from small pile burning projects to larger broadcast burns, is described in greater detail for each alternative.

Mechanical treatment level 1: Mechanical treatment is a term used to describe the application of various tools and equipment by fire management staff to reduce fuels and achieve fire management goals. Three levels of mechanical treatment are being considered at Whiskeytown, but level 1 mechanical treatment is the only type of mechanical treatment common to all four alternatives.

Fire information and education: The National Park Service manages an active fire information/

education program in the park. The park staff includes a Fire Information and Education Specialist in response to growing responsibilities as a result of the Wildland Urban Interface Initiative. This program assists in educating National Park Service employees, and volunteers, concession employees, cooperating association employees, other agencies, park visitors and the general public about fire management goals and policies.

Relocate fire cache to Oak Bottom and build new administration building at park headquarters: The park General Management Plan identified both the need for replacing the current decentralized fire cache and developing a modern park headquarters facility. The relocation of the Whiskeytown fire cache building from the park headquarters compound and construction of a new fire cache in the Oak Bottom recreational complex is a component of each action alternative. Also under each of the action alternatives, the park's current General Management Plan will be amended to clarify that the National Park Service would have the option of considering within its range of alternatives the construction a new administrative building at the park headquarters on Kennedy Memorial Drive.

Affected environment

A list of specific resource topics was developed to focus on and compare environmental impacts of fire management activities among alternatives. These resource topics were selected based on federal law, regulation, and executive orders; National Park Service management policies; National Park Service and federal wildland fire management policies; National Park Service subject matter expertise; and concerns expressed by the public or other agencies during the public scoping periods.

The existing environment that could be affected by actions proposed in this document is described in Chapter 3. These conditions establish the baseline for the analysis of effects found in Chapter 4 Environmental Consequences. None of the action alternatives considered in this document would impair these resources.

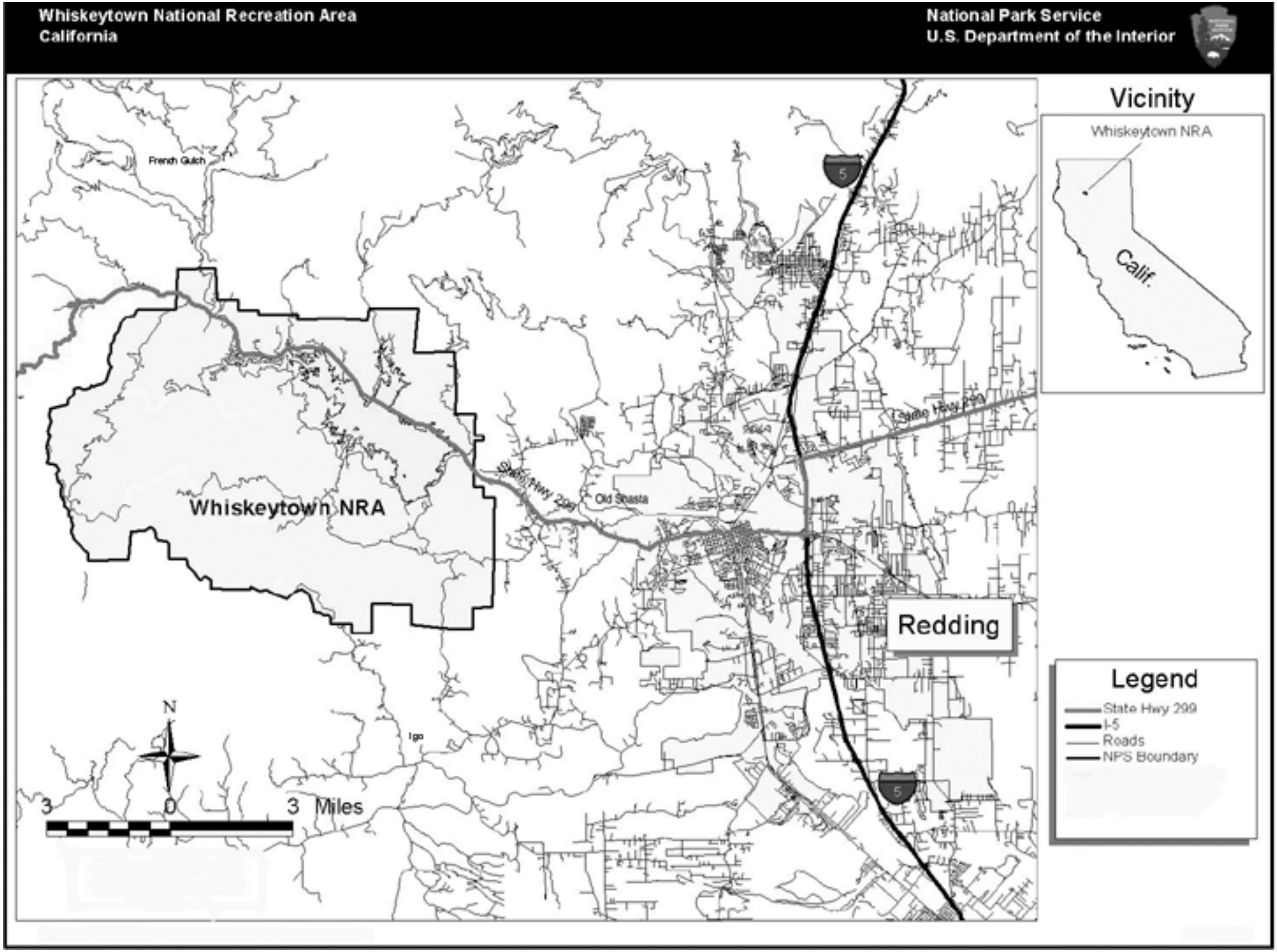
Environmental Impacts

An impact analysis for each impact topic in the affected environment has been completed for each of the four alternatives in the final Environmental Impact Statement for the Fire Management Plan. Chapter 4 Environmental Consequences, describes both beneficial; and adverse effects in detail. In developing the alternatives, the interdisciplinary team identified actions that would provide for a balance between actions that generate adverse impacts and actions that generate beneficial impacts. Additionally, some actions will have immediate adverse, though short term impacts—and also will have a longer term, beneficial impact. The complexity of returning fire back into the ecosystem should not be lost in reviewing the information provided in Chapter 4 Environmental Consequences.

The table on the next page describes the range of impacts for each affected environment by alternative.

Impacts Summary

Affected Environment	Alternative I No Action	Alternative II Prescribed Fire Dominated	Alternative III Suppression Dominated	Alternative IV Multiple Strategy Program
Biological Environment				
Vegetation Communities	Adverse to beneficial, negligible to major, short to long term, more data needed	Adverse to beneficial, negligible to major, short to long term, more data needed	Adverse to beneficial, negligible to major, short to long term, more data needed	Adverse to beneficial, negligible to major, short to long term, more data needed
Wildlife and Fish	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed
Special Status Species	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed
Geophysical Environment				
Soils	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term
Water Quality	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term
Air Quality	Adverse, negligible to major, short to long-term	Adverse, negligible to major, short to long-term	Adverse, negligible to major, short to long-term	Adverse, negligible to major, short to long-term
Ecologically Critical Area	More data is needed, moderate to major, adverse, long term	More data is needed, minor short term adverse to moderate long term beneficial	More data is needed, moderate to major, adverse, long term	More data is needed, minor short term adverse to moderate long term beneficial
Cultural Enviroment				
Archaeological, historical and ethnographic resources; cultural landscapes; museum collections	Long term moderate beneficial to short term major adverse	Long term moderate beneficial to short term major adverse to beneficial	Long term major adverse	Long term moderate beneficial to short term major adverse
Social Environment				
Health and Safety	Adverse, negligible to major, short to long term	Adverse, negligible to major, short to long term	Adverse, negligible to major, short to long term	Adverse, negligible to major, short to long term
Community Economics	Beneficial, minor to moderate, short to long-term	Beneficial, minor to moderate, short to long-term	Beneficial, minor to moderate, short to long-term	Beneficial, minor to moderate, short to long-term
Visual Resources	Beneficial, minor, long term	Beneficial, moderate, long term	Beneficial, moderate, long term	Beneficial, moderate, long term
Recreation	Adverse to beneficial, minor, long term	Adverse to beneficial, minor, long term	Adverse to beneficial, minor, long term	Adverse to beneficial, minor, long term
Compatibility with Land Use Plans	Negligible beneficial long term	Moderate ,adverse, short term to Moderate beneficial, long term	Adverse to beneficial, negligible, long term	Moderate ,adverse , short term to major, beneficial, long term


Whiskeytown National Recreation Area
California
National Park Service
U.S. Department of the Interior
Vicinity
Whiskeytown NRA
Calif.
French Gulch
Whiskeytown NRA
Old Shasta
Redding
5
N
3 0 3 Miles
Legend
State Hwy 299
I-5
Roads
NPS Boundary

Chapter 1 Introduction

National Park Service policy requires that each park with vegetation capable of burning prepare a plan to guide a fire management program responsive to natural and cultural resource objectives, protection of developed facilities, and safety considerations for park visitors and staff. The plan must describe a full range of strategic and tactical operations that would be used to ensure that all fire-related management actions and wildland fires are effectively managed.

Whiskeytown National Recreation Area (referred to as either the park or Whiskeytown) is currently operating under a Fire Management Plan that was written in 1985 and revised in 1993. The existing plan addresses various fire management techniques, including fire suppression, prescribed fire, and the limited use of mechanical treatment to reduce forest fuels. The National Park Service proposes to revise Whiskeytown's Fire Management Plan to expand the use of prescribed fire and mechanical treatment to meet fire management goals at Whiskeytown. The fire management plan outlines a program designed to contribute to the achievement of fire management goals to protect natural and cultural resources and developed facilities, as well as the safety of park staff and visitors.

Whiskeytown National Recreation Area is located in the Klamath Mountains – where the cool, wet, winters and warm, dry summers, predisposes much of the area to conditions that would carry fire on a yearly basis. The lack of refined fire history information specific to Whiskeytown makes the classification of the park's fire regimes into one or two clearly defined categories difficult. Inferences must be made from research conducted in similar plant communities and pieced together across the landscape. The definition of the role of fire is complicated even more by the fact that the park lies within a transition zone (between the Sacramento Valley and the Klamath Mountains) that has extreme ranges in elevation. What is clear is that the dynamic integration and patterns of Whiskeytown's plant communities is a reflection of numerous fire regimes along topographic and geographic gradients. It is these fire regimes that have helped to define the pattern of age classes, succession stages, and plant communities that are described in this document.

Although data on specific species composition and structure is lacking, the late 1800's General Land Office surveys describe the distribution of Whiskeytown's plant communities to be very similar to what is found in the park now. Much of the lower elevation blue oak grasslands, mixed oak woodlands, chaparral, knobcone, and ponderosa pine communities have experienced fire at least once within the last seventy years. However, little is known of the role of fire in landscapes where these habitat types integrade with one another in such a way that distinct boundaries between them are difficult to determine. Blue oak and ponderosa pine forests burned frequently with fires generally of low to moderate severity and historical fire regimes from two to twenty-three years. Mixed in with these communities are the chaparral and knobcone pine plant communities, which usually support severe stand-replacement fires. Higher up in elevation, frequent fires of low to moderate severity characterize where the mixed conifer plant community blends into where ponderosa pine and mixed oak woodlands dominate. This fire regime can vary considerably in both frequency and severity, depending on site-specifics, every seven to fifteen years. From a landscape perspective, it appears that many of these high-elevation forests areas were generally more open than they are today, due mostly to the frequency of fires. This may have promoted more grasses and herbs than are associated with most forest stands today.

The combination of logging and fire suppression has profoundly affected the structure and composition of the middle to high elevation forests. Many of the park's ponderosa pine and mixed conifer stands have become denser, mainly in small and medium size classes of shade-tolerant and fire–sensitive species. Stands have also become less complex and more homogeneous in terms of spatial arrangement. In many areas, ecosystem diversity and sustainability appear to be jeopardized by these changes, even without the threat of severe fires.

Wildland fire management activities in National Park sites are essential to the protection of human life, personal property and irreplaceable natural and cultural resources. Safety risks and expenses associated with fire management activities require exceptional skill and attention

to detail when planning and implementing fire management activities. Safety is critical when considering the park's in-holders, numerous National Park structures, and the fact that the majority of the park's visitation occurs in these combustible fuels. It is because of this, and the proximity to communities like French Gulch, Old Shasta, Centerville, Igo, and West Redding, that the National Park Service has identified Whiskeytown National Recreation Area as being at high risk for high severity wildland fire.

However, the means by which we need to provide for safety while restoring and sustaining these ecosystems are sometimes controversial. Letting nature take its course may be appropriate in some areas that have been relatively unaffected by human activities, and disturbance regimes have remained relatively intact. Yet, this approach cannot be carried over to where life and property are threatened, as well as where forests have been logged and deprived of fire for what is estimated to be over seventy years. Given these conditions, continued fire suppression will be required, but suppression alone will only exacerbate the growing problems, particularly in areas of overly dense stands and excessive fuels.

The historic structure and composition of Whiskeytown was created by a variety of disturbance regimes and many of the tools available for mimicking these processes lie within the disciplines of fire management. Given the narrow windows available in which fire management is able to execute prescribed burns, it is inconceivable that fire in its pre European settlement frequencies and severities could be restored fully in the time period covered by this plan. And prescribed fire alone cannot fully mimic the ecosystem functions of pre European settlement fire because the forests have changed greatly and the effects of reintroduced fire are likely to be quite different than those of pre European settlement fire. If fire alone is used, several applications of prescribed fire will be necessary, especially in densely stocked stands with heavy fuels concentrations, before the desired forest conditions can be approached. These early reintroductions of prescribed fire are expensive and have a high risk of escapes as well as undesirable effects. Because of this, the National Park Service is proposing to use fire surrogate treatments not only to reduce hazardous fuel loads and tree stocking levels to decrease the probability of large intense fires, but also to pretreat prescribed burn units so that prescribed fire can be safely reintroduced into these dense forests.

Fire surrogate treatments can reduce wildland fire severity by making fires less intense and safer to control. In general, thinning can lower crown bulk densities and redistribute fuel loads significantly, thus decreasing fire intensities if the surface fuels are treated. These removals have been shown to be effective in reducing crown fire potential.

Similarly, thinning and other fire surrogate treatments can mimic the effects of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, hydrology, seed scarification, non-woody vegetation response, plant diversity, disease and insect infestation, and genetic diversity, are almost unknown. Because fire and fire surrogates differ markedly in terms of these factors, including the potential for soil compaction and components of biomass removed from a site, prescribed fire are proposed to assume a considerably expanded role for Whiskeytown.

This final Environmental Impact Statement analyzes four alternative approaches to managing fire at Whiskeytown National Recreation Area.

Program goals

The Fire Management Plan goals describe what must be accomplished in order for the fire management program to be successful. The following seven goals were developed by National Park Service staff to reflect National Park Service policy as well as the comments received during public scoping meetings. These goals were used to formulate the alternatives analyzed in this Final Environmental Impact Statement for the Fire Management Plan:

Goal 1 Ensure that public and fire fighter safety is the highest priority for all fire management activities.

Goal 2 Use fire to improve wildlife habitat, stimulate biodiversity, maintain healthy watersheds, reduce exotic plants, restore circa 1800 landscapes, and improve forest health.

Goal 3 Suppress undesirable fires in order to protect the public, property, and resources.

Goal 4 Reduce fire risk adjacent to developed areas, urban interface boundaries, and cultural/historical sites.

Goal 5 Foster and maintain interagency fire management partnerships and contribute to the fire fighting effort at the local, state, and national level.

Goal 6 Develop Whiskeytown National Recreation Area staff expertise in all aspects of fire management.

Goal 7 Educate the public on the scope and effect of fire management programs.

Authority for action and related plans

This Final Environmental Impact Statement analyzes four alternative approaches to managing fire in the park. The alternative that is selected would be adopted as the new Fire Management Plan to guide the fire management program. Authority to develop a fire management program is derived from the National Park Service Organic Act (16 U.S.C. 1 et seq.), and in delegations of authority found in Part 245 of the Department of the Interior Manual. Director's Order 18 also provides guidance to National Park Service wildland fire management and Director's Order 12 guides National Park Service implementation of the National Environmental Policy Act (NEPA).

The Fire Management Plan for Whiskeytown National Recreation Area is being developed in coordination with other park planning documents, including the General Management Plan, completed in 2001. The General Management Plan provides overall direction to park activities. The plan states that the park would continue its wildland fire pre-suppression and suppression program, including efforts to reduce hazardous forest fuel buildup. Additionally, the General Management Plan states that the purpose of the fire management program would be expanded to improve wildlife habitat, stimulate biodiversity, maintain healthy watersheds, reduce exotic species, and restore circa 1800 landscape conditions reflecting American Indian fire practices (except in developed areas and designated cultural landscapes where target years may vary).

A Resources Management Plan for Whiskeytown completed in 1997 addresses the park's fire management program in more detail than does the General Management Plan. A Fire Management Plan that was written in 1985 and revised in 1993 guides the current fire management program in the park.

Additional planning would be required prior to implementing fire management projects described in this document if the potential for site-specific impacts is identified. For example, actions with the potential to impact federally listed threatened or endangered species would require compliance with the Endangered Species Act, and projects with the potential to impact cultural resources must comply with the National Historic Preservation Act. Additional site-specific analysis under NEPA may also be required if the potential for environmental impacts are identified but are not discussed in this document.

The Coggins Park area along the western boundary illustrates some of the old growth forests found in the park.

Decisions to be made

This Final Environmental Impact Statement analyzes four alternative approaches to fire management at Whiskeytown National Recreation Area. The park superintendent will use the information provided in this document, along with comments received during the 60 day public comment period, to recommend to the Pacific West Regional Director of the National Park Service which alternative should be selected. The selected alternative would update the Fire Management Plan and guide fire management in the park over the next ten years. Upon filing this document, a 30 day no-action period will precede formal selection of an alternative and signing of a Record of Decision.

Planning issues considered

Issues are the concerns raised by park staff, other government agencies, and the public that were used to develop and evaluate the alternatives in this document. Concerns ranged from the impacts of wildland fire to the impacts associated with management actions taken to manage fire and reduce fuels. Planning issues discussed in this document include impacts to the biological environment (vegetation, wildlife), the physical environment (soils, geologic resources, water quality, wetlands/floodplains, and air quality), the cultural environment (cultural resources, sacred sites), and the social environment (health and safety, community economics, recreation, and visual resources). Impacts resulting from fire and fire management activities were analyzed for the following issues:

1 Threats to human health, safety and property

2 Alteration of historic fire regimes

3 The unnatural accumulation of forest fuels resulting from fire suppression

4 Smoke management/ impacts to air quality

5 Accelerated erosion

6 Soil compaction resulting from heavy foot traffic or equipment

7 Impacts to water quality

8 Changes in nutrient cycling

9 Increased exotic species resulting from vegetation and ground disturbance

10 Degradation of prehistoric and historic cultural resources

11 Role of fire in managing resource procurement sites for Native Americans

12 Impacts to old growth forest

13 Impacts to sensitive, and federally listed threatened and endangered species

14 Impacts to wildlife

15 Impacts to vegetation

16 Amending the General Management Plan to allow reconstruction of the park administrative building and relocating the fire cache to Oak Bottom.

Fire fighters on their way to fight a fire on Shasta Bally in 1918.

IMPAIRMENT SUMMARY STATEMENT

The National Park Service must consider the impacts of each alternative to determine if the described action would lead to an impairment of resources as discussed in the National Park Service Organic Act and the General Authorities Act. If there would be impairment the action may not be approved. An impairment is an impact that would harm the integrity of park resources or values (NPS Management Policies 2001). Not all impacts constitute impairment. Severity, duration, and timing of the impact help determine whether the integrity of a park resource or value would be irreparably compromised. No alternative discussed in this document has a specific goal that would include impairment of a park resource. If there would be impairment the action will not be approved, and the selected alternative would be amended before preparing the decision document.

Chapter 2 The Alternatives

This chapter describes the alternatives selected for analysis in the Whiskeytown Fire Management Plan. Each alternative describes a strategy for managing fires and forest fuels. The use of prescribed fire and mechanical methods to reduce forest fuels in developed areas and along park boundaries are the main focus of these alternatives.

Development of Alternatives

An interdisciplinary team of National Park Service staff developed the alternatives described in this document with input from the public and other agencies. The interdisciplinary team was comprised of staff with expertise in fire management, wildlife, biology, botany, ecology, geology, safety, recreation, cultural resources, and public land policy and regulations. Public and interagency input was solicited and received through a scoping process that is described in Chapter 5 of this document.

Six different approaches to managing fire at Whiskeytown were identified through this process. Each alternative utilizes a combination of fire and fuels management strategies to meet the purpose, need and objectives of the fire management program. Four alternatives were kept for further analysis in this document, while two were dismissed from further consideration because they would not adequately meet Whiskeytown's fire management goals. Each alternative is described in greater detail in this chapter.

The alternatives described in this draft document were developed in accordance with resource management goals identified in the Park's General Management Plan. The General Management Plan states that the physical and biological systems of the undeveloped portions of the park would be managed to reflect early 1800 conditions and processes. The General Management Plan further states that the fire management program would continue wildland fire pre-suppression and suppression activities, including efforts to reduce hazardous forest fuel buildups. In addition to this, the purpose of the fire program would be expanded to:

1 Improve wildlife habitat

2 Stimulate biodiversity

3 Maintain healthy watersheds

4 Reduce exotic species

Restore circa 1800 landscapes except in developed areas and designated cultural landscapes where target years may vary.

The General Management Plan also states that the park would improve forest health by:

1 Developing and implementing a forest management plan

2 Completing research on historic forest conditions

3 Thinning and planting native species

4 Restoring fire as a part of the natural system.

Background

The National Park Service identified what fire and fuel management strategies are reasonably available to achieve park resource goals. The alternatives discussed in this document are comprised of varying combinations of these fire management and fire risk reduction strategies. Actions described for Alternative I are based on the park's current fire management program, and are included to provide a baseline against which the remaining alternatives may be compared. The strategies proposed for the various alternatives include the use of prescribed fire, managed wildland fire, and mechanical treatment to reduce hazardous fuel levels. Each of these strategies, and the issues generated by their consideration, are described below.

Suppression

Suppression is the activity most people associate with fire management. Suppression includes all actions taken to put out an active fire, and is defined as the restriction of the spread of a wildland fire and the elimination of all threats from that fire. For the time period covered by this plan, lightning-caused fires will be suppressed. Suppression is an appropriate

strategy when human safety, property or park resources are threatened, or at risk. Trained fire management staff conduct fire suppression activities. Due to the unplanned nature of most wildland fire situations, and the need for a rapid response, the closest available fire-fighting resources are dispatched to wildland fire events. Local, state and federal agencies work together to effectively manage fire suppression activities using a formal incident command system.

A variety of techniques are used to suppress fire. Fire management professionals determine what would be the most effective and cost-efficient manner with consideration to public and fire fighter safety and the protection of property and resources. Director's Order 18 mandates that the park develop and maintain a systematic process to determine the most appropriate management strategy for all unplanned ignition. Methods used to suppress wildland fires should minimize impacts of the suppression activities and the fire commensurate with effective control and resources value protected. Three terms that have been used to describe various levels of suppression activity are: contain, control, and confine. These terms are described below.

Contain means the fire is surrounded by a control line. A control line is any natural or human-constructed barrier that stops the spread of fire by providing a barrier that is devoid of fuels. Fire crews construct hand-line using chain saws and hand tools to remove all surface fuels in a one to six foot wide strip down to bare mineral soil. Ladder fuels, such as shrubs and low branches, are removed or thinned over a three to twenty-foot wide strip as well. Bulldozers may also be used to construct control lines if necessary, although their use requires the approval of the park superintendent since resulting adverse resource impacts can be quite high. Control lines may be improved by adding a black-line by burning fuels next to the control line to further minimize the chance that wildland fire would cross the control line. A wet-line may also be used, which involves first dousing the approaching flames with water, and following up with construction of a control line. Fire management crews patrol the control lines to ensure that the fire does not cross over. The control line is monitored as long as fire remains active in the burn area.

Control means there is a risk of fire escape. Aerial suppression tactics may be used in addition to construction of control lines. Fire retardant chemicals, foam, and bucket drops of water with helicopters are typically used on the hottest areas to control the rate of spread, and these actions are then followed by the construction of control lines. This approach is used in high-risk situations where it may not be appropriate to send in hand crews.

Confine means the fire is being kept in a specific location. This term usually applies to wildland fire use, where the goal is not to put out the fire but to manage it in a predetermined location at an acceptable intensity.

Minimum Impact Suppression Techniques (MIST) are employed during suppression activities to minimize adverse resource impacts and limit the amount of disturbance required to manage wildland fire. Techniques include the use of existing natural or human created firebreaks like streams, exposed rock, lakes, or roads instead of constructing control lines, and placement of control lines to minimize disturbance. MIST also includes removing trees, including snags, only when it is necessary to protect human safety. A variety of fire management activities exist that can provide for flexibility of MIST, including shaded fuel breaks, mechanical thinning, and prescribed fire. Such activities lower both the scale (size) and severity of fire suppression activities, thus altering suppression related impacts to all effected resources.

Wildland fire suppression activities typically last from one to five days, but may take longer. Following suppression of the fire, crews may rehabilitate impacts associated with suppression activities. Constructed hand-lines and bulldozed lines are treated to prevent accelerated erosion and prevent unintended visitor use. This can include scattering weed-free straw and some limited replanting. Hazardous trees located along roads and trails are also identified and removed. The effects of the fire itself are generally not rehabilitated. However, a Burned Area Emergency Response team may be employed if a high-intensity fire burns over a large area. A wildland fire suppression event is considered successful when the fire is stopped safely and efficiently with the minimum amount of impact and cost. See Appendix B for a description of the Minimum Impact Suppression Technique and Burned Area Emergency Response Guidelines developed by Whiskeytown.

A variety of techniques are used to suppress fire. Fire management professionals determine what would be the most effective and cost-efficient manner with consideration to public and fire fighter safety and the protection of property and resources.

Issues related to fire suppression activities at Whiskeytown National Recreation Area include:

Threats to human health, safety and property

All management actions involving fire have the potential to place fire fighters and the public at risk. Ensuring that only trained staff are involved in suppression operations and that safety is given top priority when making fire management decisions minimizes the risk to fire fighters. The risk to the public stems from the possibility of a wildland fire burning out of control and from impacts associated with smoke production. Programs that integrate a variety of tools and techniques for reducing fire risk provide managers with greater options relating to human health, safety and property.

Smoke management/ impacts to air quality

Air quality may be impacted by smoke production related to wildland fire. Few, if any, reasonable methods exist for mitigating smoke and air quality impacts during suppression events.

Impacts to Soil

Suppression activities result in the removal of vegetation along control lines and compaction of soils where heavy equipment and foot traffic occurs. These activities contribute to accelerated erosion, increased soil bulk density, and other adverse soil impacts. Changes in nutrient cycling also occur as a result of fire or a lack of fire over the landscape. Many of these impacts are minimized through the development of a full range of strategic and tactical operations for the management of wildland fires. Additional steps to mitigate impacts to soil resources are made by rehabilitating control lines and other suppression related alterations after the burn is completed and preventing unintended visitor use of control lines as trails.

Impacts to water quality

Accelerated erosion may affect water quality. Additionally, fuel spills and fire retardant may have the potential to impact water quality. Adherence to minimum impact suppression techniques is a key to mitigating fire effects. Post-fire mitigation also mitigates effects to water quality. Alternatives that employ alternative fire risk reduction techniques limit the spatial scale of unplanned wildland fires, and thus are a form of mitigation.

Increased exotic species resulting from vegetation and ground disturbance

Construction of control lines may contribute to an increase in exotic species related to vegetation removal and ground disturbance. During extended attack, mitigation would include the potential for washing vehicles and equipment to limit this risk. Post fire rehabilitation along with follow-up monitoring and exotic plant control will mitigate most other significant effects relating to increased exotic species as a result of suppression activities.

Degradation of prehistoric and historic cultural resources

Pre-suppression planning and coordination is designed to avoid impacts to know resources, but fire suppression activities may impact undocumented prehistoric and historic cultural resources.

Impacts to sensitive, and federally listed threatened and endangered species

Fire suppression activities may have an effect on federally listed species. The impacts to sensitive, and federally listed threatened and endangered species will be addressed through emergency consultation with the National Marine Fisheries Service or the US Fish and Wildlife Service.

Impacts to wildlife

Fire suppression activities may have an effect on park wildlife by altering vegetation that provides food and cover, but generally, this impact is limited in scope.

Impacts to vegetation

Fire suppression activities involve the removal or injury of vegetation to contain and control the spread of fire, as well as the alteration of soils that support vegetation. MIST will mitigate many of these impacts, as will post-fire rehabilitation. Alternatives that lower fire risk on a broad scale will allow for more flexibility in the application of MIST, but some impacts will be unavoidable, particularly in Fire Management Unit (FMU) 1.

Prescribed fire occurs under a controlled environment and on a limited spatial scale. Under such conditions, fire intensities and subsequent severities are generally low, with only isolated pockets of moderate to high severity effects.

Prescribed fire

Prescribed Fire is the use of management-ignited fire to meet specific resource goals and objectives under predefined fuel and weather conditions. These conditions are referred to as the "prescription." Several factors are described in a prescription, including fuel moisture, wind speed and direction, relative humidity, and temperature. Fire behavior is predicted using models that take these factors into account. Fire managers combine this information with professional experience when deciding if the right conditions exist for a safe and effective controlled burn to occur. Other factors that are taken into account when deciding whether or not a prescribed fire would occur, or continue, include smoke dispersal, resource availability (crews and equipment), and regional fire risk.

Prescribed fires are used to reduce forest fuels and associated fire risk and also to help restore forest structure to historical norms. The fire and natural resource management team at Whiskeytown evaluates the Park to determine what areas are appropriate for treatment. A burn plan is prepared when it is determined that a prescribed burn is the appropriate tool for achieving resource objectives. The burn plan includes the prescription, a description of the fuels, site-specific goals and objectives, smoke considerations, safety measures, implementation guidelines, a description of the resources needed, a contingency plan in case of fire escape, monitoring plans, rehabilitation measures, public notice requirements, and an overall risk analysis.

Burn unit boundaries are normally placed in strategic locations that are most easily defended. Ridges, roads, rivers, and rocky areas are used as boundaries alone or to complement constructed control lines. Construction of a control line on burn unit boundaries includes removing ground cover and scraping a one to six foot wide strip of earth to bare mineral soil to prevent a ground fire from leaving the predetermined burn area. This occurs prior to ignition, and is rehabilitated within a week of project completion. Within the control line, ladder fuels (brush and low tree branches) are reduced for twenty to fifty feet to prevent a ground fire from burning up into trees and spreading through the canopy. Additional clearing of ladder fuels around high value or sensitive vegetation may also be completed in the interior of the unit. Burn crews use chain saws and hand tools to construct control line. Bulldozers are not used when conducting prescribed fires. Fire hose is brought into high fuel density locations, and portable tanks filled with water are utilized to cool fires that burn too hot.

An Incident Action Plan is developed and implemented on the days that prescribed burns are conducted. This plan includes daily objectives, resource assignments, safety measures, medical plans, and a communication strategy. Fuel and weather conditions are monitored before ignition and throughout the day. Additionally, resource availability is determined, the site prepared, and an implementation checklist is completed (i.e. a "Go/No-Go" list) to determine whether or not to proceed with ignition. When conditions are correct, ignition proceeds with the careful application of fire by skilled fire management staff. On the ground ignition is commonly accomplished through the use of hand-held drip torches. Aerial ignition can occur if the terrain is steep, access to fire crews is limited, or a large area was planned for treatment.

Ignition is followed by constant evaluation of site conditions. Fire fighters hold the fire within the burn unit to keep it manageable. The perimeter is secured to prevent fire from escaping the burn unit boundaries, and it is patrolled and monitored for the rest of the season while active fire or smoke remained.

During the prescribed burn, fire fighters are stationed in and around the burn unit to ensure that the fire does not move beyond established control lines. Additionally, fire engines and water tenders are used to assist in controlling the fire. Fire management staff monitors and reports site conditions, and additional staff manages traffic conditions on park roads in the event that smoke impedes visibility along public transportation routes.

Once a prescribed burn is complete the control lines that were constructed to help contain the prescribed fire are rehabilitated. Rehabilitation includes removing garbage, flagging and hoses, and piling brush and placing plant litter over areas of bare mineral soil. Water bars are constructed where necessary, and actions are taken to prevent unintended visitor use of fire lines as trails to prevent accelerated erosion.

Permanent monitoring plots are established to record resource conditions both before and after a burn. This helps fire managers determine whether the prescribed fire has successfully met resource objectives, and increases staff knowledge of resource conditions. This is referred to as fire effects monitoring. Data collected includes tree mortality rates, fuel loading, species composition, species diversity, and the presence of exotic species.

Success for a prescribed burn is determined based on the safe, accident-free implementation of a burn plan, the accomplishment of fuel reduction and resource management goals, the minimization of smoke impacts, and the overall control of the fire.

Prescribed fire includes slash piles and landscape or broadcast burns. Slash burning is a component of each of the alternatives analyzed in this document. Slash piles are burned after mechanical or manual thinning treatments and are an effective method for reducing large or concentrated accumulations of fuel. Slash piles are located and designed to ensure safety and minimize resource impacts, thus are generally quite small and less than 10 cubic feet but can be as large as 1000 cubic feet if conditions are appropriate. Pile burning can occur during any time of the year but is normally conducted between the late fall through early spring when risk of escape is quite low. Extra care is provided during the spring season to avoid impacts to sensitive species.

Broadcast burning is used to reduce surface and ladder fuels over larger areas, and is used to introduce fire as an ecosystem process over a unit of area. When surface and lower ladder fuels like branches, needle, and leaf litter accumulate but can not be reduced by other means, prescribed fire can be used to consume portions of this plant material to reduce the fire risk. Prescribed fire is also appropriate for mimicking fire effects on a landscape scale by creating small patches that reduce the risk of large-scale fire and increase biological diversity. Broadcast burns are implemented in pre defined burn units located along the west, north, and east boundaries, and also in some interior portions of the park.

The typical season for broadcast fire is the fall, after physiological dormancy of most plants has occurred, making them more resistant to fire effects. This is usually when the window of opportunity during which prescription parameters is appropriate for implementation of a burn. It is also a relatively short time period, and may be limited to only a few days or a several weeks during a given year. Alternative opportunities for burning during which prescribed fires can safely be implemented are normally limited to a few days to weeks during the winter dormant through mid-spring nondormant seasons.

Prescribed fire occurs under a controlled environment and on a limited spatial scale. Under such conditions, fire intensities and subsequent severities are generally low, with only isolated pockets of moderate to high severity effects. The resulting effects to resources such as vegetation, wildlife, soils, cultural resources, and water quality are relatively minor, and of much lower area and severity than would occur under most unplanned wildland fire scenarios.

Issues related to the use of prescribed fire at Whiskeytown National Recreation Area include:

Threats to human health, safety and property

All fire management actions involving active fire have the potential to place fire fighters and the public at risk. Ensuring that only trained staff is involved in fire operations minimizes the risks to fire fighters. Safety is stressed during all stages of a prescribed burn – before, during, and after ignition. The risk to the public stems from the possibility of a prescribed burn escaping its boundaries, and from impacts associated with smoke production. Benefits of prescribed fire include a reduction in accumulated forest fuels and alterations in fuel continuity that can greatly reduce fire risk.

Smoke management/ impacts to air quality

Smoke management is an important component of prescribed fire management. Burn plans are designed to minimize smoke impacts. The Park works with regional air quality managers to comply with air quality laws and regulations, however, smoke is a part of conducting prescribed burns. Timing of burns is a primary method for mitigating these impacts. Additional impacts associated with this are discussed in more detail in Chapter 4.

Impacts to soil

Fire can burn at extremely hot temperatures, resulting in soil scorching that can create an impermeable layer that hinders the infiltration of water into the ground, increases susceptibility to erosion, and volatilizes certain plant nutrients. Prescribed fires are designed to burn at low intensities, and as such are a form of mitigation against high severity wildland fire. While some high severity effects may still occur in localized locations, these effects are generally much less occur as a result of unplanned fires. The construction of control lines, heavy foot traffic and vehicle traffic can also contribute to accelerated erosion. This is minimized by limiting the amount of time crews are present during site preparation and implementation of the actual burn, and by rehabilitating control lines after the burn is completed and preventing unintended visitor use of control lines as trails.

Impacts to water quality

Water quality may be negatively impacted if fire intensity or ground disturbance leads to accelerated erosion that deposits sediments into area watercourses or Whiskeytown Lake. There is also the potential for water quality impacts related to fuel spills from chain saws, vehicles and other equipment. Additionally, impacts to water quality from aerial ignition delivery systems (ping-pong balls) are uncertain. Post fire mitigation will assist in addressing these effects, but some impacts to water quality are expected. As with soil impacts, prescribed fires are designed to have much lower impacts than wildland fires, and can also reduce risks associated with a single high severity event adversely impacting an entire watershed.

Increased exotic species resulting from vegetation and ground disturbance

Exotic plant species invade disturbed areas and may spread into previously unaffected areas in the park. Prescribed fire creates a disturbance that may facilitate the introduction or spread of noxious exotic plant species. To mitigate this effect, pre and post-burn exotic plant removal occurs within and adjacent to all prescribed fire units. In addition, all vehicles used on prescribed fires are cleaned in the park's wash rack to lower risk of spreading existing or new exotic plant species.

Degradation of prehistoric and historic cultural resources

Known cultural resource sites are taken into consideration when planning prescribed burns. Impacts to unknown cultural resources are discussed in greater detail in Chapter 4.

Role of fire in managing resource procurement sites for Native Americans

Native Americans used fire to manage plant and wildlife resources. Whiskeytown National Recreation Area would incorporate management of Native American resource procurement sites into prescribed burn plans as appropriate. Collaboration with tribal groups would be necessary.

Impacts to sensitive, and federally listed threatened and endangered species

Prescribed burn plans are designed in coordination with the National Marine Fisheries Service and the US Fish and Wildlife Service, and park resource management staff to prevent adverse impacts to sensitive and federally listed threatened and endangered species.

Impacts to wildlife

Prescribed fire creates a short-term impact to wildlife that includes direct mortality, forced movement away from the prescribed burn area, or burrowing into the ground to escape the heat and smoke of the fire. Typically, the mosaic pattern of burning ensures that unburned gaps are retained, serving as refugia within the burn unit. Long-term benefits accrue from the use of prescribed fire when herbaceous plants re-sprout after the fire, and forest composition and structure is diversified. Creation of fire resistant gaps and the reduction of fire risk on a landscape scale also increases the probability that unburned or lightly burned refugia are created for wildlife species should an uncontrolled fire occur at some point in the future.

Impacts to vegetation

Individual plants can be killed or injured by prescribed fire. However, most species in the park are fire adapted, and would experience regenerative growth after the fire, depending on the season of application. Methods for mitigating the impacts to high value, old growth trees includes the removal of ladder fuels around selected, more vulnerable trees, and application of appropriate ignition techniques to lower fire intensity around high value, sensitive vegetation. Prescribed fire may be designed to mimic effects of historic fire occurrences by altering plant community composition and structure. A potential exists for prescribed fire to contribute to the presence or increased abundance of exotic plant species. Post-fire monitoring and exotic plant removal is a mitigation measure that can be employed to reduce this threat. This issue is discussed in more detail in chapter 4.

Mechanical treatment

Mechanical treatment is a term used to describe the application of various tools and equipment by fire and resource management staff to reduce fuels and to achieve fire and resource management goals. Specifically, mechanical treatments can be used to reduce fuels, to restore the historic composition and structure of plant communities, to reduce risks associated with large-scale, high severity fire events, and to construct shaded fuel break or fire control lines.

Mechanical treatment is an effective tool to meet fire management objectives in areas where the accumulation and arrangement of fuels prohibits the safe or cost effective application of prescribed fire, and in areas where fire use is otherwise inappropriate due to undesirable resource impacts and operational or other constraints. Mechanical treatment is used to reduce standing or downed fuels, such as brush, small and weakened or diseased trees, and the lower limbs of large trees. Certain areas within the park would be excluded from mechanical treatment. This includes areas with sensitive soils, steep slopes, sensitive species habitat, sensitive cultural resource sites, sacred sites, visually sensitive sites, and riparian areas. The removal of this live and dead vegetation reduces overall fuel levels and alters the horizontal and vertical continuity and distribution of vegetation. Fire managers and natural resource staff may target particular species of plants for retention or removal to create vegetation communities that reflect a desired species composition and structure to reduce fire risk while promoting ecological health.

Mechanical treatment projects would be assessed at the site-specific level by qualified park staff for the presence of special status species, for significant cultural resources, and for any other resource concerns. Site-specific recommendations for protection of sensitive resources would be incorporated into project work plans and implementation.

Mechanical treatment units would be established in strategically important areas along or adjacent to ridges and roads, and in other areas where defensible space is needed. A site-specific prescription would be developed for each mechanical treatment project. This prescription informs workers what species should be removed or retained, and what the percent cover should be. In general, larger oak and pine trees would be left, with most brush cleared. Fifty percent of dead and down wood would be cleared. Tree limbs would be removed up to a set height to reduce ladder fuels. Crews would work on a project site for two to three months overall, but would only be in a particular area for approximately three to five days at a time.

In forested areas, mechanical treatment would favor the development of the dominant codominant trees where they exist by removing intermediate and suppressed trees and understory bush. This level of treatment would remove small-sized trees, mostly less than 12 inches in diameter at breast height, from the lower canopy, leaving large trees to occupy the site. Where larger trees were not present, smaller trees would be maintained. In brush dominated areas, mechanical treatment would favor individual species and retained vegetation by thinning out a portion of the vegetation. Treatments in both forest and shrub dominated areas could vary significantly in relation to site specifics and also to thinning method employed (see following discussion on mechanical treatment levels 1, 2 and 3).

These treatments effectively alter fire behavior by reducing crown bulk density, increasing crown base height, or changing species composition to lighter crown and fire-adapted species. Such treatments can reduce the severity and intensity of wildland fires for a given set of physical and weather variables.

Although thinning is thought to improve forest health, thinning activities can also act as a vector to spread pathogens. Prevention is difficult, as root pathogens spread to surrounding vegetation through root-to-root contacts, and can survive for decades in infected or dead root systems. The most effective approach currently known is to prevent infections. Mitigation includes borate treatment of freshly cut stumps to prevent their infection by pathogens such as annosus root disease, and care to avoid creating basal trunk wounds and open root wounds, which could serve as entry points for fungal infections. The most appropriate mitigation for bark beetles may be timely sanitation of large limbs and logs by felling and burning infested trees. Preventative methods, most of which aim at reducing the number of susceptible trees in the forest, are far more likely to result in a lasting reduction in tree mortality rates.

Thinning activities may disperse fungal spores of species such as sudden oak death syndrome (*Phtophthora ramorum*). Fungal spores present in the soil can be transported on clothing, footwear, or equipment. Sudden oak death syndrome would have devastating effects to plant communities in the park because tan oak, a major understory component of these forests, is

perhaps the most susceptible species to this fungus. Although this disease is not presently known to occur within the park or on neighboring lands, an infection of tan oak within the park would have high severity effects on plant communities and wildlife, and would create a tremendous fire hazard. Ensuring clean equipment and monitoring for the early stages of infection are the only actions that can be taken to prevent introduction and limit its spread in case of infection.

Another potential consequence from thinning is that portions of the removed vegetation would significantly contribute to surface fuels (slash) if the cut portions are left on the forest floor. These fuels may have a major impact on expected fire intensities depending on where and how they are treated. Thinned materials can occur by one or many of the following: lop and scatter, chip and spread, extract from site, or pile and burn on or off-site.

The following ecological considerations would be incorporated into thinning operations in the park:

1 As much as possible, maintain soil quality and nutrients by adjusting thinning rates to leave more small twigs, green leaves and needles which retain proportionately more nutrients than other portions of plants.

2 Retain vegetative or litter cover over soil surface to minimize erosion

3 Protect water quality and yield, and prevent floods and landslides by mitigating the adverse impacts of ground disturbance and providing undisturbed buffer zones along riparian areas.

4 Conserve forest biodiversity by reducing habitat fragmentation by shaded fuel breaks, and avoiding thinning in vulnerable areas, such as riparian zones, and restoring natural structural complexity.

5 Plan at the landscape level to address ecological concerns such as biodiversity, water flows, and forest fragmentation.

6 Monitoring of mechanical treatment projects occurs to assess ecological effects. This includes documenting site conditions before and after project activity with photo-points, and also the use of the FARSITE computer simulation program.

The Wildland Urban Interface (WUI) initiative is a recent addition to the park's current fire management program. This program includes the construction of shaded fuel breaks in lower elevation forests and shrub communities to assist fire management staff in controlling the spread of wildland fire. Shaded fuel breaks are linear areas that are cleared of woody vegetation with the exception of selected overstory trees, and brush in areas where trees are not present. Width of shaded fuel breaks is 100 feet when positioned along ridge-tops and 200 feet when along roadsides. Mature trees provide shade, which helps keep surface fuels at a lower temperature than in shaded fuel breaks where no canopy is present. Retained vegetation also serves to reduce erosion and provide annual litter source to protect soil where an herbaceous cover is absent.

Each individual shaded fuel break is designed to fulfill one or more of the following purposes.

1 Public Safety and Evacuation

2 Fire fighter Safety

3 Access for Suppression Actions

4 Burn Unit Boundary

5 Park Boundary Protection

Shaded fuel breaks are designed to alter horizontal and vertical fuel arrangement by greatly reducing ladder fuels (brush, small trees and low tree limbs). This increases crown base height, the gap between surface and ladder fuels, and reduces crown bulk density. This alteration is designed to reduce the rate of spread of fire across the shaded fuel break. Under certain conditions, an approaching crown fire would drop down to a ground fire when it encounters a shaded fuel break. This improves fire fighter safety and increases the likelihood that a wildland fire may be successfully suppressed or confined, plus provides more options to employ MIST during unplanned fire events.

Shaded fuel breaks are not intended to stop an approaching fire alone, but are designed to facilitate rapid fire fighter access so that an approaching wildland fire may be more safely and effectively suppressed or confined. Shaded fuel breaks can also serve as prescribed burn unit boundaries in support of management-ignited fires.

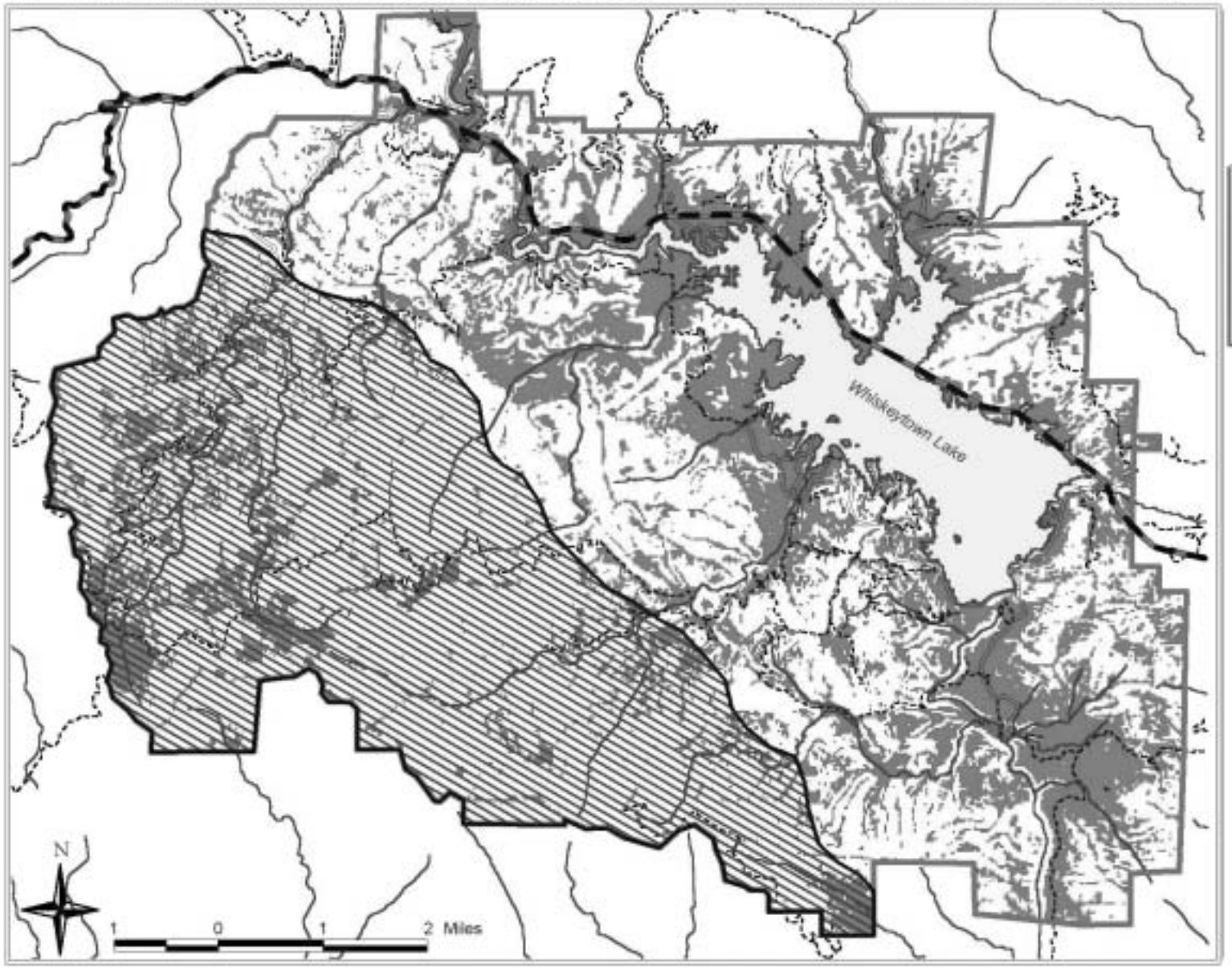
Three levels of mechanical treatment are being considered at Whiskeytown: levels 1, 2, and 3.

Level 1 mechanical treatment includes the use of chain saws, weed-eaters, hand crews, and

Whiskeytown National Recreation Area
California

National Park Service
U.S. Department of the Interior

Potential Mechanical Treatment Areas



Legend

< 30% Slope. All Levels of Mechanical Fuel Treatments Possible

Decomposed Granitic Soils. No Level 2 or 3 Mechanical Treatment

chippers to clear around buildings, to install and maintain shaded fuel breaks, and to clear along roadways. While treatment area would vary, this level is included in all four alternatives. Cleared fuels can be treated by one or many of the following: chipped and left on site, burned in piles, extracted from sites, lopped and scattered. Rehabilitation of areas treated at Level 1 would include raking and scattering organic materials in piles that burned hot, and rehabilitation of foot trails. Level 1 mechanical may also be used to reduce ladder fuels as a pretreatment to lower fire severity during future application of prescribed fire, and as an understory thinning treatment in larger units.

Thinning would focus primarily on removal of small size class understory trees and shrubs, diseased or infected vegetation, and high density forest stands. A site specific plan would be prepared for all new projects, listing sensitive species, target species, and other relevant prescription parameters.

Ecologically, this form of mechanical treatment provides the most flexibility; thinning practices can be modified to develop mixed species stands, multiple canopy layers, and a more diverse understory. If followed by prescribed fire, this level of thinning can promote the regeneration of shrub understory and create stand characteristics favorable to biodiversity, wildlife, and aesthetics. Parameters such as evaluation of the number of snags, live trees with cavities, and large downed wood (greater than 13 inches in diameter) to leave, would be assessed on a site-by-site basis, due to the inherent variability across the landscape.

When compared to other levels of mechanical treatment, Level 1 thinning would result in the least amount of soil compaction and disturbance, spread of exotics and pathogens, and would have negligible damage to residual trees. Thinning would improve the overall forest health by lessening competition in these overly dense forest stands with increased susceptibility to insects and pathogens. Although thinning alone would not prevent bark beetle infestation, the probability is decreased when thinning is combined with prompt sanitation measures and undamaged residual trees. Site-specific goals would be established to specify the density of trees to leave.

Level 2 mechanical treatments would include the use of brush-reduction machinery to grind and shred brush. This strategy would be used to provide defensible space for wildland fires and prescribed burn units, and for treating wildland urban interface units where other treatment options involve undue risk or cost. Projects would occur on slopes less than 30%, primarily during the summer and fall months when soil moisture content is appropriate. No Level 2 treatments would occur on decomposed granite soils. The machinery used would consist of rubber wheeled or rubber tracked vehicles with brush cutting, thinning, or shredding heads that are attached directly to the machine, attached to the boom, or machine pulled. Maximum rating of machinery would be 5 PSI. This equipment would be used primarily in mixed brush woodlands where brush and tree individuals are common. Machinery access trails would be rehabilitated to prevent erosion after treatment.

Level 2 mechanical treatments would be used to reduce cover of shrubs and small trees. This treatment would significantly reduce fire risk by redistributing ladder fuels that contribute to high severity crown fires. Although level 2 mechanical fuel treatments significantly reduce ladder fuels and crown fire potential, they can create a hotter and drier microhabitat and increase the level of surface fuels that may exasperate surface fire potential under drought conditions.

The slash generated by level 2 treatments would create a barrier that would likely limit the germination of seeds and emergence of seedlings. Depending on the depth and compaction of the slash, it is probable that this level of treatment would favor retained vegetation and those species that re-sprouted, although re-sprouting may be affected by the season when brush is removed. Within three to five years, decomposition would have reduced wood chips and herbs would have the ability to proliferate if seed source is available. The redevelopment of surface fuels in the treated areas would be relatively slow, and repeat treatments should not be required at frequent intervals.

Slash would be piled to a depth of no more than 3-4 inches to prevent inhibited root-growth in trees remaining in, and adjacent to, the treated area. The restoration and maintenance of structural diversity and large downed wood would be taken into consideration when planning level 2 treatments to benefit wildlife.

Machinery used for level 2 mechanical treatments would be washed to decrease the likelihood that seeds from nonnative plants would be physically transported by equipment. Seeds may travel with any soil particle moved from an infested area. Once an infestation of invasive nonnative species is established it is

Current Shaded Fuel Break System at Whiskeytown National Recreation Area

			Purpose				
	Shaded Fuelbreak Name	**Total Size (acres)**	**Public Safety & Evacuation**	**Firefighter Safety**	**Suppression Access**	**Burn Unit Boundary**	**Park Boundary Protection**
Ridge Top	Buck	21.0	No	Yes	Yes	Yes	Yes
	Buck Divide	36.1	No	Yes	Yes	Yes	No
	Bull *	20.7	No	Yes	Yes	Yes	Yes
	Eiger	19.3	No	Yes	Yes	Yes	Yes
	Ganim	19.3	No	Yes	Yes	No	No
	Kanaka East	28.8	No	Yes	Yes	Yes	Yes
	Kanaka South	17.6	No	Yes	Yes	Yes	No
	Kanaka West	20.1	No	Yes	Yes	No	Yes
	Monarch	30.7	No	Yes	Yes	Yes	No
	Mule	27.3	No	Yes	Yes	No	No
	North Kanaka	33.2	No	Yes	Yes	Yes	No
	North Star East	8.5	No	Yes	Yes	Yes	Yes
	North Star West	22.6	No	Yes	Yes	Yes	Yes
	Oak Bottom	8.8	No	Yes	Yes	Yes	No
	Orofino	17.9	No	Yes	Yes	Yes	Yes
	Panther	31.6	No	Yes	Yes	Yes	No
	Prospect	13.9	No	Yes	Yes	Yes	No
	Roost	16.5	No	Yes	Yes	Yes	No
	Shasta Divide	38.9	No	Yes	Yes	Yes	Yes
	South Fork	36.3	No	Yes	Yes	Yes	No
	South Fork Spur	0.6	No	Yes	Yes	No	No
	Southwest Roost	8.1	No	Yes	Yes	Yes	No
	Sunshine	19.6	No	Yes	Yes	Yes	No
Roads	Bldgs 318-324	17.4	Yes	Yes	Yes	No	No
	Kennedy Mem Dr	38.1	Yes	Yes	Yes	Yes	No
	Muletown Road	50.1	Yes	Yes	Yes	Yes	No
	Pioneer Rd	34.6	Yes	Yes	Yes	Yes	No
	North Muletown Rd	40.0	Yes	Yes	Yes	Yes	No
	Paige Bar Road	66.3	Yes	Yes	Yes	Yes	No
	Post Office Road	35.1	Yes	Yes	Yes	Yes	No
	South Shore Drive	140.6	Yes	Yes	Yes	Yes	No
	Total Acreage	919.6					

* Indicates shaded fuelbreak with mid-slope sections

highly persistent and can spread rapidly. However, depending on the depth and compaction of the slash resulting from fuels treatment, it is possible that seed germination would be inhibited. Establishment and competition by wind dispersed exotic annual grasses is of additional concern because these species compete against native herbaceous and woody species, and also contribute to fine fuel loads.

Prescribed burns that are planned in treated areas will be low intensity burns that are not conducted when fuel moisture is high in order to prevent severe soil impacts, eradication of the site's seed bank and 'cooking' roots of retained plants.

Brush mastication would increase the chance of infestation by forest pathogens by decreasing plant density and improving the health of residual species. However, treatments may also act as a vector to pathogen infestation if residual plants are damaged and if soil and duff moisture is significantly increased. Care must be taken to avoid creating basal trunk wounds, which serve as entry points for fungal and beetle infections.

Level 3 mechanical treatment is the use of machinery to remove brush and small-diameter trees. The size of individual trees removed would vary by species and focus on trees smaller than 12 inches in diameter at breast height (DBH), although may include a limited number of dead or diseased trees up to twenty inches DBH. This strategy would be used in the construction of shaded fuel breaks and to thin understory and overstocked stands. Thinning treatments would focus on the removal of smaller diameter trees that function as ladder fuels. This would help to protect park resources from large high severity crown fires by altering fuel composition and structure. Treatments would also increase forest health by reducing competition for available plant resources such as moisture, light, and soil nutrients. Such thinning would be used to restore the natural structure and composition of dense forests created by decades of fire suppression. Projects would occur in oak woodland, ponderosa pine, mixed conifer, and knobcone pine plant communities on slopes less than 30%. Work would occur during the summer and fall months when soil moisture content is within tolerance to limit soil compaction.

The machinery consists of rubber tracked or rubber wheeled vehicles with attached felling and processing heads. Small-scale yarders would also be included. Existing skid roads and log landing areas would be used and no new roads would be constructed. Machine access routes and ground disturbance would be rehabilitated after Level 3 mechanical treatment occurred.

Biomass generated by level 3 treatments may be removed from the project sites and used to produce wood products or fuel for cogeneration plants supplying electricity. Site specific prescriptions would be developed to ensure that adequate materials remain on-site to meet wildlife needs, to ensure nutrient cycling, and to prevent accelerated erosion. Excess slash material would be treated to prevent an increase in surface fuels resulting from level 3 treatments.

Machinery used for level 3 mechanical treatments would be washed to decrease the likelihood that seeds from nonnative plants would be physically transported by equipment. Level 3 treatments followed by fire may promote invasive and undesirable plant species by eliminating the native seed bank and creating open, disturbed areas that favor exotics. Prescribed burns that are planned in treated areas would be low intensity burns that are not conducted when fuel moisture is high, in order to prevent eradication of the site's seed bank. Wind dispersal of exotic annual grasses is of concern because these species compete against native herbaceous and woody species, and also contribute to more frequent fires.

Level 3 treatments to thin dense forested areas would decrease the chance of infestation by forest pathogens by reducing plant density and improving the health of forest species. However, they may also act as a vector to infestation if residual plants are damaged. Care must be taken to avoid creating basal trunk wounds, which serve as entry points for fungal and bark beetle infections. Once established, it is difficult to prevent the spread of some fungal infestations because root pathogens spread to surrounding trees through root-to-root contacts, and can survive for decades in infected or dead root systems. The only approach currently effective is to keep infections from occurring in the first place.

In addition to this, equipment must be kept clean and project sites must be monitored for the early stages of white pine blister rust and other disease species, such as sudden oak death syndrome (*Phtophthora ramorum).*

Certain areas within the park would be excluded from mechanical treatment. These include areas with sensitive soils, steep slopes, sensitive species

habitat, sensitive cultural resource sites, sacred sites, visually sensitive sites, and riparian areas.

Mechanical treatment unit boundaries would be established in strategically important areas along ridges and roads, and in other areas where defensible space for shaded fuel breaks is needed. A written, site-specific prescription would be developed for each mechanical treatment project. This prescription informs workers what species should be removed or retained, and what the percent cover should be. In general, oak and pine trees would be left, and brush would be cleared. Approximately fifty percent of dead and down wood would be cleared. Tree limbs would be removed up to a set height to reduce ladder fuels. Crews would work on a project site for two to three months overall, but would only be in a particular area for approximately three to five days.

Issues related to Mechanical Treatment at Whiskeytown National Recreation Area include:

Threats to human health, safety and property

It is necessary for equipment operators to be trained in the correct use of mechanical equipment to ensure worker safety.

Soil impacts

The removal of surface vegetation may contribute changes in thermal, hydrologic, biologic, and chemical characteristics of soil. Use of certain types of equipment, and repeated vehicle or foot traffic may also contribute to compaction and accelerated erosion. These factors can alter soil properties thus affecting water quality and vegetation. Avoidance of sensitive soils and steep slopes is a primary mitigation measure to limit these impacts.

Impacts to water quality

Fuel spills from equipment used for mechanical treatment may occur. Additionally, alterations in to soil chemistry and accelerated erosion from mechanical treatment activities may result in downstream impacts to water resources. Mitigation measures will include avoiding sensitive watersheds and limiting spatial and temporal extent of area treated in any given watershed.

Increased exotic species resulting from vegetation and ground disturbance

Removal of vegetation and ground disturbance activities may contribute to an increase in exotic species. Mechanical treatment prescriptions will recognize the need to maximize retained vegetation canopy cover as a means to limit this threat. Additional mitigation to limit exotic species includes the application or retention of a soil mulch where facilitated access exists. Pre- and posttreatment exotic species removal are additional methods that would be employed to mitigate the threat associated with exotic plant species.

Degradation of prehistoric and historic cultural resources

Known prehistoric and historic cultural resources would be protected during mechanical treatments. Crews conducting mechanical treatments may identify previously unidentified cultural resources. Shaded fuel breaks may provide easier access to cultural resource sites. Unintentional damage to undocumented resources may occur as a result of mechanical treatment if a sensitive resource is disturbed by heavy equipment. Surveys would be conducted to avoid resource damage.

Impacts to sensitive, and federally listed threatened and endangered species

Mechanical treatments would be planned in coordination with wildlife specialists to prevent impacts to federally listed threatened and endangered species and their critical habitat.

Impacts to wildlife

There would be short-term impacts to wildlife in the immediate area of mechanical treatments due to noise disturbance. Other impacts related to the alteration and removal of vegetation are discussed in Chapter 4.

Impacts to vegetation

Individual plants would be removed, and portions of plant communities would be altered. This process would benefit retained species by reducing competition for available soil nutrients and water, and by decreasing fire risk. Injury to retained vegetation during operations would have the potential to result in delayed mortality, and increases in forest pathogens through cut stumps or fresh injury scars. Utilization of light on the land machinery will help reduce this threat. Additional discussion of mitigation is included earlier in this chapter by treatment level (1-3). Impacts are discussed in greater detail in Chapter 4.

All fire management activities at Whiskeytown are coordinated and implemented by a professional fire management staff in coordination with natural and cultural resource specialists.

ACTIONS COMMON TO ALL ACTION ALTERNATIVES

The actions described in the subsections below are a component of each of the four alternatives considered in this draft document. All fire management activities at Whiskeytown are coordinated and implemented by a professional fire management staff in coordination with natural and cultural resource specialists. The National Park Service fire management team at Whiskeytown consists of the positions listed below:

Fire Management Officer, Fuels Specialist, Fuels Technician, Engine Captain, Fire Use Module Leader, Assistant Engine Captain, Assistant Fire Use Module Leaders, Fire Information/ Education/Prevention Specialist, Geographic Information System Specialist, Fire Ecologist, Fire Archeologist, Fire Archeology Technician, Fire Engine Operator, Senior Fire Fighters, Fire Program Assistant, and Fire Program Clerk.

The park employs a seasonal crew of fire fighters to supplement permanent staff during the fire season, and Whiskeytown staff from other divisions trained in fire management actions also assist the fire program as needed.

Other agencies are also involved in the planning and execution of fire management actions in the park These include the USDA Forest Service, the Bureau of Land Management, the California Department of Forestry and Fire Protection, and the Western Shasta Resource Conservation District. Work crews from the California Conservation Corps are utilized, as are additional crews that are hired on contract.

Suppression

Suppression is the activity most people associate with fire management and includes all actions taken to put out an active fire, and is defined as the restriction of the spread of a wildland fire and the elimination of all threats from that fire. A description of suppression actions is discussed previously in this chapter under the "Development of Alternatives" and should be referred to for specific components associated with this management activity. Alternatives that include fire risk reduction treatments and shaded fuel breaks will provide for a greater range of suppression options.

Prescribed fire

Prescribed Fire is the use of management-ignited fire to meet specific resource goals and objectives under predefined fuel and weather conditions. It is a component of each of the alternatives analyzed in this document, although significant differences do exist among the alternatives. A general discussion of prescribed fire can be found in the development of alternatives section at the beginning of this chapter. The specific use of prescribed fire, ranging from small pile burning projects to larger broadcast burns, is described in greater detail for each alternative.

Mechanical treatment level 1

Mechanical treatment is a term used to describe the application of various tools and equipment by fire management staff to reduce fuels and achieve fire management goals. Three levels of mechanical treatment are being considered at Whiskeytown, but level 1 mechanical treatment is the only type of mechanical treatment common to all four alternatives. Significant differences in level 1 treatment do exist among the alternatives. A general discussion of mechanical treatment 1 can be found in the development of alternatives section of this chapter.

Fire information and education

The National Park Service manages an active fire information/education program in the PARK. The park staff includes a Fire Information and Education Specialist in response to growing responsibilities as a result of the Wildland Urban Interface Initiative. This position assists in educating park employees, and volunteers, concession employees, cooperating association employees, other agencies, park visitors and the general public about fire management goals and policies.

Education and information on the fire management program will be accomplished in several ways. Fire education programs presented to park visitors, such as the junior fire fighter program, evening programs, and guided walks. Fire education and prevention outreach programs presented throughout the year to schools, community groups and other organizations. The Fire Information Specialist would work with other government and local agencies in the presentation of these programs. The media are kept informed of the park's prescribed and wildland fires.

Bulletin boards and displays on fire and the fire management program would be placed at visitor contact areas, such as the Visitor Center, Headquarters and the campgrounds. Educational displays on fire topics used at job fairs and special events as appropriate. Park brochures, handouts, park newspaper articles, press releases, fire fact sheets and park planning documents contain information on fire programs and would incorporate fire messages.

Construction of a new fire cache in the Oak Bottom area would alleviate space constraints that restrict development of a modern park headquarters administration building.

Relocate fire cache to Oak Bottom and build new administration building at park headquarters

The park General Management Plan identified both the need for replacing the current decentralized fire cache and developing a modern park headquarters facility.

The fire cache is currently dispersed in five different buildings in three locations: the park headquarters compound, the Whiskey Creek area, and in the Oak Bottom area. The relocation and consolidation of the Whiskeytown fire cache building from these areas and construction of a new fire cache in the Oak Bottom Campground/Marina area is a component of each alternative. Fire cache buildings at headquarters and the Whiskey Creek area include a rented office trailer, a former residence, and three separated fire engine bay buildings. Equipment used by fire fighters is stockpiled where space is available—this often means spreading equipment storage across the park.

The development of a new, centralized fire cache will mean improved coordination between the hazardous fuels/suppression crews, the fire use module and administration functions for the fire management program. Relocating the fire cache to the Oak Bottom location would greatly improve operational efficiency of the fire management program by consolidating resources in one central location and providing close proximity to the highest risk wildland fire area. Furthermore, the current park headquarters is too congested to have all park functions in the headquarters compound. Limited employee parking and increased staffing has forced the fire program to move to vacant buildings in disparate areas of the park. Public education of wildland fire safety and the role of fire would also be facilitated by relocating the fire cache in relatively close proximity to the popular Oak Bottom RV and campsite area. Building plans for a new fire cache have already been developed, although a site design for the Oak Bottom facility would need to be completed in the future.

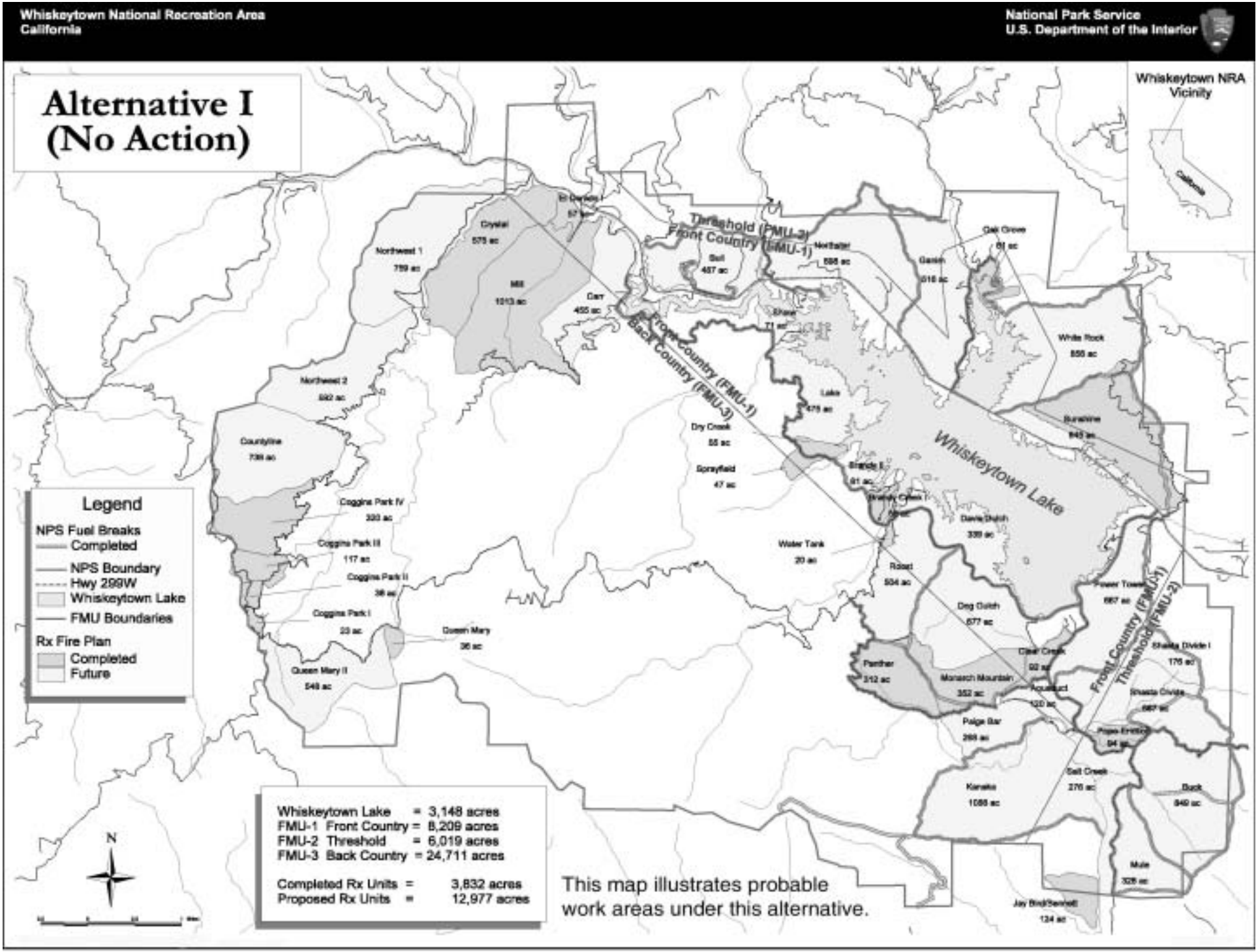
In the late 1950's the Bureau of Reclamation bulldozed the current park headquarters compound and developed a temporary engineer office and vehicle yard. The National Park Service 'inherited' these assorted temporary buildings from the Bureau of Reclamation's dam construction phase. Office space at the headquarters compound consists of the Bureau of Reclamation buildings, converted park employee housing, and temporary trailers. Over the years since the National Park Service has been operating at Whiskeytown (1962), staff has increased with increased visitation demands. The limited space in the headquarters compound and deteriorating construction of the park administration building is a serious concern and for this reason it was included in the park's General Management Plan. Construction of a new fire cache in the Oak Bottom area would alleviate space constraints that restrict development of a modern park headquarters administration building. With the fire management staff and equipment moved to Oak Bottom, areas currently occupied by this staff could then be occupied by park administrative staff while demolition of the current building and construction of a modern facility occurs.

In January 2001, a planning charet for park headquarters was held to review alternative and develop conceptual alternatives for the headquarters area. During that meeting, it was determined that the current headquarters compound is too small for both a fire cache and an administrative building and that park buildings don't currently accommodate staff needs. Under each of the action alternatives, the park's current General Management Plan will be amended to clarify that the National Park Service would have the option to consider in its range of alternatives the option to construct a new administrative building at the park headquarters on Kennedy Memorial Drive.

Relocation and construction of a new fire cache in the Oak Bottom area, and future improvements of the park's administration building at headquarters in its current location is expected to affect approximately six acres—all within currently developed and highly disturbed areas.

CURRENT GENERAL MANAGEMENT PLAN FACILITIES DIRECTION

The existing management direction in the General Management Plan states that the park should develop a modern headquarters facility through adaptive re-use of residential facilities in the park or through other alternatives, such as seeking office space in Redding.


Whiskeytown National Recreation Area
California
National Park Service
U.S. Department of the Interior
Alternative I
(No Action)
Whiskeytown NRA
Vicinity
California
Legend
NPS Fuel Breaks
Completed
NPS Boundary
Hwy 299W
Whiskeytown Lake
FMU Boundaries
Rx Fire Plan
Completed
Future
Threshold (FMU-2)
Front Country (FMU-1)
Front Country (FMU-1)
Back Country (FMU-3)
Whiskeytown Lake
Front Country (FMU-1)
Threshold (FMU-2)
Whiskeytown Lake = 3,148 acres
FMU-1 Front Country = 8,209 acres
FMU-2 Threshold = 6,019 acres
FMU-3 Back Country = 24,711 acres
Completed Rx Units = 3,832 acres
Proposed Rx Units = 12,977 acres
This map illustrates probable
work areas under this alternative.
N

Alternative I would continue the current fire management plan.

Alternative I: No Action (Current Program)

The National Environmental Policy Act requires that environmental analysis documents include a No-Action alternative. The No-Action alternative for plan modifications, such as the proposed update of Whiskeytown's Fire Management Plan, assumes that no new actions would be taken. This does not mean that the National Park Service would not take "action" to manage fire at Whiskeytown. The No Action alternative would continue the current fire program.

Alternative I is the No-Action alternative for this analysis. If this alternative were chosen, the National Park Service would continue to manage Whiskeytown's fire management program in the park in accordance with the existing Fire Management Plan. This alternative is included to provide an accurate baseline against which other alternatives may be compared.

The current fire management program utilizes a limited range of fire management strategies - including prescribed fire, Level 1 mechanical treatment, and suppression of all wildland fires (including natural ignitions). Discussions of the general strategies are provided earlier in this chapter under the development of alternatives section. Implementation of these strategies specific to this alternative is described below.

Prescribed fire

The current program includes both broadcast and pile burning components, with prescribed fire projects range in size from 0.5 to 1000 acres occurring in all vegetation types. Slash piles are burned after mechanical treatments in shaded fuel breaks and around improvements. Broadcast burning is used to reduce surface and ladder fuels over larger areas. Projects located within prescribed fire burn units occur during the nondormant season from 0-5% of the time. Projects located in shaded fuel breaks occur during the nondormant season 20-30% of the time. This activity is conducted in accordance with the current shaded fuel break maintenance prescribed burn plan. Maximum burning in a given year under this alternative would be 1400 acres.

Mechanical treatment

Of the mechanical treatments considered, only level 1 mechanical treatment would be utilized to reduce hazardous fuel levels in the park. This would include the use of chain saws, weed-eaters, hand crews, and chippers to clear around buildings, to install and maintain shaded fuel breaks, and to clear along roadways. The existing WUI program would continue under this alternative. Total maintained shaded fuel break acres would be 850 acres, with as needed maintenance based on site evaluations occurring at least every three years. Annual average maintenance of all mechanically treated areas under this alternative would be 275 acres. A table illustrating the shaded fuel break system under Alternative I is presented on page 17.

Purpose and need

Selection of Alternative I would address the purpose and need for which management action is being proposed. Fire fighter and public safety would be the top priority in all management actions taken. The continuation of the current fire management program would allow the park to improve forest health and restore a circa 1800 landscape, although this would take probably take much longer than other alternatives due to the limited number of tools available. Undesired fires would continue to be suppressed and hazardous fuels would continue to be reduced near developed areas. This alternative would continue current levels of interagency partnering to manage fire. The National Park Service would continue to develop staff expertise related to fire and fuels management. Public education would continue to be a vital component of Whiskeytown's fire management program. Charts comparing how each alternative meets the purpose and need for taking action are included at the end of this chapter.

Impact summary and impairment statement

Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fire risk would increase over time as a result of the increase in hazardous fuels. Second growth forests would continue to be overstocked, stressing overall stand health and immunity from pathogenic problems.

Fire management activities would result in some vegetation mortality, but would reduce threat of large, unmanageable and severe wildland fires. Short-term adverse impacts related to project activity would result in beneficial effects to restore more natural forest conditions. Long-term adverse impacts are acceptable due to the beneficial impacts provided, and most long-term adverse impacts could be mitigated. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of

large, unmanageable, and severe wildland fires when projects are completed.

Mitigation measures may minimize adverse impact intensity and duration, however, some adverse impacts would still occur.

Fire management activities would result in some mortality, but can alter fuels in such a way that wildland fires may become more manageable. There may be additional long-term impacts to plant communities related to management actions proposed for this alternative, (particularly related to the installation and maintenance of a shaded fuel break network) that cannot be predicted at this time.

From a watershed standpoint, the treatment of fuels in the high elevation mixed conifer and ponderosa plant communities can reduce the size and intensity of wildland fires. In doing so, this lessens the chance of debris flows and other watershed events that can permanently alter riparian communities.

Among the beneficial impacts of this alternative are the ability to pre-plan for prescribed burns, mechanical treatments and shaded fuel break construction and maintenance. On the other hand, at the proposed treatment level, reduction of hazardous fuels would take several decades, increasing the possibility that high severity wildland fires could occur and result in major and permanent adverse impacts to cultural resources.

Alternative I is compatible with adjacent fire agency planning effort—the shaded fuel break system currently being implemented by Whiskeytown is a component of these plans. Any actions taken on surrounding lands would result in effects similar to fire management activities in the national park, with the same types of risks. The moderate effects of the treatments in the Whiskeytown wildland urban interface under Alternative I would potentially become beneficial, short-term and moderate.

The actions of this alternative would have adverse, short-term and minor to major effects upon the health and safety of both the public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse effects.

There have been very few fire management actions taken inside the park in the past with long-term effects to either scenic or recreational resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts including introduction and spread of exotic plant species, burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these effects would be potentially visible from highways passing through or roads entering the park. The effects would be adverse to beneficial, long-term and minor.

The National Park Service may not impair park resources or values. Impairment of park resources or values would not occur under Alternative I. In summary, Alternative I would address the fire management program goals outlined earlier, however using the very limited tools of the current program would accomplish the least of the alternatives offered in this document.

Under Alternative II, the fire program would focus on the intentional use of fire through the application of prescribed fire to meet ecological restoration and maintenance objectives, and to reduce hazardous fuels throughout the park.

Alternative II: Prescribed Fire Dominated

This alternative emphasizes Fire Management Goal 2 – Use fire to improve wildlife habitat, stimulate biodiversity, maintain healthy watersheds, reduce exotic plants, restore circa 1800 landscapes, and improve forest health. Under Alternative II, the fire program would focus on the intentional use of fire through the application of prescribed fire to meet ecological restoration and maintenance objectives, and to reduce hazardous fuels throughout the park. All other fires would be suppressed including natural ignitions. Mechanical treatment would only be used to construct prescribed burn unit boundaries and to reduce fuels around developed areas. The shaded fuel break system would not be expanded or maintained, although existing shaded fuel breaks would be used as prescribed burn unit boundaries, as appropriate. Discussions of the general strategies are provided earlier in this chapter under the development of alternatives section. Implementation of these strategies specific to this alternative is described below.

Prescribed fire

This alternative would include pile burning and broadcast burning. Projects under Alternative II would include areas up to 1,000 acres in size to simulate, to the greatest extent feasible, the scale and pattern of natural fire events. Up to 3,000 acres would be burned during each year of implementation. Due to the limited available prescription windows during the dormant season, alternative II would implement prescribed burns during the nondormant season from 10%-20% of the time to maximize all available prescription windows for execution of prescribed fire projects.

Mechanical treatment

Level 1 mechanical treatment would be used to accomplish hazard fuel and resource management objectives in developed areas or other improvements. It would also be used to prepare shaded fuel breaks for use as prescribed fire burn unit's boundaries. Total average mechanical treatment level 1 acres would be 80 annually.

The existing shaded fuel break system would not be maintained as it currently exists and would continue to serve as occasional prescribed fire boundaries and strategic fire lines during suppression incidents. New fire lines that would be installed would serve only as prescribed fire unit boundaries. The lines would be scraped down to mineral soil 2-4 feet in width, and ladder fuels will be reduced to 20-100 feet within the burn units. With no maintenance planned, vegetation would grow back in these areas.

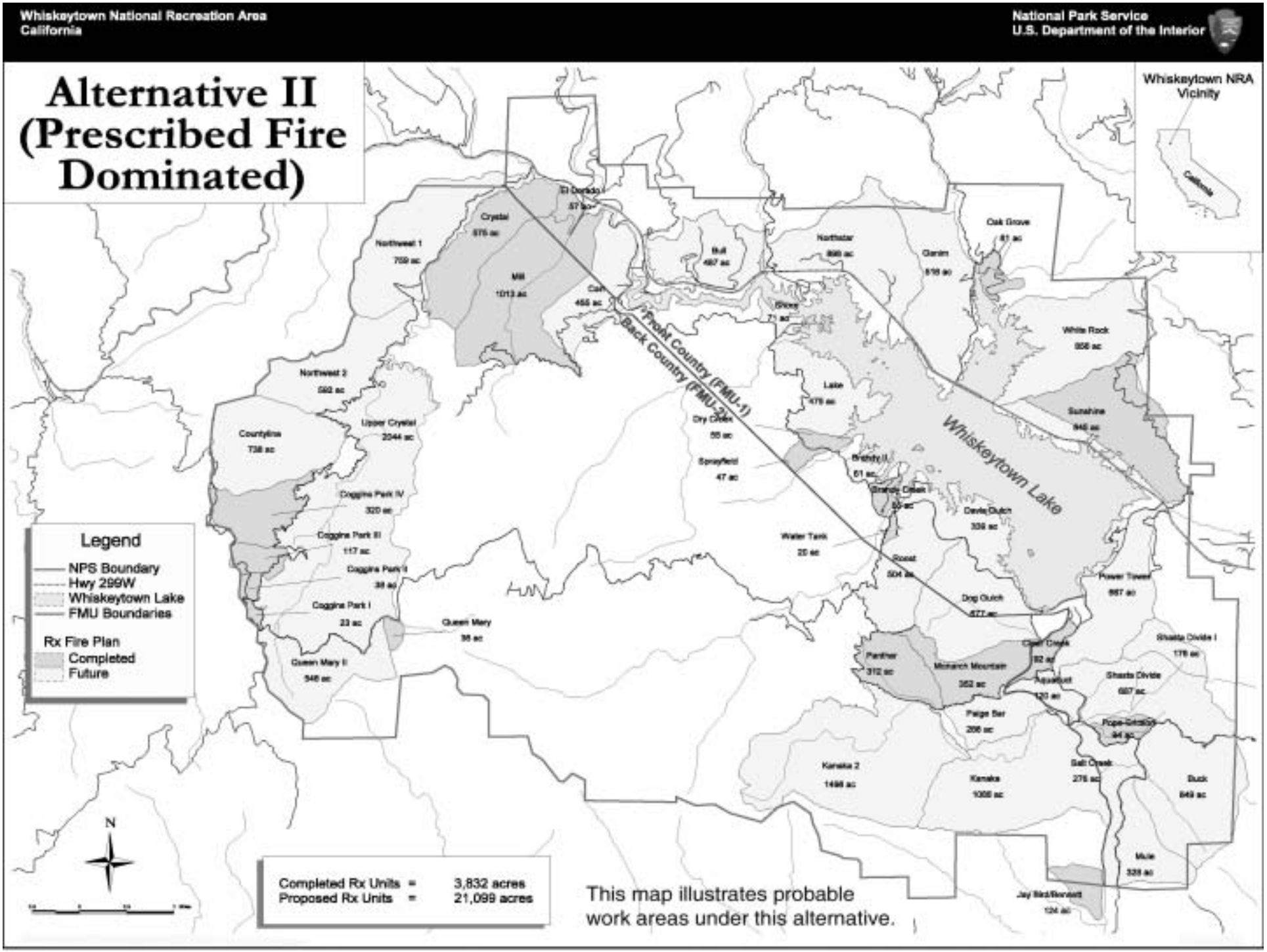
Purpose and need

Alternative II would meet most of the purpose and need for taking action. Public and fire fighter safety would continue to top priority during all management actions. However, the increased use of prescribed fire without the expansion and maintenance of the park's shaded fuel break system may increase the potential for fire escapes. Implementation of Alternative II would improve forest health and help restore circa 1800 landscape conditions. However, this would likely take several decades as a result of the limited number of tools available to reduce forest density and restore stand structure. Undesirable fires would continue to be suppressed, and hazardous fuels near developed areas would continue to be reduced. Interagency partnerships would be continued. Staff expertise would continue to be developed, although not in the full range of available fire and fuel management strategies due to the limited tools available under this alternative. Public education would continue to be a vital component of Whiskeytown's fire management program. Charts comparing how each alternative meets the purpose and need for taking action are included at the end of this chapter.

Impact summary and impairment statement

Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained and plant regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. Expanded spring burning could result in increased overstory tree mortality and decreased reproduction of herbaceous species, depending on plant stage of development and timing.

This alternative meets several of the park's stated fire management objectives. Reliance on prescribed fire as the primary tool for landscape vegetation restoration would require a longer period of time than other alternatives with a broader range of fire management tools. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of large, unmanageable, and severe wildland fires.


Whiskeytown National Recreation Area
California
National Park Service
U.S. Department of the Interior
Alternative II
(Prescribed Fire
Dominated)
Whiskeytown NRA
Vicinity
Front Country (FMU-1)
Back Country (FMU-2)
Whiskeytown Lake
Legend
NPS Boundary
Hwy 299W
Whiskeytown Lake
FMU Boundaries
Rx Fire Plan
Completed
Future
N
Completed Rx Units = 3,832 acres
Proposed Rx Units = 21,099 acres
This map illustrates probable
work areas under this alternative.

Some vegetation and wildlife mortality would occur as prescribed fire reduces fuel levels and suppression of wildland fires continues. Mitigation measures may minimize intensity and duration of adverse impacts; however, some adverse impact would still occur.

Cultural resource management would benefit under this alternative through the ability to pre-plan for prescribed burns and mechanical treatments. On the other hand, heavy reliance on prescribed burning means that those cultural resources vulnerable to direct fire effects could be adversely impacted in situations where adequate pre-burn survey and/or mitigation could not be employed. The rate of treatment in Alternative II improves upon that proposed for Alternative I.

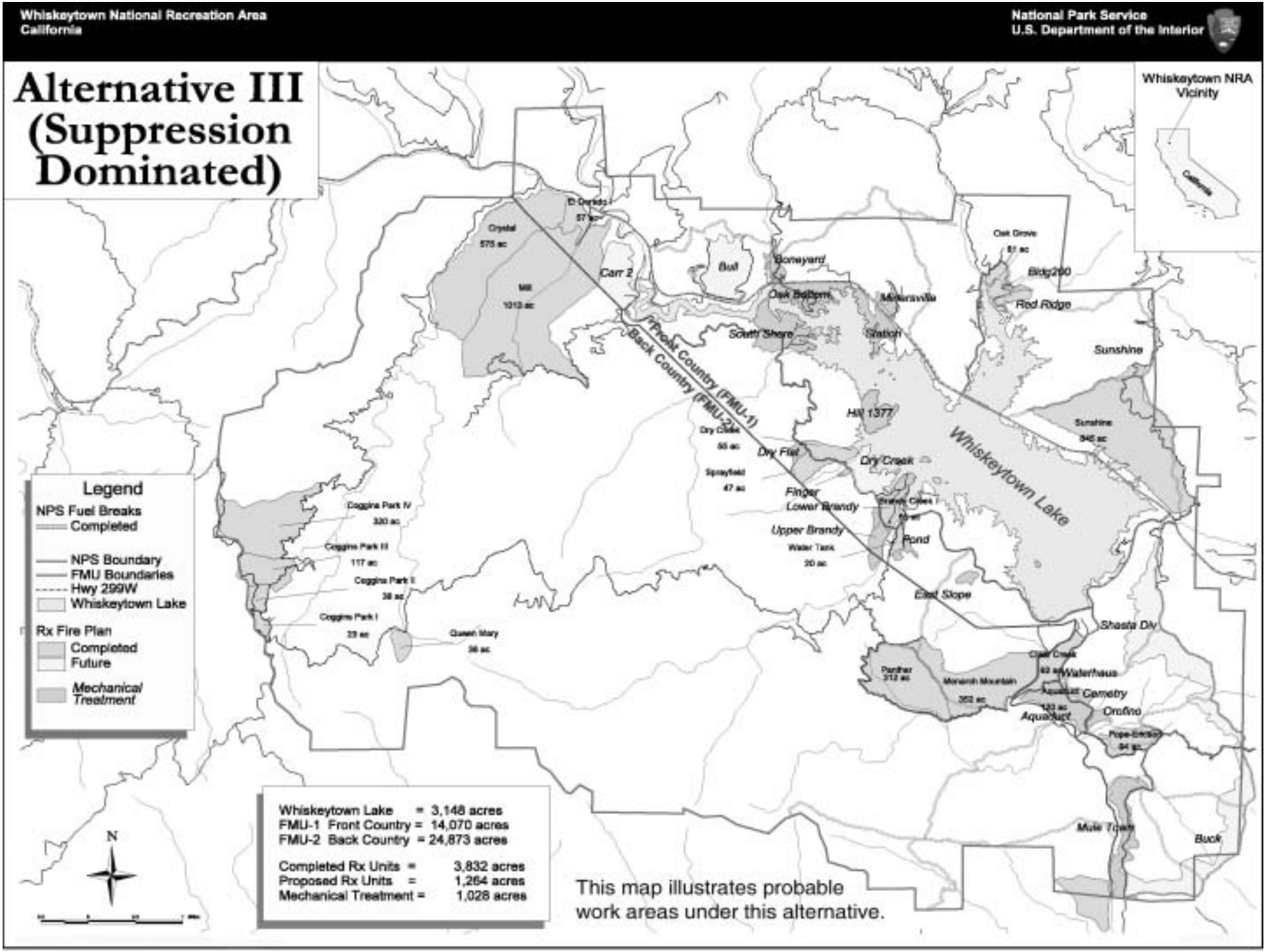
Alternative II conflicts with adjacent land use plans because of the elimination of the shaded fuel break system. The West Redding shaded fuel break system, developed by the local cooperating agencies, includes the lands in Whiskeytown—they are strategic areas that are essential to the effectiveness of the program. The emphasis on reducing fire risk is compatible with adjacent land plans. The implications for suppression would be mixed—a beneficial reduction in fuels is countered by reduced access for fire fighters due to lack of shaded fuel break system during holding actions. Reduced holding action capacity can mean increased risk in escaped prescribed fires.

This alternative would have adverse, short-term and moderate to major effects upon the health and safety of both the public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse effects. Additionally, the absence of a shaded fuel break system in this alternative increases the intensity of direct adverse impacts to fire fighter safety. There would be no impairment from the effects of this alternative.

There have been very few fire management actions taken inside the park in the past with long-term effects to either scenic or recreational resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in effects including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these effects would be potentially visible from highways passing through or roads entering the park. The effects would be adverse to beneficial, long-term and minor.

Impairment of park resources or values would not occur under Alternative II.

In summary, Alternative II would address the fire management program goals outlined earlier, however relying on the limited tool of prescribed fire could be problematic for the fire management staff. By limiting the types of tools available for the fire program, this alternative indirectly increases involvement of outside agencies in accomplishing fire management treatment targets. Air quality concerns do prevent some prescribed fires from occurring—therefore this alternative may end up requiring a great deal of planning to occur with limited implementation ability.


Whiskeytown National Recreation Area
California
National Park Service
U.S. Department of the Interior
Alternative III
(Suppression
Dominated)
Whiskeytown NRA
Vicinity
Legend
NPS Fuel Breaks
Completed
NPS Boundary
FMU Boundaries
Hwy 299W
Whiskeytown Lake
Rx Fire Plan
Completed
Future
Mechanical
Treatment
Front Country (FMU-1)
Back Country (FMU-2)
Carr 2
Bull
Boneyard
Oak Bottom
Millersville
South Shore
Station
Oak Grove
Bldg290
Red Ridge
Sunshine
Hill 1377
Dry Flat
Dry Creek
Whiskeytown Lake
Finger
Lower Brandy
Upper Brandy
Pond
East Slope
Shasta Div
Waterhaus
Cemetery
Oregon
Mule Town
Buck
Queen Mary
Whiskeytown Lake = 3,148 acres
FMU-1 Front Country = 14,070 acres
FMU-2 Back Country = 24,873 acres
Completed Rx Units = 3,832 acres
Proposed Rx Units = 1,264 acres
Mechanical Treatment = 1,028 acres
This map illustrates probable
work areas under this alternative.
N

Alternative III would emphasize hazardous fuel reduction using primarily mechanical, as opposed to prescribed fire, treatments.

Alternative III: Suppression Dominated

The development of this alternative emphasizes Fire Management Goal 3—Suppress undesirable fires in order to protect the public, property, and resources; and Fire Management Goal 4—Reduce fire risk adjacent to developed areas, urban interface boundaries, and cultural/historical sites. Under Alternative III, all natural and human-ignited wildland fires would be suppressed. No prescribed fire projects would be implemented to restore or maintain natural systems. Prescribed burning would only occur in conjunction with mechanical fuel treatments around developments and on shaded fuel breaks. Mechanical treatment level 1 and level 2 would be utilized. Fuel reduction would be the primary goal of projects implemented under this alternative. Discussions of the general strategies are provided earlier in this chapter under the development of alternatives section. Implementation of these strategies specific to this alternative is described below.

Prescribed fire

Alternative III would consisting of pile burning and a few prescribed fire projects to strengthen and widen by up to ¼ to ½ mile shaded fuel breaks for tactical purposes in the case of suppression fire events. No large, broadcast burns would be conducted. Up to 250 acres would be burned during each year of implementation.

Mechanical treatment levels 1 and 2

This alternative would use both mechanical treatment levels 1 and 2. Mechanical treatment would be used to reduce forest fuels in and around developed areas, to install new shaded fuel breaks and widen existing shaded fuel breaks. The shaded fuel break system would be the same as under the current program. Shaded fuel breaks would be used to achieve the following goals:

1 Serve as strategic fire lines for tactical operations during suppression incidents;

2 Provide fire fighter access;

3 Facilitate evacuations if necessary; and,

4 Facilitate prevention of fires from leaving the park or entering the park beyond the designated shaded fuel break.

5 Annual program levels would be up to 225 acres for each of the two mechanical treatment levels proposed in this alternative.

Purpose and need

Alternative III would meet most of the purpose and need for taking action. Public and fire fighter safety would continue to be the top priority during management actions. However, increased smoke production would be expected during wildland fire events as a result of surface fuel accumulation that would not be adequately reduced through mechanical treatments and limited prescribed fire. This alternative would not improve forest health or restore circa 1800 landscape conditions. Actions taken under this alternative would be designed to maximize fuel reduction and prepare for wildland fire suppression events. Fire would not be restored to the ecosystem. Undesirable fires would continue to be suppressed and hazardous fuels around developed areas would continue to be reduced. Interagency partnerships would be continued. Staff expertise would continue to be developed, although not in all available fire and fuel management strategies due to the very limited use of prescribed fire. Public education would continue to be a vital component of Whiskeytown's fire management program. Charts comparing how each alternative meets the purpose and need for taking action are included at the end of this chapter.

Impact summary and impairment statement

Alternative III would emphasize hazardous fuel reduction using primarily mechanical, as opposed to prescribed fire, treatments. This alternative meets some of the park's stated fire management objectives. However, it is expected that wildland fire frequency and intensity would increase over time. This situation could result in stand replacement, including loss of old growth, leading to type conversion.

Reliance on mechanical or repeated disturbance to some plant communities could be harmful in terms of seedling regeneration and the spread of exotic plant species. Thinning and other fire surrogate treatments can mimic the effects of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are unclear. More data is needed.

Fire management activities woul result in some vegetation and wildlife mortality, but would eventually reduce threat of high intensity wildland fire. The risk of escaped management-

ignited fire becoming wildland fire is offset by the reduced use of prescribed fire.

Mitigation measures may minimize intensity and duration of adverse impacts, however, some adverse impact would still occur.

As it does little to reduce overall fuel loads over time, this alternative has the potential to result in major and permanent damage to cultural resources. Focusing on suppression merely delays the inevitable fact that flammable vegetation would eventually burn, likely with high intensity, and a multitude of adverse operational and indirect effects could potentially arise.

Alternative III is generally compatible with adjacent land use plans. Its emphasis on preparedness, suppression, and hazard fuel reduction especially complements the CDF state plan, and area plans. The expanded use of mechanical treatment is compatible with land use plans. Its lack of emphasis on forest health is slightly at odds with the BLM plan. A fuels buildup in the interior portions of the park would make suppression difficult, raising fire risk. Wildland fires could grow rapidly.

This alternative would have adverse, short-term and minor to major effects upon the health and safety of both the public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse effects.

There have been very few fire management actions taken inside the park in the past with long-term effects to either scenic or recreational resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in effects including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these effects would be potentially visible from highways passing through or roads entering the park. The effects would be adverse to beneficial, long-term and minor.

Impairment of park resources or values would not occur under Alternative III.

In summary, Alternative III would address the fire management program goals outlined earlier; however the emphasis on mechanical treatment, with its associated equipment accessibility limitations in large sections of the park, would increase the risk of high frequency, high intensity wildland fires in areas most inaccessible to fire fighters.

Alternative IV: Multiple Strategy Program (Preferred Alternative)

This alternative attempts to place equal emphasis on all Fire Management Goals. Under Alternative IV, a full range of strategies would be used to achieve hazard fuel and resource management goals, including the use of prescribed fire, all levels of mechanical treatment, an expanded shaded fuel break system, and fire suppression. Wildland fire use was originally included in this alternative in the Draft Environmental Impact Statement, however, based on public comments and recommendations from cooperating agencies and National Park Service staff, this tool will not be considered for implementation under this plan. The Multiple Strategy Program would focus on restoring Whiskeytown's plant communities to reduce the risk of high severity wildland fire by decreasing forest stand density, reducing surface fuels, and attempting to restore fire as a natural disturbance process to the greatest extent feasible. More acres would be targeted for treatment each year than under other alternatives. Discussions of the general strategies are provided earlier in this chapter under the development of alternatives section. Implementation of these strategies specific to this alternative is described below.

Prescribed fire

This alternative would include both pile and broadcast burns. Project size for Alternative IV would range from 0.5 to 1,000 acres, and would occur in all vegetation types. Up to 2,200 acres would be treated in each year of implementation. Anticipated acreage for wildland fire use was included in the 2,200 acres in the Draft Environmental Impact Statement--the prescribed fire figure for this alternative has not changed in this document because the very small percentage that wildland fire use acres did not justify a complete reevaluation of the environmental impacts. Slash piles would be burned or chipped after mechanical treatments. Broadcast burns would be used to reduce surface fuels and help restore fire as a natural process over larger areas. Projects located within prescribed fire burn units would occur during the nondormant season from 0-15% of the time. Projects located in shaded fuel breaks would occur during the nondormant season 20-30% of the time.

Mechanical treatment levels 1, 2 and 3

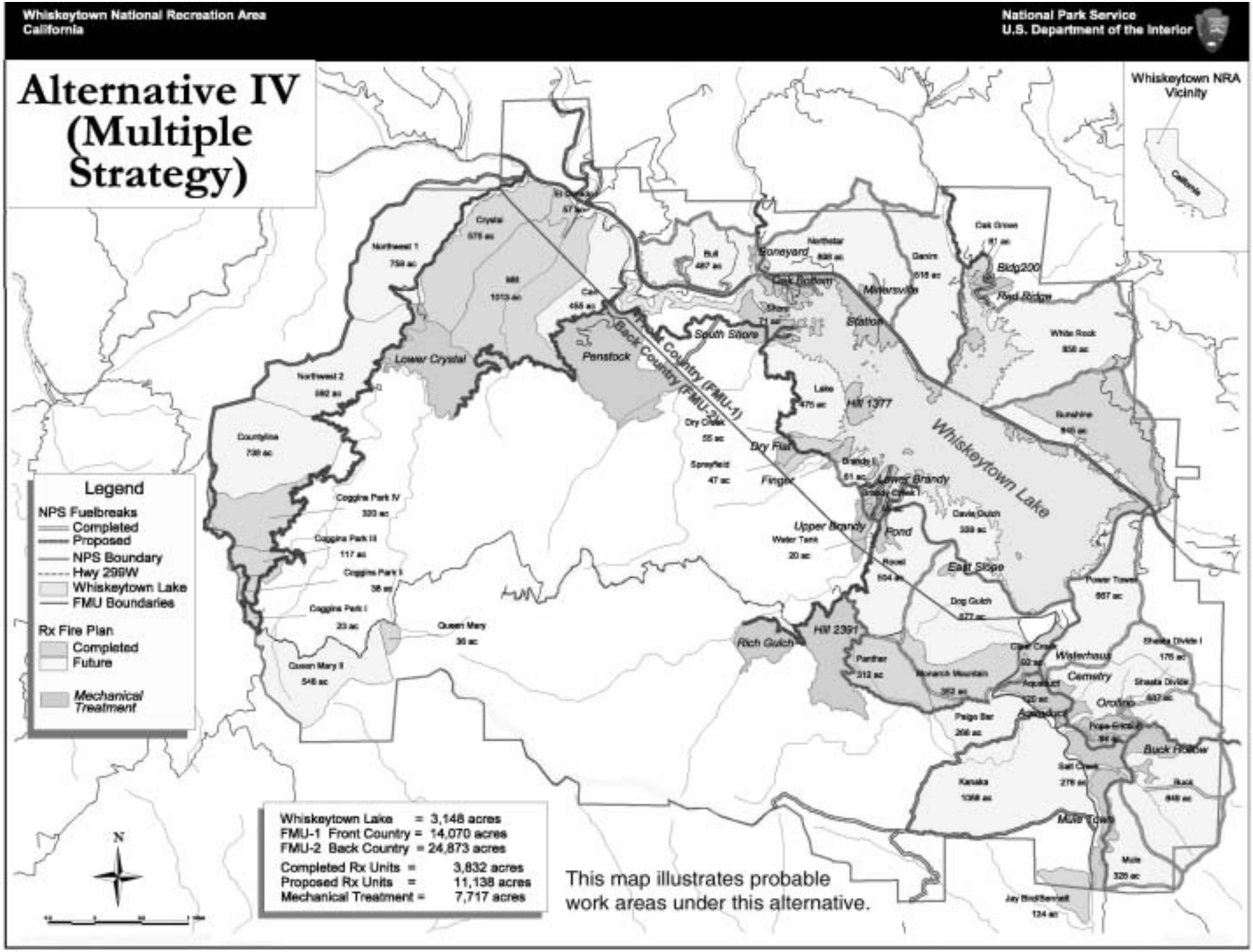
All three levels of mechanical treatment would be utilized to reduce fuel levels and mimic the effects of fire on structural patterns of woody vegetation. Mechanical treatment would be used to reduce forest fuels in and around developed areas, and to install and widen new and existing shaded fuel breaks, respectively. Shaded fuel breaks would be used as prescribed fire burn-unit boundaries, as strategic fire lines for tactical operations during suppression incidents, to alter fire behavior by reducing crown fires to surface fires, to provide fire fighter access, to facilitate evacuations if necessary, and to assist in preventing fires from leaving the park or entering the park beyond the designated shaded fuel break. Mechanical treatments would also focus on improving forest health by thinning dense forests and woodlands areas where fire use may be risky or otherwise inappropriate. Totals of mechanical treatment would be up to 1,075 acres/year.

Purpose and need

Selection of Alternative IV would address the purpose and need for taking action. Fire fighter and public safety would be the top priority during all management actions. The expansion of the current fire management program would allow the park to more effectively improve forest health and restore a circa 1800 landscape through the use of all available fire and fuel management tools, including the use of prescribed fire and expanded mechanical treatment. Undesired fires would continue to be suppressed and hazardous fuels would continue to be reduced near developed areas. This alternative would enhance current levels of interagency partnering to manage fire. The National Park Service would continue to develop staff expertise related to fire and fuels management. Public education would continue to be a vital component of Whiskeytown's fire management program. Charts comparing how each alternative meets the purpose and need for taking action are included at the end of this chapter.

Impact summary and impairment statement

Alternative IV would utilize all available fire managment and fuel rduction techniques to reduce te risk of high severity wildland fire while managing prescribed fire to meet resource management objectives. Despite a broader range of fire management tools, it is expected that wildland fire frequency and intensity would increase over the short-term, until such time as the actions implemented on the ground begin to promote a return of the fire return inerval and naturally occurring fire intensity. This alternative meets all of the park's stated fire management


Whiskeytown National Recreation Area
California
National Park Service
U.S. Department of the Interior
Alternative IV (Multiple Strategy)
Whiskeytown NRA Vicinity
Legend
NPS Fuelbreaks
Completed
Proposed
NPS Boundary
Hwy 299W
Whiskeytown Lake
FMU Boundaries
Rx Fire Plan
Completed
Future
Mechanical Treatment
Front Country (FMU-1)
Back Country (FMU-2)
Whiskeytown Lake
Lower Crystal
Penstock
South Shore
Hill 1377
Lower Brandy
Upper Brandy
Hill 2391
Rich Gulch
East Slope
Dog Gulch
Davis Gulch
Cemetery
Buck Hollow
Mule Town
Coggins Park IV
Coggins Park III
Coggins Park II
Coggins Park I
Queen Mary
Queen Mary II
Countyline
Whiskeytown Lake = 3,148 acres
FMU-1 Front Country = 14,070 acres
FMU-2 Back Country = 24,873 acres
Completed Rx Units = 3,832 acres
Proposed Rx Units = 11,138 acres
Mechanical Treatment = 7,717 acres
This map illustrates probable work areas under this alternative.
N

The Multiple Strategy Program would focus on restoring Whiskeytown's plant communities to reduce the risk of high severity wildland fire by decreasing forest stand density, reducing surface fuels, and attempting to restore fire as a natural disturbance process to the greatest extent feasible.

objectives. It is expected that wildland fires would be reduced over time using a combination of fire management techniques in comparison to the current fire management program.

Fire management activities would result in vegetation mortality, but would reduce threat of high severity wildland fire. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk or wildland fire ignition and high severity wildland fires when projects are completed.

Mitigation measures may minimize intensity and duration of adverse impacts; however some adverse impact would still occur.

Under this alternative, a substantial number of projects would be subjected to pre-planning for cultural resources compliance and a mix of prescribed fire and mechanical treatments would be employed. As the most aggressive alternative at combating hazardous fuel loads, Alternative IV would more quickly reduce the chances of adverse effects associated with wildland fires and wildland fire suppression than other alternatives.

Alternative IV is compatible with adjacent land use plans. The increased emphasis on the shaded fuel break system, and mechanical treatments for fuels is emphasized on neighboring lands. The additional emphasis on mechanical treatments, including the use of mechanized equipment to reduce brush and thin trees, is compatible with adjacent land use plans, which currently call for mechanized equipment to reduce hazard fuels and restore landscapes.

This alternative would have adverse, short-term and minor to major effects upon the health and safety of both the public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse effects. Since this alternative is expected to reduce hazardous fuels and return a more natural fire regime to the various plant communities, the adverse effects listed above would lessen over time and lessen in intensity.

There would be no impairment from the effects of this alternative.

There have been very few fire management actions taken inside the park in the past with long-term effects to either scenic or recreational resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in effects including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these effects of this alternative would be potentially visible from highways passing through or roads entering the park. The effects would be adverse to beneficial, long-term and range from negligible to minor.

In summary, Alternative IV would address the fire management program goals outlined earlier, using the broadest set of fire management tools available to potentially accomplish more than any of the other alternatives offered in this document.

Shaded Fuel Break System under Alternative IV (Multiple Strategy)

			Purpose				
	Shaded Fuel break Name	Total Size (acres)	Public Safety & Evacuation	Firefighter Safety	Access for Suppression Actions	Burn Unit Boundary	Park Boundary Protection
Ridge Top	Buck	21	No	Yes	Yes	Yes	Yes
	Buck Divide	36.1	No	Yes	Yes	Yes	No
	Bull *	20.7	No	Yes	Yes	Yes	Yes
	Coggins Park	5.1	No	Yes	Yes	Yes	No
	Countyline Rd	34.8	No	Yes	Yes	Yes	Yes
	Eiger	19.3	No	Yes	Yes	Yes	Yes
	Ganim	19.3	No	Yes	Yes	No	No
	Kanaka East	28.8	No	Yes	Yes	Yes	Yes
	Kanaka South	17.6	No	Yes	Yes	Yes	No
	Kanaka West	20.1	No	Yes	Yes	No	Yes
	Mill Creek	58.5	No	Yes	Yes	No	No
	Monarch	30.7	No	Yes	Yes	Yes	No
	Mule	27.3	No	Yes	Yes	No	No
	North Kanaka	33.2	No	Yes	Yes	Yes	No
	North Star East	8.5	No	Yes	Yes	Yes	Yes
	North Star West	22.6	No	Yes	Yes	Yes	Yes
	Northwest	68.5	No	Yes	Yes	Yes	No
	Oak Bottom	8.8	No	Yes	Yes	Yes	No
	Orofino	17.9	No	Yes	Yes	Yes	Yes
	Panther	31.6	No	Yes	Yes	Yes	No
	Pitmans	11.2	No	Yes	Yes	No	No
	Prospect	13.9	No	Yes	Yes	Yes	No
	Queen Mary Rd	28.6	No	Yes	Yes	Yes	No
	Roost	16.5	No	Yes	Yes	Yes	No
	Shasta Bally Rd	94.4	No	Yes	Yes	No	No
	Shasta Divide	38.9	No	Yes	Yes	Yes	Yes
	South Fork	36.3	No	Yes	Yes	Yes	No
	South Fork Spur	0.6	No	Yes	Yes	No	No
	South Shore Ridge	9.1	No	Yes	Yes	No	No
	Southern Boundary	54.3	No	Yes	Yes	No	No
	Southwest Roost	8.1	No	Yes	Yes	Yes	No
	Star Area	6.7	No	Yes	Yes	No	No
	Sunshine	19.6	No	Yes	Yes	Yes	No
	Upper Brandy	14.4	No	Yes	Yes	No	No
	Upper Crystal Crk	85.4	No	Yes	Yes	Yes	No
Roads	Bldgs 318-324	17.4	Yes	Yes	Yes	No	No
	Grizzley Gulch Rd	25.6	Yes	Yes	Yes	Yes	No
	Hwy 299-1	65	Yes	Yes	Yes	Yes	No
	Hwy 299-2	60.8	Yes	Yes	Yes	Yes	No
	Hwy 299-3	86.1	Yes	Yes	Yes	Yes	No
	Kennedy Mem Dr	38.1	Yes	Yes	Yes	Yes	No
	Lower Crystal Crk	95.6	Yes	Yes	Yes	No	No
	Muletown Road	50.1	Yes	Yes	Yes	Yes	No
	North Muletown Rd	40	Yes	Yes	Yes	Yes	No
	Paige Bar Road	66.3	Yes	Yes	Yes	Yes	No
	Pioneer Rd	34.6	Yes	Yes	Yes	Yes	No
	Post Office Road	35.1	Yes	Yes	Yes	Yes	No
	South Shore Drive	140.6	Yes	Yes	Yes	Yes	No
	Trinity Mnt Road	39.9	Yes	Yes	Yes	No	No
	Whiskey Creek Rd	27.3	Yes	Yes	Yes	Yes	No
	Total Acreage	1790.9	* Indicates shaded fuelbreak with mid-slope components				

The Environmentally Preferred Alternative

National Park Service policy regarding implementation of the National Environmental Policy Act (NEPA) requires that an environmentally preferred alternative be identified in all NEPA analysis documents after the environmental analysis is complete. The environmentally preferred alternative (Alternative IV) is the one that promotes the national environmental policy expressed in Section 101 of NEPA. This includes alternatives that would:

1 Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2 Assure for all for all visitors a safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

3 Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4 Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment which supports diversity and variety of individual choice;

5 Achieve a balance of population and resource use which would permit high standards of living and a wide sharing of life's amenities; and

6 Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Simply put, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural and natural resources.

After analyzing the alternatives described in this Environmental Impact Statement, the National Park Service has determined that Alternative IV is environmentally preferred. Each of the other alternatives relies on fewer management tools to address the extent of the fire management issues facing the park. Restricted use of mechanical equipment in Alternative I and emphasizing either prescribed fire or suppression activities would not address items number 2, number 3 and number 4 identified above in both a manner and timeframe that Alternative IV would.

National Park Service policy also directs that all environmental analysis documents address compliance with Section 102(1) of NEPA. This section states that the policies, regulations, and public laws of the United States hall be interpreted and administered in accordance with the policies set forward in NEPA. This document was written in support of National Park Service Fire Policy and other policies and legislation governing management of National Park sites in accordance with NEPA.

Range of Alternatives

The alternatives described in this chapter represent a range of reasonable alternatives. A reasonable alternative is one that achieves, in large part; the agency defined purpose and need while not violating any minimum environmental standards. The purpose and need for writing a fire management plan are described in Chapter 1. Fire management staff at Whiskeytown National Recreation Area identified seven program goals that address the park's purpose and need for taking action. Six alternatives were developed using these criteria.

Alternative I – No Action (Current Program)

Alternative II – Prescribed Fire Emphasis

Alternative III – Suppression Emphasis

Alternative IV – Multiple Strategy Program

Alternative V – Mechanical Emphasis

Alternative VI – Natural Fire Emphasis

Each alternative was crafted in a manner that would address most if not all of the goals and objectives. These points are summarized in the tables at the end of this chapter.

Alternative V - Mechanical Fuel Reduction Dominated

This alternative would maximize the use of mechanical treatments to meet fire and fuel management goals. Prescribed burns would be used to eliminate slash generated through mechanical treatments, but not to treat fuels or restore fire as a natural disturbance process. This alternative would use all levels of mechanical treatment, ranging from use of hand tools to small-scale logging in order to construct and maintain shaded fuel breaks along park boundaries and developed areas within the park. Areas where mechanical treatment can be employed to reduce fuels at a larger scale at Whiskeytown are limited because much of the park is too steep, inaccessible, or has highly erosive soils to apply mechanical treatments to any great degree.

This alternative was eliminated from further consideration because it does not adequately meet the stated purpose and need for taking action that is described in Chapter 1. Public and fire fighter safety would be at increased risk if this alternative were chosen because no proactive fuels reduction would only occur in areas limited appropriate areas. In addition to this, continuation of a full suppression program a Whiskeytown would increase the risk fo high severity wildland fire due to the continued accumulation of forest fuels. This alternative would only foster interagency partnerships related to wildland fire suppression, and staff expertise would only be developed related to fire suppression activities and various mechanical treatments.

Alternative V would meet some of the stated purpose and need in that it would continue to suppress undesirable fires and reduce hazard fuels near developed areas. Whiskeytown would also continue to educate the public on the park's fire management program. Despite this, the risks to park resources and safety were considered higher than acceptable. Additionally, this alternative would not meet the requirements outlined in the new National Fire Plan. Alternative 5 was not retained for further analysis for the reasons mentioned above.

Alternative VI – Natural Fire Dominated Program

This alternative would minimize management actions by allowing managed natural ignitions (lightning caused wildland fires) to accomplish hazard fuel reduction and resource management goals. All human-ignited fires would be suppressed, as would any naturally ignited fires that posed an unacceptable risk to human safety, park resources, or park neighbors. Fire would also be suppressed if resources (staff and equipment) to manage the long-term fire events were unavailable. A very limited amount of prescribed burning would occur to facilitate the use of natural ignitions. This would involve improving control lines to contain naturally ignited fires within predetermined boundaries. Level 1 mechanical fuel treatment would be used to reduce fuel levels in and around developed areas and along park boundaries to buffer these sites from unplanned events. The shaded fuel break system would not be expanded or maintained under this alternative.

This alternative was eliminated from further consideration because it does not adequately meet the stated purpose and need for taking action that is described in Chapter 1. Public and fire fighter safety would be at increased risk if this alternative were chosen because no proactive fuels reduction would occur. This would increase the risk for high severity wildland fire due to the continued accumulation of forest fuels. This alternative would only foster interagency partnerships related to wildland fire use and wildland fire suppression. Staff expertise would only be developed related to these limited actions. Alternative VI would meet some of the stated purpose and need in that it would continue to suppress undesirable fires and reduce hazard fuels near developed areas. Whiskeytown would also continue to educate the public on the park's fire management program. However, the primary goal of promoting public and fire fighter safety would not be met because wildland fire events that occurred would be more likely to result in high intensity crown fires that would significantly impact park resources. In this alternative the goal of improving forest health to restore circa 1800 landscape conditions would be unlikely to occur. The risks to safety and park resources were considered higher than acceptable. Additionally, this alternative would not meet the requirements outlined in the new National Fire Plan. Alternative 6 was not retained for further analysis for the reasons mentioned above.

Range of alternatives compared by fire management goals

Goals	Alt. I	Alt. II	Alt. III	Alt. IV	Alt. V	Alt. VI
Firefighter & Public Safety	⊙	⊙	⊙	⊙		
Restore landscape and forest health	⊙	⊙		⊙		
Suppress undesired fires	⊙	⊙	⊙	⊙	⊙	⊙
Reduce hazardous fuels near developed areas	⊙	⊙	⊙	⊙	⊙	⊙
Foster interagency relationships	⊙	⊙	⊙	⊙		
Develop staff expertise	⊙	⊙	⊙	⊙		
Educate public on fire	⊙	⊙	⊙	⊙	⊙	⊙

⊙ - A component of the alternative

Range of alternatives compared by fire management strategy

Strategy	Alt. I	Alt. II	Alt. III	Alt. IV	Alt. V	Alt. VI
Suppression	⊙	⊙	⊙	⊙	⊙	⊙
Prescribed Fire	⊙	⊙	⊙	⊙		⊙
Mechanical 1	⊙	⊙	⊙	⊙	⊙	⊙
Mechanical 2			⊙	⊙	⊙	
Mechanical 3				⊙	⊙	
Shaded fuel break	⊙		⊙	⊙	⊙	

⊙ - A component of the alternative

Scope of individual projects and annual program

Strategies		Alt. I	Alt. II	Alt. III	Alt. IV
Mechanical treatments	Project size	Up to 25 acres	Up to 100 acres	Up to 200 acres	Up to 300 acres
	Projects/year	Up to 16	Up to 6	Up to 12	Up to 20
	Annual Average	225 acres/year	80 acres/year	450 acres/year	1075 acres/year
Prescribed fire	Project size	1000 acres max	1000 acres max	30 acres max	1000 acres max
	Projects/year	Up to 6	Up to 10	Up to 7	Up to 10
	Annual Average	1400 acre/year	3000 acre/year	250 acre/year	2200 acre/year

*The acreage and project numbers are not program targets, but rather are shown to demonstrate the anticipated differences between alternatives based on the fire management tools available to each.

Range of alternatives compared by Shaded Fuel Break System utilization

	Shaded Fuelbreak Name	Public Safety & Evacuation			Firefighter Safety			Access for Suppression Actions			Burn Unit Boundary			Park Boundary Protection		
		Alt. I	Alt. III	Alt. IV	Alt. I	Alt. III	Alt. IV	Alt. I	Alt. III	Alt. IV	Alt. I	Alt. III	Alt. IV	Alt. I	Alt. III	Alt. IV
Ridge Tops	Buck	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Buck Divide	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Bull	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Eiger	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	Ganim	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
	Kanaka East	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	Kanaka South	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Kanaka West	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
	Monarch	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Mule	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
	North Kanaka	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	North Star East	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	North Star West	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	Oak Bottom	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Orofino	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
	Panther	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Prospect	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Roost	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Shasta Divide	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	South Fork	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
	South Fork Spur	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
	Southwest Roost	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Sunshine	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
Roads	Bldgs 318-324	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
	Kennedy Mem Dr	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Muletown Road	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	North Muletown Rd	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Paige Bar Road	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Pioneer Rd	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Post Office Road	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	South Shore Drive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No
	Implemented under Alternative IV Only															
	Grizzley Gulch Rd			Yes			Yes			Yes			Yes			No
	South Shore Ridge			No			Yes			Yes			No			No
	Southern Boundary			No			Yes			Yes			No			No
	Star Area			No			Yes			Yes			No			No
	Trinity Mnt Road			Yes			Yes			Yes			No			No
	Upper Brandy			No			Yes			Yes			No			No
	Upper Crystal Crk			No			Yes			Yes			Yes			No
	Whiskey Creek Rd			Yes			Yes			Yes			Yes			No
	Coggins Park			No			Yes			Yes			Yes			No
	Countyline Rd			No			Yes			Yes			Yes			Yes
	Hwy 299-1			Yes			Yes			Yes			Yes			No
	Hwy 299-2			Yes			Yes			Yes			Yes			No
	Hwy 299-3			Yes			Yes			Yes			Yes			No
	Lower Crystal Crk			Yes			Yes			Yes			No			No
	Mill Creek			No			Yes			Yes			No			No
	Northwest			No			Yes			Yes			Yes			No
	Pitmans			No			Yes			Yes			No			No
	Queen Mary Rd			No			Yes			Yes			Yes			No
	Shasta Bally Rd			No			Yes			Yes			No			No

Impacts Summary

Affected Environment	Alternative I No Action	Alternative II Prescribed Fire Dominated	Alternative III Suppression Dominated	Alternative IV Multiple Strategy Program
Biological Environment				
Vegetation Communities	Adverse to beneficial, negligible to major, short to long term, more data needed	Adverse to beneficial, negligible to major, short to long term, more data needed	Adverse to beneficial, negligible to major, short to long term, more data needed	Adverse to beneficial, negligible to major, short to long term, more data needed
Wildlife and Fish	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed
Special Status Species	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed	Moderate to major, adverse, long term, more data needed	Minor short term adverse to moderate long term beneficial, more data needed
Geophysical Environment				
Soils	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term
Water Quality	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term	Beneficial, major, long term
Air Quality	Adverse, negligible to major, short to long-term	Adverse, negligible to major, short to long-term	Adverse, negligible to major, short to long-term	Adverse, negligible to major, short to long-term
Ecologically Critical Area	More data is needed, moderate to major, adverse, long term	More data is needed, minor short term adverse to moderate long term beneficial	More data is needed, moderate to major, adverse, long term	More data is needed, minor short term adverse to moderate long term beneficial
Cultural Enviroment				
Archaeological, historical and ethnographic resources; cultural landscapes; museum collections	Long term moderate beneficial to short term major adverse	Long term moderate beneficial to short term major adverse to beneficial	Long term major adverse	Long term moderate beneficial to short term major adverse
Social Environment				
Health and Safety	Adverse, negligible to major, short to long term	Adverse, negligible to major, short to long term	Adverse, negligible to major, short to long term	Adverse, negligible to major, short to long term
Community Economics	Beneficial, minor to moderate, short to long-term	Beneficial, minor to moderate, short to long-term	Beneficial, minor to moderate, short to long-term	Beneficial, minor to moderate, short to long-term
Visual Resources	Beneficial, minor, long term	Beneficial, moderate, long term	Beneficial, moderate, long term	Beneficial, moderate, long term
Recreation	Adverse to beneficial, minor, long term	Adverse to beneficial, minor, long term	Adverse to beneficial, minor, long term	Adverse to beneficial, minor, long term
Compatibility with Land Use Plans	Negligible beneficial long term	Moderate ,adverse, short term to Moderate beneficial, long term	Adverse to beneficial, negligible, long term	Moderate ,adverse , short term to major, beneficial, long term

Chapter 3 The Affected Environment

This chapter provides a concise description of the project area and the resources that would be affected by actions proposed under the various alternatives.

Background on Whiskeytown National Recreation Area

Whiskeytown National Recreation Area is located in northern California in Shasta County, 85 miles inland from the Pacific Ocean, and eight miles west of the city of Redding, California that has a population of 80,000. The recreation area can be reached from both the east and west by California Highway 299. The park covers 42,503 acres, approximately 70 square miles, and includes the 3,220 acre Whiskeytown Lake. Whiskeytown Lake lies at the confluence of seven perennial streams that form one of the largest watersheds of the Sacramento River, and provides drinking water for several municipalities. Nearly six million people live within a day's drive of the park.

The enabling legislation of Congress that established Whiskeytown National Recreation Area on November 8, 1965, under Public Law 89-336 provided specific responsibilities for management of the park. The park was created to "*provide…for the public outdoor use and enjoyment*" of the specified reservoirs and surrounding lands "*by present and future generations, and for the conservation of scenic, scientific, historic, and other values contributing to public enjoyment of such lands and water.*" Whiskeytown was created to provide for recreational opportunities and protection and conservation of natural and cultural resources. The mandate is derived from the National Park Service Organic Act of 1916, outlines the fundamental purposes of the National Park System, and directs the National Park Service to allow for public use and enjoyment provided that the resources therein remain unimpaired for future generations. The conservation of natural and cultural resources takes primacy over the provision of recreation.

Most of the park's 46 mile boundary is bordered by private land, with some bordering lands administered by the Bureau of Land Management. There is one state-owned tract of 29 acres and six private tracts totaling 15 acres within the park. A recreational easement extending along lower Clear Creek from the park boundary to Placer Road is in mixed public/private ownership--the park does not currently exercise management over this portion. Elevations in the park range between 625 feet at the southern end of lower Clear Creek to 6,209 feet at the summit of Shasta Bally. The park provides many varied habitats for a unique and diverse assemblage of plant and wildlife species.

Climate

The park is in an area of Mediterranean climate with hot, dry summers, and cool winters with moderate rainfall. At the lower elevations, temperatures over 100° F often occur during the months of May through September, with occasional subfreezing temperatures from November through March. The frost-free growing season averages 250 days at the lower elevations (Biek 1988). The mean annual temperature is 58° F, as recorded at the weather station located at park headquarters. Reliable measurements of temperature at higher elevations are not available, but distinctly cooler temperatures at found at higher elevations. The average annual precipitation at park headquarters is 60 inches, nearly all in the form of rain. The south side of the lake receives higher total rainfall than the north side. Seventy-five to ninety percent of the total annual rainfall occurs between November 1st and April 30th. Reliable figures on snowfall are not available; however, snow often remains at the higher elevations well into June.

Fire History

Fire has long been recognized as a major ecological process in the development and maintenance of California ecosystems. Disturbances such as fire and the frequency, intensity, duration, and extent at which they occur, can have a profound effect on species diversity within and among communities (Rosenzweig 1995). Ecosystems are defined by the processes that regulate them (Christensen et. al 1989), and land managers now recognize that it is imperative to take disturbance regimes into

Congress established Whiskeytown National Recreation Area to "provide…for the public outdoor use and enjoyment"…"by present and future generations, and for the conservation of scenic, scientific, historic, and other values contributing to public enjoyment of such lands and water."

account in order to maintain natural ecosystems (Agee 1993). Improvement and maintenance of ecosystem health meets one of the fire management program goals discussed in Chapter One.

Located between the Cascade Range, Coast Range, and Sacramento Valley, Whiskeytown National Recreation Area is an area of significant diversity. The park's several plant communities and species diversity reflect a broad range in elevation, rugged topography, and diverse soil types. The historic fire regimes of Whiskeytown are complicated due to these extremes in topography and an extensive history of anthropomorphic disturbance. What makes describing these regimes even more complicated is that there is a general lack of information on the historical fire regimes of the Klamath Mountains.

Rising up from the Sacramento foothills, Whiskeytown's lower elevations are primarily comprised of chaparral, knobcone pine, and mixed oak woodlands with scattered ponderosa pines. Little is known about the fire history of these plant communities in Whiskeytown. According to the literature, oak woodlands usually are characterized by fast-moving fires of low severity. On the other hand, chaparral and knobcone pine communities usually support severe fires that kill above ground portions of the plants. Fires within the chaparral and knobcone pine plant communities are characterized by fast moving and intense fires. Fire return intervals in chaparral and knobcone pine are quite variable, depending on local site conditions. These return intervals have been estimated to range between twenty to fifty years, with ranges of approximately ten to more than a hundred years (Keeley 1982). The historic occurrence of fires in the chaparral and knobcone communities are also considered to be infrequent because these crown fire species are subject to immaturity risk, which means that repeated fire would convert the community to one of frequent surface fires. This would most likely be annual grasslands or chamise, given the elevation, slope, and soil types that they exist in now. Other evidence includes recent reports that clearly show knobcone pine and other serotinous species such as McNab cypress in Whiskeytown before the lake was filled. As a matter of fact, Whiskeytown supported the largest population of McNab cypress in California. Heat sensitive serotinous species such as knobcone pine and McNab cypress do not survive in areas that have frequent fire. Therefore, their presence indicates a fire regime of infrequent fire in the lower elevations.

On the other hand, mixed oak woodlands have a fire history of burning frequently with fires generally of low to moderate severity. Historical fire return intervals in these areas were generally from two to eight years. In Whiskeytown, chaparral and knobcone pine are primarily found on south-facing slopes, and the oak woodlands are found on in riparian areas and north-facing slopes. The combination of their fire regimes makes up a "mixed fire regime" in which fast-moving and intense crown fires would race up south-facing and sun-exposed slopes. These fires then become an understory fire as they would back down the north-facing slopes and more mesic riparian areas.

Higher in elevation towards the top of Shasta Bally, ponderosa pine and mixed oak woodlands dominate on the north-facing slopes, and begin to blend with mixed conifer forests above 3,000 feet. The fire return intervals for these plant communities range from 3 to 50 and are usually associated with frequent fires of low to moderate severity. These frequent, low-intensity fire regimes greatly reduced the ground fuels and vegetation with only minimal impacts to the overstory trees, and typically promoted a diverse herbaceous and shrub understory layer. Increased fuel loads correlate to higher severity fires and more pronounced fire impacts, although individual and species-specific responses do prevail. Specifically, median fire return intervals for seven mixed conifer and ponderosa pine forest sites were seven to fifteen years, with a range of three to fifty five years (Skinner in prep.). However, the fire regime can vary considerably in both frequency and pattern of severity by topography, site quality, vegetation and other local factors (Skinner and Chang 1996).

To address the variability within fire regimes, a recent analysis of fire in the Klamath National Forest (Odion et al. in prep) found that long-unburned forests tended to burn at low severity and that the highest fire severity occurred in areas burned on relatively short (10-20 year) rotations. The latter effect was likely due to management practices (post-fire logging, plantation establishment) that do not apply to the park. However, this research does support other recent research (e.g. Keeley et al. 1999b, Bessie and Johnson 1995, Johnson et al. 2001) indicating that wildland fires are not necessarily more extreme now than ever before due to fire suppression. The unnatural fuel-buildup idea

Stands have also become less complex and more homogeneous in terms of spatial arrangement. In many areas, ecosystem diversity and sustainability appear to be jeopardized by these changes, even without the threat of fire.

applies to ponderosa pine forests of the interior west, where surface fire historically maintained open forests, which have now become prone to crown fires because of changes in fuel loading and arrangement without fire (Covington 2000). There is little or no good evidence to support this model in many other ecosystems (Anderson et al. 1999), but it has nonetheless been widely applied. Gutsell et al. (2001) suggest that managers should demand convincing evidence of a crown fire regime before embarking on thinning treatments that are, evolutionarily, clearly unprecedented.

Dendrochronology can tell us how frequently trees have been scarred by fire as far back as tree ring records go, but there are no such records for reconstructing how much crown fire was natural in this landscape. The amount of crown fire and fire return interval likely varied considerably in this area with its sharp gradients and steep topography. Crown-fires, although hazardous and undesirable in other respects to humans, did occur naturally, and are not necessarily harmful ecologically. Overall diversity may be promoted through the creation of snags, important for wildlife, and other impacts of opening up forests. Chaparral and knobcone pine communities are crown fire dependent. Chaparral may have naturally occurred in areas with forest potential after high severity fire, forming a shifting mosaic, promoting diversity, and restoring productivity to these areas via nitrogen-fixing shrubs and mycorrhizal facilitation of forest redevelopment. Large, old trees such as ponderosa pine and Douglas fir may escape damage in fires of mixed severity with scattered crown fire because these trees become fire resistant or because fire, by nature, can be highly variable.

As this body of research indicates, fire return intervals and severity in this region are highly variable. This variation may be important in promoting the rich biodiversity the region is renowned for (Taylor and Skinner 1998). However, fire history studies show that natural ignitions alone do not account for historic fire frequency in mixed conifer forests, which points to a significant fire incidence from American Indian burning (Kilgore and Taylor 1979). All California Indian tribes used fire as a tool to control brush, drive game, collect insects, obtain preferred basketry materials, or promote the growth of seed-producing plants. (Sturtevant 1978, Lewis 1973, Anderson 1993, Anderson 1999). The effect of Native American fire use is "so important that it has left its mark upon most every vegetation type in California." (Anderson 1993).

Prior to European settlement, lightning strikes were the principal source of natural ignitions of forest fires (Agee 1993). Although Whiskeytown has accurate records of fire starts dating back only 30 years, it is quite likely that most lightning strikes in Whiskeytown historically occurred in the mid-elevation, and resulted in surface fires until they hit major topographic barriers. Most fires in the Klamath Mountains are bounded by permanent watercourses and ridge tops that act as major barriers. In the park, less than one lightning strike per year resulted in a wildland fire from the 25 lightning strikes recorded from 1969 to 1998. Lightning strikes account for 90.8% of the wildland fire acreage burned in the park since 1969. Most of the lightning-ignited fires in the park since 1983 were located on the upper one-third of north and east-facing 26- 40% slopes in the lower elevations (1500-2500 feet). Recent historical fire information has been reconstructed through California Department of Forestry and National Park Service spot maps and fire history reports, and dendrochronology studies, although in-depth fire history information specific to Whiskeytown is not available. California Department of Forestry and National Park Service spot maps show that since 1929 a size class C (10-99 acres) wildland fire occurred in the park on an average of every 4.5 years, and a size class F (1000-5000 acres) wildland fire occurred on an average of every 13.75 years.

Current Conditions

Whiskeytown's complex history of natural and anthropomorphic disturbance, diverse plant communities and fire regimes are testament for a multifaceted approach to fire management. A combination of logging and fire suppression in Whiskeytown's ponderosa pine and mixed conifer forests has created dense, homogeneous stands of pole-sized trees. These forests consist mainly of small and medium size classes of shade-tolerant and fire–sensitive species. Stands have also become less complex and more homogeneous in terms of spatial arrangement. In many areas, ecosystem diversity and sustainability appear to be jeopardized by these changes, even without the threat of fire. In the lower elevations, the park borders an urban interface that is being developed on almost a daily basis. This urban encroachment is occurring within an assemblage of chaparral, knobcone pine, and oak woodlands and is characterized by a fire regime that consists of intense and fast moving fires. When hot and dry summers, steep slopes, and frequent fire starts are taken into account, wildfire is inevitable. The synergistic effects of a naturally diverse region, history of human caused disturbance, and increasing pressures to promote fire-safe

communities near federal lands, provides a challenging opportunity for researchers and land managers.

The means by which we need to restore and sustain these ecosystems are controversial. Letting nature take its course may be appropriate in some areas that are relatively unaffected by human activities, have relatively intact disturbance regimes, and are not adjacent to urban developments. However, this approach cannot be carried over to forests that have been sporadically logged and deprived of fire for what is estimated to be over one hundred years. Given the excessive quantity of fuels in the park's high elevation forests, continued fire suppression will be required, but suppression alone will only exacerbate the growing problems of overly dense stands and excessive fuels.

The historic structure and composition of Whiskeytown was created by a variety of disturbance regimes, and many of the tools available for mimicking these processes, lie within the disciplines of resource management. Given the narrow windows available in which the park is able to execute prescribed burns, it is inconceivable that fire in its pre European settlement frequencies and severities could be restored fully. And, prescribed fire alone cannot fully mimic the ecosystem functions of pre European settlement fire patterns because the forests have changed greatly and the effects of reintroduced fire are likely to be quite different than those of pre European settlement fire. If fire alone is used, several applications of prescribed fire will be necessary, especially in densely stocked high elevation forests with heavy fuels concentrations, before the desired forest conditions can be approached. These early reintroductions of prescribed fire are expensive and have a high risk of escapes as well as undesirable effects. Because of this, land managers and forest scientists advocate the widespread use of fire surrogate treatments not only to reduce fuel loads and tree stocking levels to decrease the probability of large intense fires, but also to pretreat prescribed burn units so that prescribed fire can be safely reintroduced into these dense forests.

The logistics of conducting enough prescribed burns in the park in order to produce the desired fire impacts is challenging due to heavy fuel loads, narrow burn windows, as well as the proximity of towns and 67 acres of private landholdings in the park. Other obstacles include air quality regulations, administrative moratoriums, and local social and political constraints. Prescribed burn units need to be retreated because total downed woody fuel loads five years post-burn can equal and sometimes significantly exceed the pretreatment levels. An initial low intensity fire can result in moderate levels of mortality, particularly among smaller, suppressed trees in some decadent habitats within the park. These trees typically fall to the ground within a few years and raise the 1000 hour fuel loads (downed woody materials larger than 3 inches in diameter) well beyond pre-burn levels.

Impact Topics

Whiskeytown National Recreation Area contains resources of geological, biological, cultural, and social value. The park was created both to provide for recreational opportunities and to conserve the natural environment. As a unit of the National Park System, the park is mandated to protect and conserve natural and cultural resources. The mandate is derived from the National Park Service Organic Act of 1916, which outlines the fundamental purposes of the National Park System. The mandate also directs the National Park Service to allow for public use and enjoyment of national parks, provided that the resources therein remain unimpaired for future generations. The conservation of resources takes primacy over the provision of recreation, however.

A prime example of the mixed conifer community is found along Crystal Creek Road, from above the Crystal Creek Regional Boys Camp to Coggins Park.

BIOLOGICAL ENVIRONMENT

PLANT COMMUNITIES

The park is located within the Klamath Mountain physiographic province and is an area of significant diversity due to proximity to the Cascade Range, Coast Range, and Sacramento Valley. The diverse plant communities intergrade with one another in such a way that distinct boundaries are seldom observed. This patchy vegetation pattern reflects a broad range in elevation, rugged topography, diverse soil types, and a history of natural and human disturbance. For the purposes of the Fire Management Plan and Environmental Impact Statement, these diverse habitats have been grouped into seven plant communities based on descriptions by Biek (1988) and Sawyer and Keeler-Wolf (1995). The seven plant communities are: Mixed Conifer, Ponderosa Pine, Knobcone Pine, Mixed Oak Woodland, Blue Oak Grasslands, Chaparral Communities, and Riparian Communities.

The following sections describe the plant communities, their distribution, typical plant species, and responses to fire:

Mixed Conifer: The mixed conifer community covers approximately 10,000 acres and is primarily comprised of a mixture of codominant tree species. These species are ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), Douglas fir (*Pseudotsuga menziesii*), sugar pine (*Pinus lambertiana*), and white fir (*Abies concolor*). Subcommunities contain species that are less dominant but regionally plentiful such as white alder (*Alnus rhombifolia*), California yew (T*axus brevifolia*), red fir (*Abies magnifica var. shastensis*) and Jeffrey pine (*Pinus jeffreyi*). In areas of dense forest canopy, the understory shrubs are either sparse or scattered and consist of tan oak (*Lithocarpus densisflorus vars. densiflorus and echinoides*), greenleaf manzanita (*Arctostaphylos patula*), dogwood (*Cornus spp.*), western azalea (*Rhododendron occidentale*), snowbush (*Ceanothus cordulatus*), and sierra gooseberry (*Ribes roezlii*). Logging, debris flows, high severity fire and the nature of the granitic soils can create more open canopies so that montane chaparral species such as greenleaf manzanita, chinquapin (*Chrysolepis sempervirens*), tan oak and huckleberry oak (*Quercus vaccinifolia*) can dominate.

The ground cover in the mixed conifer plant community is composed of grasses, ferns, sedges, and some of the park's most unique herbaceous species such as parsley fern (*Cryptogramma acrostichoides*), twinflower (*Linnea borealis var. longifloria*), and bride's bonnet (*Clintonia uniflora*). The forest floor vegetation layer consists of low-growing lichens and mosses.

The mixed conifer forests can be found between approximately 3,000 feet to 5,900 foot elevation on Shasta Bally. A prime example of the mixed conifer community is found along Crystal Creek Road, from above the Crystal Creek Regional Boys Camp to Coggins Park. The unlogged areas at Coggins Park demonstrate a forest community that probably covered most of the higher elevation mountain slopes before they were logged. Jeffrey pine and white fir are found on the upper slopes of Shasta Bally, with the east side favoring Jeffrey pine. A few acres at the summit of Shasta Bally have a significant amount of red fir.

Fire is an important ecological process in the development of mixed conifer forest types. While site-specific records for the park are limited, it is generally well recognized that frequent, low intensity fires historically characterized similar ecosystems in the western United States. These fires occurred across the landscape on an 8-12 year interval. Small scale, high intensity fires did occur in isolated patches with some regularity, but historically were extremely rare. The frequent, low-intensity fires maintained moderate to low quantities of dead and down woody fuels, and favored the development of herbaceous understory species such as iris (*Iris spp.*), locoweed (*Astragulus gambelianus*), milkmaid (*Cardamine californica*), bedstraw (*Galium spp.*), rattlesnake plantain (*Goodyera oblongiflora*), and several other orchids (*Piperia spp*). Other herbaceous species include exotics such as prickly lettuce (*Lactuca serriola*) and cat's ear (*Hypochaeris spp.*), and grasses such as nitgrass (*Gastridium ventricosum*), foxtails (*Bromus spp.*), silver hair grass (*Aira caryophyllea*), various fescues (*Vulpia spp.*), and dogtail grass.

In general, mature ponderosa pine is resistant to low and moderate intensity fires, while most other overstory conifer species are able to survive low intensity fires. Young saplings and seedlings are usually killed by fire, so relatively few small trees become large trees. The historic role of fire in the mixed conifer plant community was complex, varying over time and across the landscape. Under a natural fire

Representative examples of the Ponderosa Pine plant community can be seen on the slopes above Brandy Creek, along the Mill Creek Trail, along the Crystal Creek Water Ditch Trail, and on Monarch Mountain.

Knobcone pine communities can be seen along the Mt. Shasta Mine Loop Trail, Whiskey Creek area, and along Mule Town Road towards the town of Shasta.

regime, these factors promoted mosaics of even and uneven aged stands and structural diversity. The isolated high intensity patch burns provided for a mosaic forest where a mix of shrub and tree species predominated.

The role of fire in the development and maintenance of the mixed conifer forest has changed as aggressive fire suppression curtails slow moving ground fires. Populations of shade tolerant fir and incense cedar are not being controlled by fire, and there are few distinct breaks in the continuity of the understory vegetation. The incidence and subsequent influence of fire has been minimal over the last century. The result of this alteration in the historic fire regime combined with logging and mining is difficult to assess accurately, but some generalizations can be made based upon the limited available research.

Ponderosa Pine: Ponderosa pine forests cover approximately 10,000 acres in the park from approximately 1,500 to 3,000 foot elevations. Ponderosa pine is the dominant tree in this community with Douglas fir, dogwood, canyon live oak, and other scattered hard and softwood species present to a lesser extent. Black oak is codominant with ponderosa pine in many areas. The understory shrub component includes manzanita, ceanothus species, poison oak (*Toxicodendron diversilobum*) and toyon (*Heteromeles arbutifolia*). Other shrubs, herbaceous species and grasses are quite similar to those in the mixed conifer discussion above, with the exception that the lower elevation ponderosa pine communities have more annual and exotic grass cover, which may contribute to increased fire frequency. The ponderosa pine forests in the park are often intermingled with mixed oak woodlands. Representative examples of this plant community can be seen on the slopes above Brandy Creek, along the Mill Creek Trail, along the Crystal Creek Water Ditch Trail, and on Monarch Mountain.

North-facing slopes in the Whiskeytown area are primarily composed of ponderosa pine-mixed conifer forests, with some black oak woodland. In the west, these forests have a well-known, almost famous intrinsic relationship with fire with frequent lower elevation understory fires in the pre-settlement ponderosa pine type (Brown et al 1994). Pacific ponderosa pines have numerous adaptations to fire, including a thick bark and open crown structure that allows this species to survive fires. This species also has a self-pruning mechanism that reduces the chance of crown fires. Other adaptations include deep roots, a high foliar moisture content, insulated bud scales, medium to light lichen growth, and seedlings that grow optimally in soil seedbeds that are cured by fire.

Research has shown that before suppression, most ponderosa pine stands experienced low intensity surface fires with a fire frequency ranging from 6-19 years in different parts of its range. Research conducted by Skinner (in prep.) found that the median fire return intervals for the ponderosa pine-mixed conifer forests in the nearby Klamath Mountains were 7-15 years with a range of 3-55 years. Johnson (1980) conducted a fire scar analysis of Shasta Bally ponderosa pines and found that before 1900, natural fires occurred on an average of 13.5 years. Johnson also calculated the average frequencies according to aspect and found that fires occurred on south facing slopes an average of 12.9 years, southeast facing slopes 13.3 years, and northeast facing slopes 16.2 years. A fire regime for the ponderosa pine-mixed conifer communities of 7-15 years is entirely plausible when fire scar data from the park is compared with other fire history research. Ponderosa pine communities exhibit slightly longer fire season than the higher elevation mixed conifer communities. The drier, lower elevation ponderosa pine forest supports a higher percentage cover of exotic annual grasses. These annual grasses are adapted to frequent fires and can develop a fine fuel layer sufficient to carry fire in a much shorter cycle than in the higher elevation mixed conifer forest.

Knobcone Pine: Knobcone pine communities cover approximately 2000 acres in the lower elevations of the park, from about 1000 to 2000 foot elevations. Stands of knobcone pine are typically even-aged, and range from dense stands with few other associate tree species to open communities codominated by black oak, with scattered grey pine (*Pinus sabiniana*), ponderosa pine, and other occasional hardwood and softwood species. The understory is variable, but typically dominated by white leaf manzanita (*Arctostaphylos viscida*), with toyon, poison oak, coffeeberry (*Rhamnus spp.*), yerba santa, and ceanothus species. The ground cover when present can be quite diverse, consisting of a blend of perennial and annual grasses, with herbaceous species such as buckwheat (*Eriogonum spp.*), bracken fern (*Pteridium aquilinum var. pubescens*) and everlasting (*Antennaria spp. and Gnaphalium spp.*) in more open areas.

The knobcone pine community often intergrades with the ponderosa pine, mixed oak woodland, and chaparral plant communities.

Representative examples of mixed oak woodlands can be seen in the Brandy Creek area, Dry Creek area, and along Muletown Road.

Knobcone pine communities can be seen along the Mt. Shasta Mine Loop Trail, Whiskey Creek area, and along Mule Town Road towards the town of Shasta. Knobcone pines are not restricted to serpentine at Whiskeytown as they are in much of their natural range.

Knobcone pines are a serotinous species; most cones remain closed until opened by the high temperatures from fire. While this closed-cone characteristic is more pronounced in this species than the other closed-cone pines and cypress (Vogl et al. 1977), the species does succeed in the absence of fire and is common on disturbed sites. The structure and species composition of this plant community is indicative of moderate to high frequency stand-replacing fires that results in the domination of fire-dependent species. A continuous fuel layer from the surface to tree crowns frequently exists in the knobcone pine community. This continuous fuel profile promotes a high severity crown fire system under typical fire season conditions. Knobcone pines are susceptible to moderate to high intensity fire due to their thin bark. Continued production and accumulation of cones throughout its lifetime ensures that large quantities of seed are released following such fires. A long-term benefit of this type of fire for the knobcone pine is the restrictive role it plays in soil development processes. Essentially, this process limits establishment of many plant species that would otherwise compete with the knobcone pines. Little information is available about low severity fire effects on this species.

Some areas representative of this type have extremely high densities of live and dead standing trees. Limited survey data from the park show areas of knobcone pine forest with live tree densities exceeding 400 trees per acre, and some stands with over 700 standing dead tree stems per acre. Such heavy accumulations of vegetation make the application of prescribed fire unsafe without significant pre-fire mechanical treatments. In some fire monitoring plots five years following prescribed fire the total downed woody fuel loads are higher than pre-burn data (Whiskeytown National Recreation Area Fire Effects Data 2001).

Mixed Oak Woodlands: Mixed oak woodland communities cover approximately 10,000 acres scattered throughout the park at elevations up to 2,500 feet, although black oak woodland subcommunities can occur at much higher elevations. The lower elevation oak communities are dominated by black oak, canyon live oak (*Quercus chrysolepis*), and interior live oak (*Quercus wizlisenii*). Small communities of valley oak (*Quercus lobata*) are found near Clear Creek. Higher elevation communities are dominated by black oak and/or canyon live oak with scattered ponderosa pine and other hardwood and conifer species. Redbud (*Cercis occidentalis*) is found in open areas, and shrub understory species include manzanita, toyon, poison oak, wild rose (*Rosa spp.*), and several ceanothus species. Common herbaceous species include wild dandelion (*Agoseris spp.*), Indian paintbrush (*Castilleja spp.*) Indian warrior (*Pedicularis densiflora*), penstemon (*Penstemon spp.*), California Indian Pink (*Silene californica*), iris, monkeyflowers (*Mimulus spp.*), California poppy (*Eschscholzia californica*), milkweeds (*Asclepias spp.*), columbine (*Aquilegia formosa*), woolly sunflower (*Eriophyllum lanatum*), lupine (*Lupinus spp.*) mule ears (*Wyethia spp.*), brodiaea (*Brodiaea spp.*), and yarrow (*Achillea millefolium*). Representative examples of mixed oak woodlands can be seen in the Brandy Creek area, Dry Creek area, and along Muletown Road.

The natural fire regime in mixed oak plant communities varies considerably depending on the species composition and vegetation structure specific to each site (this is true of all plant communities). Black oak is capable of abundant crown sprouting following fire, as light surface fires trigger succession through sprouting (Chang 1996). The frequency and vigor of resprouts is lower with increasing fire severity. Oaks are highly variable in their response and resistance to fire because of differences in their bark thickness, tree structure, and sprouting response. Understory composition and the degree of fire intensity also influence individual survival.

One factor causing fire damage to oaks is due to the fact that most associated species are susceptible to fire damage. Canyon live oak and interior live oak have fairly thin bark and are easily top-killed by fire. However, light surface fires trigger succession in live oak species through sprouting (Chang 1996). Increased fire severity results in increased overstory tree mortality, particularly among interspersed pine species. Vigorous resprouting from black oak root crowns was observed three weeks after the extremely hot "Whiskey" wildland fire in August 1999. Other adaptations of black oak include the need for bare or almost bare soil required for acorn germination; a soil condition that results from light or moderate severity fires. Frequent low-severity fires promote a open

The blue oak grassland community can be seen in distinct patches on the south-facing slopes along Highway 299 near Crystal Creek Road. Other areas include clearly defined zones between the low elevation (1,100-2,000 feet) mixed woodland and knobcone pine plant communities along Muletown Road, toward the community of Igo.

Typical low elevation chaparral communities are found on south-facing slopes north of Whiskeytown Lake and Highway 299, and are scattered throughout the park on dry sites at lower elevations.

appearance in mixed oak woodlands similar to the mixed conifer forest, although the mixed oak woodlands can have higher structural diversity and a less distinct gap between ground fuels and overstory tree canopy than is seen in mixed conifer forests.

Blue Oak Grasslands: Blue oak grasslands cover approximately 400 acres within the park. Unlike the other plant communities, the blue oak grasslands appear to have distinct boundaries that are probably a result of soil properties and past land use practices. The dominant species is blue oak (*Quercus douglasii*) that is associated with scattered gray pine and interior live oak. Shrubs are widely spaced and include manzanita, yerba santa, ceanothus, and poison oak. The ground cover includes annual and perennial grasses such as ripgut brome, dogtail grass, starthistle (*Centaurea sp.*), fescues, wild oat (*Avena fatua*), and nut sedge (*Cyperus strigosis*). The blue oak grassland community can be seen in distinct patches on the south-facing slopes along Highway 299 near Crystal Creek Road. Other areas include clearly defined zones between the low elevation (1,100-2,000 feet) mixed woodland and knobcone pine plant communities along Muletown Road, toward the community of Igo.

Blue oak communities are generally thought to benefit from fire. Acorn survival and germination may be negatively affected by fire but there is a positive association between blue oak ages and fire dates, suggesting post fire sprouting. The low rate of recruitment since the 1940's may be partly due to fire suppression (McClaran and Bartolome 1989). The sensitivity of blue oaks to high intensity fires is not well understood; low intensity fires have little effect on the overstory tree canopy in the blue oak woodland, although above ground portions of shrubs other low growing plant species can be largely consumed. Moderate intensity fires result in varied levels of crown scorch. Frequently, large trees or stems of trees would be consumed in this type of fire, but sprouting subsequent to such fires is often quite high. The result is rapid recovery of the overstory or development of small pockets of young trees.

Infrequent fire regimes favor development of woody shrub species, while frequent fire intervals favor greater cover by grasses and forbs. Changes in the understory vegetation, primarily in the prevalence of annual exotic grass species may have an influence on the behavior of the current fire regime, but sufficient data does not exist to make this determination. It is suspected that fire exclusion for an extended period of time enables shrub species and associated tree species such as gray pine to gain in total cover, but data has not been collected to confirm this in the park.

Chaparral: Chaparral plant communities cover approximately 8000 acres in the park. The chaparral plant community varies in species composition and vegetation structure from distinct monocultures to combinations of shrub and small tree species that intergrade with other plant communities. Thick, leathery, oily leaves that form a highly flammable leaf litter layer characterize chaparral species. Such characteristics enable chaparral plants to withstand extremes in temperature and precipitation, as well as the periodic consumption of fire. This broad-leaved community is diverse, ranging from dense, impenetrable thickets to open, mixed shrub-oak woodlands. While chaparral over most of its range is characterized by stand-replacing fire, this may not apply to some of the chaparral in the park, as fire severity and fire effects in prescribed burns have been mixed.

Chaparral communities in the park are dominated by white leaf and greenleaf manzanita, ceanothus species, chamise (*Adenostoma fasciculatum*), toyon, yerba santa (*Eriodictyon californicum*), and poison oak. Oak and pine species are also sparsely scattered throughout many of the drier areas, and occur with some density on wetter sites and north and northeast facing slopes. The thick layer of leaf litter and lack of light results in a sparse herbaceous understory of species such as brodiaeas (*Brodiaea spp.*), wild onion (*Allium spp.*), chaparral honeysuckle (*Lonicera interrupta*), creeping sage (*Salvia sonomensis*), and Indian warrior (*Pedicularis densiflora*). Common exotic grasses include rye (*Lolium perenne*), cheatgrasss, and fescues (*Vulpia spp.*).

A montane chaparral plant community occupies the loose, sandy, granitic soils between the 3000 foot elevation and the top of Shasta Bally. This montane chaparral is dominated by greenleaf manzanita, combined with pinemat manzanita (*Arctostaphylos nevadensis*), common manzanita (*A. manzanita*), mountain whitethorn (*Ceanothus cordulatus*), huckleberry oak, and bush chinquapin. Understory species in this community are usually absent, and this community appears to be the result of past crown fire in forest vegetation, as well as logging of mixed conifer forests at high elevations on highly erodible soils.

A willow-scrub riparian plant community can be seen along upper Clear Creek, lower Clear Creek near Peltier Bridge Campground, and Willow Creek. A white alder riparian forest lines streams in deep, steep-sided canyon bottoms above about 2,000 feet, along Boulder, Crystal , and Brandy Creeks.

Typical low elevation chaparral communities are found on south-facing slopes north of Whiskeytown Lake and Highway 299, and are scattered throughout the park on dry sites at lower elevations. Chamise-dominated chaparral has a more limited distribution; typical populations can be found in the Whiskey Creek area and bordering the blue oak grasslands north of Highway 299 near Crystal Creek Road. Montane chaparral can be seen at the summit of Shasta Bally and on logged slopes surrounding the old-growth forest at Coggins Park.

Although fire-return intervals in chaparral vary among different sites (Skinner and Chang 1996), most shrublands are believed to be adapted to and seem to persist where there are relatively infrequent but recurring fires (Skinner 1995). Fires are characteristically intense, with soil surface temperatures reaching 650 degrees Fahrenheit, removing all or most of the above ground biomass (Kricher 1998). The natural fire regime perpetuates a mosaic of age classes within the chaparral community, decreasing the chance for widespread wildland fires. Chaparral is highly flammable and also possesses various adaptations to fire, including the ability to sprout massively and quickly from thickened root bases after even severe burning or produce a heavy crop of seedlings from fire-resistant and fire-stimulated seeds that germinate following fire (Chang 1996, Keeley 2000). Chaparral typically exhibits a highly specialized post-fire flora. The short-lived species may grow mostly, or only after fire, and exist as dormant seed between fires. Vegetative responses vary and are determined by a complex interaction of temperature, soil moisture, heat duration, depth of burn, and season of burn (Weatherspoon 1988). Bulb plants that may be more or less dormant between fires typically grow vigorously after fire, and may exhibit fire-dependent, or fire enhanced reproduction (Tyler in press). Seeds of ceanothus species germinate vigorously following fire (Hastings and DiTomaso 1996).

In some areas of the chaparral plant community, species composition following fire closely resembles what was there before the fire, which suggests that chaparral is the climax community. Such communities recover quickly from fire and regain dominance soon after (Biswell 1974). In other areas, however, the absence of fire or occurrence of low severity fire allows the slow development of an overstory tree canopy that can eventually dominate a site. This process is highly pronounced in the montane chaparral community, where shrub species face competition with tree species. Therefore it takes high severity fire effects to remove the tree species and allow the establishment of chaparral. After initial establishment, periodic moderate to high severity fires help maintain the chaparral by killing trees before they shade out the shrubs, whereas alternative fire regimes allow the trees to regain dominance.

Historically, the intense, fast-moving fires characteristic of chaparral were confined by natural fuel breaks formed by age-class boundaries and topographic features. Research by Minnich (1995 and earlier papers cited therein) in Baja California suggested that fire maintained a relatively fine scale age class mosaic there. Recent research (Keeley et al. 1999, Moritz in press) has found that north of Baja California, fires would tend to burn through chaparral of any age class older than about 5 years, i.e. that fire spread is largely determined by weather.

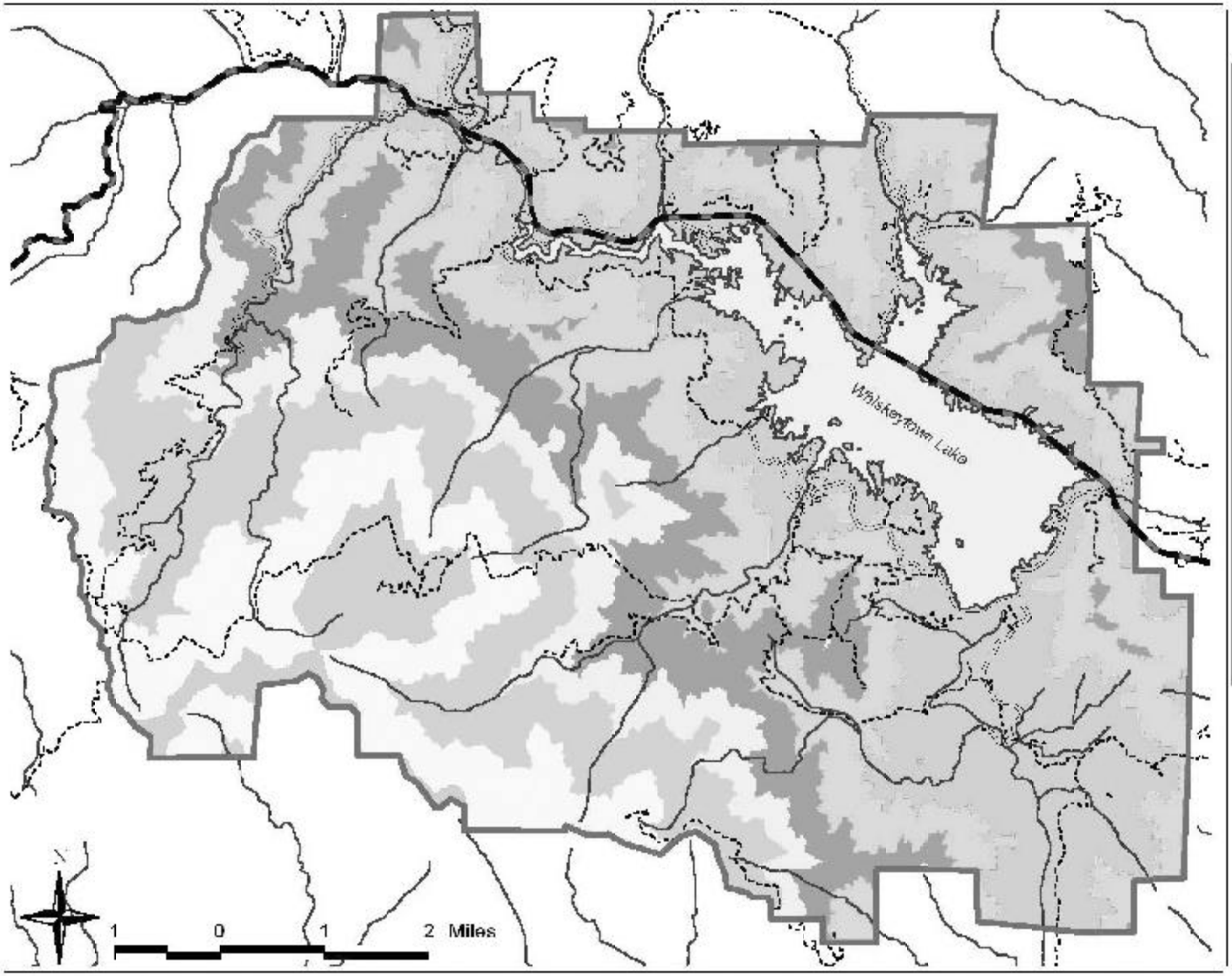
Successful seedling establishment of many plant species in chaparral plant communities does not occur in the absence of fire. Fire return intervals in chaparral appear to be quite variable, depending upon local site conditions, proximity to areas of American Indian use, and elevation. Chaparral fire return intervals generally have been estimated to be 20-50 years with ranges of approximately 10-100 or more years (Keeley 1982, Kilgore 1987, Barro and Coparkd 1991). Studies about chaparral fire intervals in California are generally confined to studies on the Coast and Transverse ranges, and may represent conservative estimates of fire frequency for inland areas like Whiskeytown due to the differences in lightning frequency and burning conditions (Keeley 1982).

Riparian Vegetation: Whiskeytown lies at the confluence of seven perennial tributaries that form one of the largest watersheds flowing into the Sacramento River. Riparian communities cover approximately 4,000 acres and vary in species composition and vegetation structure depending on elevation, steepness of slope, aspect, and quantities and timing of the water source. Although vigorous and well vegetated, little data is available on the vegetation of the riparian communities. Tree species occurring on canyon slopes and seasonal ravines primarily consist of Douglas fir, canyon live oak, dogwood, bigleaf maple (*Acer macrophyllum*), and scattered mixed conifers. On canyon bottoms, the lake edge, and more moist sites tree species include Fremont's cottonwood (*Populus fremontii*), black cottonwood (*Populus balsamifera ssp. trichocarpa*), willow (*Salix spp.*.), White alder (*Alnus sp.*), and Oregon ash (*Fraxinus latifolia*).

Whiskeytown National Recreation Area
California

National Park Service
U.S. Department of the Interior

Plant Communities



Legend

- > 5000 ft. Montane Chaparral, Mixed Conifer Forest
- 4000 ft. - 5000 ft. Mixed Conifer Forest, Montane Chaparral
- 3000 ft - 4000 ft. Mixed Conifer Forest, Ponderosa Pine, Mixed Oak Woodland
- 2500 - 3000 ft. Ponderosa Pine, Mixed Oak Woodland, Mixed Conifer Forest
- 2000 - 2500 ft. Ponderosa Pine, Mixed Oak Woodland, Chaparral
- 1500 - 2000 ft. Mixed Oak Woodland, Ponderosa Pine, Chaparral
- < 1500 ft. Chaparral, Knobcone Pine, Mixed Oak Woodland

* Vegetation communities are listed in order of dominance for each elevation band. For example, in the < 1500 foot elevation band: Chaparral is most dominant, followed by Knobcone Pine, and Mixed Oak Woodland is least dominant.

* This vegetation map reflects general vegetation communities and dominance. A more detailed and accurate vegetation mapping effort is currently being completed.

Understory species are quite variable. Native shrub species include California blackberry (*Rubus ursinus*), wild grape (*Vitus californica*), western azalea (*Azalea spp.*), miner's dogwood (*Cornus sessilis*), spice bush (*Calycanthus occidentalis*), button willow (*Cephalanthus occidentalis var. californica*), snowberry (*Symphoricarpos albus var. laevigatus*), and California wild rose (*Rosa spp.*), with chaparral species such as buckeye and snowdrop bush (*Styrax officinalis*) mixed in along the periphery. The understory is a combination of Indian rhubarb (*Darmera peltata*), grasses such as slender hair grass (*Deschampsia elongata*) and rattlesnake grass (*Briza spp.*), Horsetails (*Equisitum spp.*), sedges, rushes, ferns, cattails (*Typha spp.*), and herbaceous species such as soaproot (Chlorogalum pomeridianum), California pipevine (*Artistolchia californica*), buttercups, (*Ranunculus spp.*), phacelia (*Phacelia spp.*), monkeyflower, smartweed (*Polygonum spp.*), mugwort (*Artemesia douglasiana*), miner's lettuce (*Claytonia perfoliata and Montia parviflora*), self-heal (*Prunella vulgaris*), dock (*Rumex spp.*), and violets (*Viola spp.*).

The exotic Himalayan blackberry chokes a significant portion of the riparian community. Other common exotic species include black locust (*Robinia pseudoacacia*), cut-leaf blackberry, plantains (*Plantago spp.*), and mulleins (*Verbascum thaspus and V. blattaria*).

A willow-scrub riparian plant community can be seen along upper Clear Creek, lower Clear Creek near Peltier Bridge Campground, and Willow Creek. A white alder riparian forest lines streams in deep, steep-sided canyon bottoms above about 2,000 feet, along Boulder Creek, Crystal Creek, and Brandy Creek. A unique yew-willow riparian woodland with California yew (*Taxus spp.*) and a variety of willows is found on Shasta Bally.

The role of fire in riparian areas is uncertain, as minimal data is available (Agee 1994). The assumption can probably be made that fire regularly affected most forest zone riparian areas prior to fire suppression, although more moist conditions would offer some protection. Species-specific effects of fire on individual plants vary, although most riparian plants are not adapted to high intensity fire. Some species, such as pacific yew, are quite sensitive to temperatures generated in even low-intensity fire. Although prescribed burning reduces the probability of high severity wildland fires, precautions must be exercised to maintain biodiversity by protecting temperature-sensitive species, such as Pacific yew. Willow species appear to sprout vigorously and grow rapidly following fire or other disturbances. Skinner (1997) found that in areas with intermittent streams in the upper Klamath Mountains, fires appear to have burned with a frequency similar to the surrounding uplands. Skinner's work found a range of fire return intervals within these riparian areas to be 6-47 years, with a median fire return interval of 13 years.

Special Status Plant Species: National Park Service management policies and the Endangered Species Act mandate protection of special status plants and their habitats. The National Park Service is also responsible for providing information to the U.S. Fish and Wildlife Service on the status of candidate or proposed candidate plants within their jurisdiction. The implementation of inventory and monitoring protocols is required to collect this information.

An extensive floristic inventory of the park and collection of herbarium voucher specimens was initiated in 1986 by David Biek, and completed with the assistance of the Shasta Chapter of the California Native Plant Society. Sixteen sensitive plants are known to occur in the park. Sensitive plant species are plants that are not officially listed as threatened or endangered by the State of California or the federal Endangered Species Act, but warrant consideration and protection due to limited distribution, scarcity of individuals, or the likelihood of becoming listed as threatened or endangered. These sixteen plants and their current status are detailed in the California Native Plant Society publication "*Inventory or Rare and Endangered Plants of California, sixth edition*", 2001.

There are no known state or federally listed threatened or endangered plants in the park, although blue elderberry is host to the federally listed threatened valley elderberry longhorn beetle, and the elderberry must be protected as if it were listed. Potential impacts from visitor use, developments, fire management actions, air pollution, road maintenance, and other disturbances are undocumented.

The current status of some of these plants in the park is unknown, and some historic populations have not been surveyed since the late 1980s. Survey and inventory work on these sensitive plants was initiated in 2000, and current inventory data can be found in Appendix A: Whiskeytown National Recreation Area Species List. Two species, Shasta County arnica and Howell's alkali grass have been monitored sporadically for several years. Sporadic

monitoring is ongoing for both species, using protocols developed by the park.

Shasta County arnica is a plant limited in distribution known to occur only in a 35 mile radius area around Shasta Lake, Trinity Lake, and Whiskeytown Lake. Monitoring since 1992 indicates that populations are increasing or holding their own. The plant seems to prefer disturbed areas like road cuts and fuel breaks with a north or northeast aspect.

Howell's alkali grass (*Puccinellia howellii*), a rare grass whose only known global location is in Whiskeytown National Recreation Area, was recognized as a distinct species in 1989 and little is known about its biology and ecology. Some studies have been completed that are available at the park for review. The grass appears to be an obligate wetland species and the only known worldwide population is unevenly distributed within a complex of three mineral springs at an elevation of approximately 1,350 feet. Realignment of Highway 299 in 1991 destroyed 1,200 square feet of plants and habitat, and may have altered the hydrology of the springs. The proximity of the grass to the highway means it is potentially subject to high severity events that could eliminate all or a major portion of the population, and/or its habitat. This species could be considered stable and sustainable only if additional populations are discovered in other protected locales.

Formal management and recovery plans for Howell's alkali grass have yet to be addressed. Measures to protect the grass would also protect the mineral springs, a rare community that is of considerable importance to wildlife and critical habitat for Howell's alkali grass. To preclude federal listing as threatened or endangered, the National Park Service and U.S. Fish and Wildlife Service are developing a conservation agreement that will include the California Department of Transportation and the California Department of Fish and Game. The conservation agreement would outline protection measures to be implemented, the contributions of each agency, and provide for listing the species as Endangered if the conservation agreement fails to result in adequate protection.

Two additional species of concern within the park include blue elderberry (*Sambucus mexicana*) and McNab Cypress (*Cupressus macnabiana*). Although the tree is not listed as threatened, endangered, or sensitive by federal or state governments or the California Native Plant Society, the park considers McNab Cypress to be a species of concern due to its limited range and apparent decline in the park. Whiskeytown is the northernmost extension of McNab cypress, and the type location for the species. According to Biek (1988), a grove of McNab Cypress grew on metavolcanic rock along Clear Creek downstream from the historic town of Whiskeytown. This area is now beneath the waters of Whiskeytown Lake. A few specimens were transplanted to various locations in the park and to two residences in the towns of French Gulch and Redding. One specimen that appears to be naturally recruited is found near Clear Creek near the Tower House Historic District. Anecdotal information indicates that there were others scattered around the park. Three of these specimens remain; the others have been inadvertently removed by work crews, died from probable development impacts, or appear to be dying as a result of being limbed. Of the three remaining specimens, two are near failure from slumping, and are threatened by a restoration project. McNab Cypress is exceedingly difficult to propagate but several have been successfully grown from seed and are being planted in appropriate areas in the park. These appear to be doing well, and the park will continue to propagate and plant this uncommon tree.

Blue elderberry is a species of concern because it is the host plant for the federally listed threatened valley elderberry longhorn beetle. Several elderberry shrubs grow near Trinity Mountain Road along Clear Creek. The park is required to protect the elderberry in accordance with guidelines provided by the U.S. Fish and Wildlife Service.

Invasive Plant Species: Numerous exotic or alien plant species have become established in some areas of the park, and exotics currently account for approximately 25-30 percent of the plants in the park. Many exotic plants are highly invasive, able to out-compete native species, and disrupt native plant communities and processes. An accurate and complete assessment of the abundance and extent of exotics in the park initiated in 2002 was completed in 2003. Several infestations have been successfully treated and control efforts for the next several years are expected to achieve a significant reduction in exotic plant populations in the park. Treated areas will require monitoring and retreating indefinitely. The park works cooperatively with the Shasta County Weed Management Area to eradicate exotics across boundaries.

Mandates that require direct action to monitor and control the spread of exotics include the 1916 National Park Service Organic Act, the General Management Plan for the Whiskeytown Unit (2001), and agency-wide policy document National Park Service-75 (1992). Changes in vegetation resources must be observed and documented in order to interpret and analyze such changes as the basis of informed decisions.

The goal of the exotic plant program is to reduce exotic pest plant populations in the park and allow re-colonization by native species. Developed areas along main roads are currently being treated, and back country sites will be treated secondarily, working from the least to the most infested areas, which has been shown to be the most effective method (Fuller and Barbe 1985). Strategies are outlined below:

1 Inventory and map exotic plants in developed areas;

2 Prioritize areas with regard to urgency and develop area plans;

3 Develop education programs for visitors and employees;

4 Control high priority exotic plant species;

5 Monitor treated areas at least annually; and,

6 Conduct regular and repeated maintenance to prevent re-infestation.

Relationships between fire and the spread of invasive exotic species have become increasingly clear over the past few years, but little data is available for the return of exotics following fire in the park. Bull thistle (*Cirsium vulgare*) has colonized the "Coggins IV" burn unit and the Salt Creek shaded fuel break with dozens of plants that were not previously noted in that location. Himalayan blackberry responds vigorously to fire of all severity classes, and is well adapted to invade recently burned areas. Mustards and thistles are known to proliferate following fire, and exotics are thought to become dominant due to increased light and nutrient availability. Other exotics found in the park that respond favorably to burning include giant reed, perennial rye (*Lolium perenne*), cheatgrass (*Bromus tectorum*), medusahead (*Taeniatherum caput-medusa*), tamarisk (*Tamarix chinensis*), and the brooms. Brooms expand their distribution with a single fire, but may be controlled with repeated fire (Odion and Haubensak 1997).

Some invasive exotics build up a large seedbed in the soil, with viable seed lasting for many years until the next disturbance. Short fire-return intervals caused by increased flammability of the dense grasses can type-convert native communities, as native plants are unable to survive these frequent fires (Brooks 2001). The increase in fire frequency can be significant. Return intervals increased from 60-100 years to 3-5 years in certain locations of the Great Basin following invasion by exotic grasses (Giessow and Zedler 1996).

Sensitive Plants in Whiskeytown National Recreation Area

Sanborn's onion	*Allium sanbornii*
Three-bract onion	*Allium tribracteatum*
Shasta County arnica	*Arnica venosa*
Clarkia	*Clarkia mildrediae* and *Clarkia virgata*
Clustered lady's slipper	*Cypripedium fasciculatum*
Small spikerush	*Eleocharis parvula*
Red-anthered juncus	*Juncus marginatus var. marginatus*
Rattan's linanthus	*Linanthus rattanii*
Tehama navarretia	*Navarretia heterandra*
Snowmountain beardtongue	*Penstemon purpusii*
Howell's alkali grass	*Puccinellia howellii*
Sanford's arrowhead	*Sagittaria sanfordii*
Canyon Creek stonecrop	*Sedum paradisum*
Western trillium	*Trillium ovatum*
Trinity Mountain triteleia	*Triteleia crocea var. crocea*

Wildlife

The Whiskeytown Unit supports an abundant and diverse wildlife community, which reflects the diversity of the vegetative communities in the park. More than 200 vertebrate species are known to occur in the park, including at least 35 mammal species, 150 bird species, and 25 reptile and amphibian species (Appendix A). Additional species are likely to be confirmed in the park as wildlife inventories become more complete. The perpetuation of relatively intact wildlife populations within the park is partially dependent on the ability of public and private land managers to ensure that adequate habitat is protected in and around the park boundary. The population of Redding has grown from 16,000 to 80,000 in 20 years, and some encroachment on wildlife habitat near the park has occurred. Habitat fragmentation resulting from current and past land management actions within and outside of the park boundary continues to be a major threat to wildlife. High severity wildland fire from fuel buildup and the introduction of exotic species are other major threats.

Whiskeytown Lake and its tributaries support a large variety of fish, both native and exotic. Fish present at Whiskeytown include rainbow trout (*Salmo gairdnerii*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), spotted bass (*Micropterus punctulatus*), Kokanee salmon (*Oncorhynchus nerka kennerlyi*), chinook salmon (*Onchorhynus tshawytscha*), bluegill (*Lepomis macrochirus*), black crappie (*Poxomis nigromaculatus*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), channel catfish (*Ictalurus punctatus*), brown bullheads (*Ictalurus nebulosus*), Sacramento squawfish (*Ptychocheilus grandis*), hardhead (*Mylopharodon conocephalus*), green sunfish (*Lepomis cyanellus*), western suckers (*Catostomus occidentalis*), and riffle sculpins (*Cottus gulosus*). The California Department of Fish and Game regularly stocks rainbow trout in Whiskeytown Lake and some of the perennial streams during the spring and summer months. The lake has also been historically stocked with brown trout and kokanee salmon.

Special Status Animal Species: Whiskeytown National Recreation Area also has responsibility to protect and perpetuate sensitive, unique, rare, threatened, or endangered fauna. Good data exists documenting most rare, threatened, or endangered animals. As watershed restoration efforts to increase the number of listed fish species up lower Clear Creek continue, there is the likelihood that all of these species would increase in numbers. The lack of good information on vegetation now makes the evaluation of habitat used by potential rare, threatened, or endangered animals difficult, and makes decisions about managing these species somewhat subjective. After a vegetation-mapping project currently underway is completed, the ability would exist to readily retrieve habitat population data that would facilitate analysis.

Two federally threatened wildlife species are known to occur in the park, the bald eagle (*Haliaeetus leucocephalus*) and the northern spotted owl (*Strix occidentalis caurina*). Bald eagles were first documented as nesting at Whiskeytown Lake in 1973. Whiskeytown currently hosts two nesting pair of bald eagles as well as a substantial wintering population. The goals of bald eagle management at Whiskeytown are to protect nesting bald eagles from disturbance and to maintain and enhance bald eagle habitat. The following actions are taken to accomplish these goals:

1 Eliminate disturbances to bald eagle nest sites between January 1st and July 31st of each year by restricting access to nesting territories via area closures;

2 Consult with the U.S. Fish and Wildlife Service, under section 7 of the Endangered Species Act, prior to development or habitat manipulation within a bald eagle nesting area;

3 Conduct low intensity prescribed fires that preserve dominant trees and reduce fuel loads to decrease the probability of high severity wildland fire;

4 Periodically monitor bald eagle prey base, especially fish and waterfowl populations, to document changes that could affect eagle productivity; and,

5 Develop silvicultural prescriptions, in conjunction with U.S. Fish and Wildlife Service, to manage for present and future suitable bald eagle nesting habitat.

Two nesting pairs of bald eagles were monitored for nesting success sporadically from 1979 to 1986. Bald eagles have been closely monitored for nesting success and productivity since 1986. Areas of the park that contain potential bald eagle nesting habitat are surveyed annually for potential new nesting

territories. California Department of Fish and Game Bald Eagle Nesting Territory Report Forms are completed at the end of each nesting season. Additionally, the park participates in the annual U.S. Fish and Wildlife Service midwinter bald eagle survey.

A single pair of nesting northern spotted owls with two fledglings was discovered in the summer of 1994. The activity center has been be monitored annually since this time and records are kept detailing nesting location, status, and production. This activity center has successfully produced young during three of the last seven years. Spotted owl surveys are ongoing and eventually all suitable habitat within the park would be surveyed. The detection of additional pairs of northern spotted owls is possible as some suitable habitat exists in some of the more remote areas of the park. The park consults with the U.S. Fish and Wildlife Service, under section 7 of the Endangered Species Act, prior to development or habitat manipulation in areas meeting the criteria for suitable spotted owl habitat.

The range of the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), a federally threatened species, overlaps the park and some suitable habitat may exist in the lower elevation riparian areas, but no sightings of either the beetle have been confirmed to date. Elderberry has been documented along a portion of Clear Creek above the reservoir.

The peregrine falcon (*Falco peregrinus*), a recently federally de-listed species and state Endangered Species, has been reported a few times by members of the local chapter of the Audubon Society and is likely a migrant, although some potential nesting habitat may exist on the southeast side of Shasta Bally.

Two federally threatened fish species occur in Clear Creek below Whiskeytown Dam. These are the spring-run chinook salmon and Central Valley (Evolutionary Significant Unit) steelhead trout. The removal outside of the park of McCormick-Saeltzer Dam on lower Clear Creek in the fall of 2000 has allowed these two species access to Whiskeytown. These anadromous fish are now utilizing portions of lower Clear Creek within Whiskeytown for spawning. Spawning gravel is being added to Clear Creek below Whiskeytown Dam to enhance this habitat.

The park also contains six federal Species of Concern. Those species are foothill yellow-legged frog (*Rana boylei*), tailed frog (*Ascaphus truei*), northwestern pond turtle (*Clemmys marmorata marmorata*), pacific fisher (*Martes pennanti pacifica*), and the pacific western big-eared bat (*Corynorhinus townsendii townsendii*). Whiskeytown contains several species with California State status but no federal status. The bank swallow (*Riparia riparia*), a California threatened species, has been observed several times within the park by members of the local Audubon Society and is probably a rare summer resident. The following species are confirmed to occur at Whiskeytown and are California Species of Special Concern: Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), osprey (*Pandion haliaetus*), yellow-breasted chat (*Icteria virens*), yellow warbler (*Dendroica petechia*), common loon (*Gavia immer*), California gull (*Larus californicus*), double-crested cormorant (*Phalacrocorax auritus*), pallid bat (*Atrozous pallidus*), and merlin (*Falco columbarius*). As wildlife inventories become more complete additional species with federal or state status may be discovered within the park.

Ecologically Critical Areas

For the purposes of this document, the following four areas within the park are considered to be ecologically sensitive as they embody unique and special resource values as described below.

Mineral Springs

One of the most unique and ecologically sensitive areas within the park is a complex of three noncontiguous mineral springs that occur between a 1,200 foot segment of Willow Creek and Highway 299. Despite extensive surveys, this is the only known global location Howell's alkali grass, an obligate wetland grass species that appears to have specific microhabitat requirements to the alkali water that seeps from the skeletonized soils and rock outcrops. Aside from being critical habitat for Howell's alkali grass, this site is recognized to be a community of considerable importance to wildlife, and species of concern, such as Pacific fishers, band-tailed pigeons, and foothill yellow-legged frogs are documented to use the site. The mineral springs are also a culturally significant area listed by the State of California as a Significant Natural Area (SHA-41).

Old Growth

The sections of unlogged old-growth forest in the park constitute ecologically sensitive areas with unique aesthetic and natural resource values. These old growth forests represent those that covered the mountain slopes prior to logging, and provide an intact and relatively

Brandy Creek drains off of Shasta Bally.

undisturbed habitat for flora and fauna that are threatened throughout the Klamath Mountains. The old growth sections may be a close representation of desired future conditions in mixed-conifer and ponderosa pine forests in the park.

Perhaps the greatest threat to the old-growth forests is the unnatural accumulation of ladder fuels due to fire suppression. Significant soil disturbance is another concern, due to the steep topography and highly erodible soils. Some old-growth areas qualify as critical habitat for goshawks, numerous amphibians, and the federally threatened spotted owl. Some sensitive plant species such as yellow tritieleia, and Salmon Mountains wakerobin grow in the mature, moist conditions, as do phantom orchid, spotted coral root, rattlesnake plantain, tiger lily, white-flower bog orchid (*Piperia unalescensis)*, and broadleaf twayblade.

Top of Shasta Bally

One small section at the summit of Shasta Bally presents the only example of the sub alpine meadow community found in the park. The area is located on the east side of the summit in a shallow bowl, surrounded by red fir, where deep snow accumulates in the winter. This area is ecologically sensitive and highly susceptible to disturbance. The melting snow provides water to the fine, porous, decomposed granite soil. Grasses, sedges, rushes, and small herbs cover the ground and a small patch of false hellebore (*Veratrum californicum var. califonicum*) also grows here, in the wettest spot. This species is characteristic of the Wet Sub alpine Meadow community that is common the Klamath Mountains but rare within the park. Other plants found here include the sensitive species snow mountain beardtongue, three-bract onion, clustered lady's slipper, yellow triteleia, and bog orchid.

Riparian habitats

Riparian plant communities provide wildlife corridors and habitat for aquatic species of plants, animals, and invertebrates. Biodiversity, water quality and quantity and recreation values are provided, enhanced, and protected in riparian areas. Some species, such as pacific yew, are quite sensitive even to low-intensity fire, and precautions must be taken to protect yew and other temperature-sensitive species.

Geophysical Environment

Geologic Resources

Physical, chemical, spatial, and temporal characteristics of Whiskeytown's geology dictate the response of the rocks and associated soils to the actions proposed in each alternative. For example, older rocks tend to be more fractured and these physical and temporal properties can contribute to erosion. Chemical composition of rock can also inhibit or accelerate erosion. Weathering of bedrock is influenced by spatial properties such as relief, altitude, and aspect. All rock units within Whiskeytown are considered highly to extremely erosive when disturbed due to their chemical composition, fracture, and weathering environment.

Whiskeytown is located in the Eastern Klamath Metamorphic Belt of the Klamath Geologic Province. The five major exposed bedrock units range in age from the very old lower Devonian Copley greenstone to the relatively less old lower Cretaceous Shasta Bally batholith. Also present within Whiskeytown are several dike intrusions ranging in composition from aplite to dacite. Unconsolidated Quaternary units expressed as colluvial and alluvial deposits locally overlie all units. All Paleozoic units are folded, jointed, and thrust faulted and/or normal faulted.

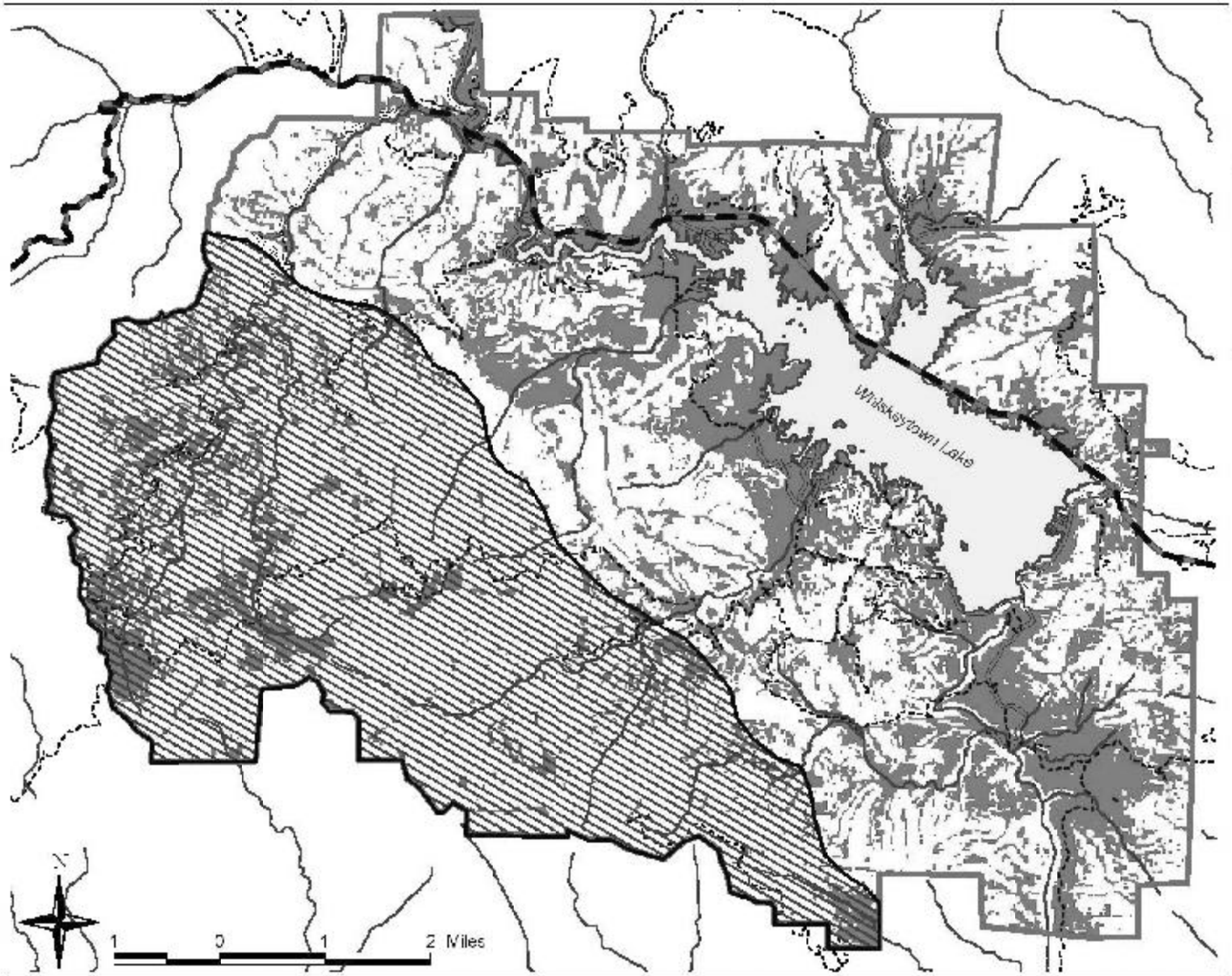
The oldest exposed bedrock units are the volcanic lower Devonian Copley greenstone and the Balakala rhyolite, which cover about 30 % of the geology within Whiskeytown. The units are considered contemporaneous in age and emplacement with an often inter-fingering contact relation. Copley greenstone is considered to be of near-shore oceanic origin to onshore (Albers 1964) and composed of keratophyre, spilite, meta-andesite, tuff, shaly tuff, and shale. Subsequent hydrothermal alteration of mafics to chlorite provides the pervasive green color. The Balakala rhyolite is considered to be of onshore to near-shore origin and is composed of porphyritic quartz keratophyre, tuff, and tuffaceous shale. The Balakala rhyolite is albitized from the same hydrothermal processes that altered the Copley greenstone. Medium-temperature, medium-pressure contact metamorphism from intrusion of the Shasta Bally batholith has alteration zones of granulite and amphibolite facies present within these units. Both of these units are highly fractured, faulted, and folded, increasing their susceptibility to erosion.

Stratigraphically above and in unconformable contact with the Balakala rhyolite and Copley greenstone is the Bragdon formation of

Whiskeytown National Recreation Area
California

National Park Service
U.S. Department of the Interior

Potential Mechanical Treatment Areas



Legend

- < 30% Slope. All Levels of Mechanical Fuel Treatments Possible
- Decomposed Granitic Soils. No Level 2 or 3 Mechanical Treatment

Mississippian age. This contact is locally referred to as the Spring Creek thrust. The Bragdon formation is composed of three units variously composed of conglomerate, sandstone, siltstone, shale mudstone, and tuff. A fourth unit is composed of phyllite derived from contact metamorphism of the Shasta Bally batholith. This formation is highly fractured, faulted, and folded, increasing their susceptibility to erosion.

The Jurassic Mule Mountain stock covers about 20% of the geology within Whiskeytown and is stratigraphically above and in unconformable contact with the Bragdon formation. This plagiogranite ranges in composition from albite granite to trondhjemitic granite. The Mule Mountain stock is very unstable due to the highly fractured, faulted, and folded history and post-emplacement albitazation.

The youngest non-Quaternary rock is the Cretaceous Shasta Bally batholith and associated dike intrusions and covers about 35% of The park geology. The Shasta Bally batholith as has three facies that range from quartz diorite to granodiorite and are differentiated by the ratio of hornblende and biotite and by crystalline size. Biotite is an expansive mica mineral that readily decomposes with water and is the primary cause of extreme erosion. A large zone (70% within the park) of the batholith has a very high ratio of biotite to hornblende and is extremely erosive. Several dikes occur within Whiskeytown are a result of emplacement of the batholith.

Whiskeytown has a long history of placer and ore mining that dates back to the 1850s. Two past igneous events, emplacement of the Mule Mountain stock and Shasta Bally batholith, created conditions for gold and base metal ore deposits. These deposits are not just within Whiskeytown, but are also exposed just outside of the park boundary. Most notable of these intrusions are the Iron Mountain and Birdseye porphyry. The Iron Mountain Copper-Zinc district was created when the Mule Mountain stock was intruded into the Copley greenstone. Metasomatic fluids migrating through fractures in the Copley greenstone melted base metals and transported these components for emplacement along a normal fault and fold. Birdseye porphyry, a dike rock from the intrusion of the Shasta Bally, is the principle rock with spatial association to gold.

Soils: The soils within Whiskeytown are typical of soil formation within the Eastern Klamath Metamorphic Belt of the Klamath Geologic Province with the exception soils formed on the Shasta Bally batholith. Generally, soils within Whiskeytown can be described according to parent material, elevation, slope, and vegetation cover. The general Great Soil Groups in Whiskeytown as defined by the Natural Resource Conservation Service (formerly the Soil Conservation Service) consist of entisols, inceptisols, spodosols, alfisols, and limited mollisols. More specific soil descriptions vary on localized conditions.

The higher elevation steep slopes (greater than 30°) have poorly developed soils described as entisols and inceptisols. More specific, the decomposed granite entisols Shasta Bally batholith, which forms most of the high elevations on the south side of Whiskeytown can be described as saprolites, because no soil horizons exist except for vegetation laying on top of the decomposed granite. The inceptisols tend to be on less steep slopes with vegetation and exhibit a higher degree of soil formation than the entisols; usually having organic material incorporated and exhibiting weak horizon formation.

The lower altitudes of Whiskeytown tend to have less steep slopes (less than 30%) and mixed conifer, deciduous, and chaparral vegetation. These soils have a greater horizon formation than the entisols and inceptisols. Typical of these environments, spodosols and alfisols form depending upon the local vegetation cover. The spodosols form in more acidic conditions inherent to coniferous vegetation and the alfisols form in less acidic conditions in oak woodland and chaparral vegetation. The mollisols form in grassland environments.

Exposed Bedrock Units in Whiskeytown National Recreation Area

Feature	Age	Type
Shasta Bally batholith	Cretaceous (Mesozoic)	granodiorite to quartz diorite
Mule Mountain stock	Jurassic (Mesozoic)	metaplagiogranites
Bragdon formation	Mississippian (Paleozoic)	sedimentary
Balakala rhyolite	Devonian (Paleozoic)	metavolcanics
Copley greenstone	Devonian (Paleozoic)	metavolcanics

Water quality within the park is generally of very high quality, although some watersheds are affected by acid mine drainage from past mining practices.

WATER QUALITY

Whiskeytown is a water-based recreation area with significant water resources that attract many visitors who enjoy the cool, clear water. Whiskeytown Lake covers 3220 surface acres with 240,000 acre-feet of water at full capacity, 1210 feet above sea level. Whiskeytown Dam impounds the Clear Creek watershed on the southeast end of the recreation area and the lake is fed by seven major watersheds, Clear Creek, Brandy Creek, Crystal Creek, Boulder Creek, Mill Creek, Willow Creek, and Whiskey Creek. During the dry summer months, Whiskeytown Lake receives most of is water from Trinity Lake via a 17 mile underground tunnel which empties in Whiskeytown Lake at the Carr Powerhouse at a maximum rate of 3200 cubic feet per second. Below the dam, the major tributary to Clear Creek is Paige Boulder Creek which drains into Clear Creek about one mile downstream from the Whiskeytown Dam. Additionally, many intermittent streams drain into Whiskeytown Lake. Several streams, most notably Cottonwood Creek, drain outside of the Clear Creek watershed. Whiskeytown Lake supplies power generation at the Spring Creek Powerhouse along the Sacramento River via an underground tunnel, irrigation for the California Central Valley crops, and drinking water for the Lower Clear Creek Water District.

Water quality within the park is generally of very high quality, although some watersheds are affected by acid mine drainage from past mining practices. The streams on the southern side of the recreation area flow through virtually pristine watershed conditions with a large snow pack component from the higher elevations. North side streams are known to or have the potential for acid mine drainage. Whiskeytown Lake provides clean, cool water year round.

Baseline data for the south side is gathered at a water quality monitoring station on Paige-Boulder Creek. The monitoring station gathers the following data: pH level; specific conductivity; temperature; dissolved oxygen; turbidity; and, stage of flow.

Paige-Boulder Creek is considered representative of the park's south side streams including Crystal Creek, Brandy Creek, Mill Creek, and Boulder Creek. The specific conductivity of Paige-Boulder Creek ranges from 30-70 mmhos with an average of about 50 mmhos. The pH ranges from about 7.2 to a maximum of 8.2 with an average around 7.7. Turbidity ranges from 0-100 NTU and dissolved oxygen is considered to be a saturation level and ranges from 9-12 mg/l. Temperature ranges from 2-25°C. These range values are seasonal and fluctuate with precipitation. The south side drainage's are impacted from past timber harvest activities, which have the potential to increase turbidity in the watersheds as the old logging roads deteriorate, introducing sediments into the system.

Watersheds on the north side of Whiskeytown all have past mining activities that have impaired or have the potential to impair water quality. Base metal and gold mining inside and outside of The park boundaries has left a legacy of acid mine drainage problems, and currently the National Park Service is quantifying the extent of the damage to these watersheds and the water that flows from them. These watersheds include Willow Creek and Whiskey Creek and other smaller tributaries on the north side also have potential for acid mine drainage. The only watershed that has been quantified is Willow Creek, which has its headwaters to the west of Whiskeytown and enters Clear Creek near the Tower House District. Large amounts of iron, zinc, aluminum, and lesser quantities of cadmium and other metals drain from the old Greenhorn Mine into Willow Creek and the waters of Whiskeytown Lake. Willow Creek is listed on the California State 303d list for non-attainment of water quality standards.

Biological impairment of Whiskeytown Lake in the form of fecal coliform and e. coli have been identified at three of the swim beaches Oak Bottom, East Beach, and Brandy Creek during summer recreational periods. These occurrences are extremely rare and are not interpreted as chronic problems. Because of these isolated incidents, Whiskeytown Lake has been added to the California State 303d list non-attainment of water quality standards.

Wetlands/Floodplains

Whiskeytown has considerable wetland resources that are centered around Whiskeytown Lake, and as a result of the Whiskeytown Dam impoundment, has a minimal amount of functional floodplains above and below the dam.

The entire shoreline of Whiskeytown Lake is considered an artificial wetland, because of the seasonably stable height of the lake and its associated vegetation. Operation of the lake by the US Bureau of Reclamation maintains two seasonal shorelines, full pool at 1,210 feet above sea level during the summer and approximately 1,193 feet during the winter season. The standard operations of the US Bureau of Reclamation raises the lake elevation in April or May for the summer to accommodate recreation and lowers the lever in October or November for winter flood protection of the Sacramento River. These two discrete water levels form a seasonal zone of inundation that fluctuates fifteen to twenty feet vertically and about forty to fifty feet horizontally based on an average shoreline slope of twenty to twenty five degrees. Other smaller wetlands occur locally along streams both above and below Whiskeytown Dam.

When Whiskeytown Dam was constructed in the mid 1960s, it impounded Clear Creek, which altered the traditional hydrologic response of Clear Creek and the tributary creeks many miles above and below the dam. Clear Creek now only has a functional floodplain for about two miles as it enters the park's northernmost boundary. The historic pre-dam floodplain below the dam is no longer functional because of the diminished releases. The existing floodplain is overgrown with riparian vegetation and is incised within its channel. Other floodplains exist on the lake confluence with Brandy Creek and Boulder Creek and at the confluence of Clear Creek and Paige-Boulder Creek. Wetlands in these areas and up these major creeks have never be delineated.

Air Quality

Whiskeytown National Recreation Area is classified as a Class II airshed under the Federal Clean Air Act (42 USC 7401 et seq. as amended). The Federal Clean Air Act stipulates that federal land managers have an affirmative responsibility to protect a park's air quality-related values, including visibility, plants, animals, soils, water quality, cultural and historic structures and objects, and visitor health from adverse air pollution impacts. The Shasta County Air Quality Control District regulates air quality issues within Whiskeytown. Air quality is an important issue when considering how park fire management policies affect the park/ urban interface. Since air quality would be affected in the short-term during any ignition event, it is an issue requiring analysis.

The Federal Clean Air Act, as amended in 1990, requires the Environmental Protection Agency (EPA) to identify National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. Standards have been set for six pollutants: ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), particulate matter less than 10 microns (PM10), and lead (Pb). In 1997, EPA promulgated a revised NAAQS for ozone and a new NAAQS for particulate matter less than 2.5 microns (PM2.5). In the spring of 1999, an U.S. Court of Appeals panel remanded the standard to EPA for further consideration. However, in early 2001, the Supreme Court upheld EPA's authority to set these new more stringent standards.

While EPA's authority to set the new eight-hour ozone standard was upheld, the Supreme Court

Prominent sensitive receptors in and around Whiskeytown National Recreation Area

Receptor	Location
Town of Old Shasta	Directly adjacent to the east boundary of the park
Town of French Gulch	1.2 miles north of the park
Town of Igo	2 miles south of the park
Town of Whiskeytown	Inside park
City of Redding	6 miles east of the park
Whiskeytown Environmental School	Inside park

Air quality in the park is affected by internal and external air pollution sources. Internal air pollution sources include campfires, woodstoves, and barbecues. Area air pollution sources include prescribed and wildland fires and motor vehicle emissions.

ordered it to rework its policy for implementing the new ozone standard in non-attainment areas. Although the Court of Appeals prohibited EPA from implementing the eight-hour ozone standard, it did note that the Clean Air Act required EPA to finalize area designations within specific time frames. The California Air Resources Board (CARB) updated the proposed area recommendations with the most current air quality monitoring data and transmitted California's recommendations to EPA in July 2000. These recommendations include moderate non-attainment designations for the federal 8 hour standard in all but five Sacramento Valley counties. All but one Sacramento Valley counties are designate as non-attainment for the state 1 hour ozone standard of 0.09 ppm. Shasta County as well as the entire Sacramento Valley is classified as non-attainment with the state PM10 standard, according to the CARB *Almanac of Emissions and Air Quality* (2001).

The pollutants are called criteria pollutants because the standards satisfy criteria specified in the Act. An area where a standard is exceeded more than three times in three years can be considered a non-attainment area subject to planning and pollution control requirements that are more stringent than areas that meet standards.

Air quality in the park is affected by internal and external air pollution sources. Internal air pollution sources include campfires, wood stoves, and barbecues. Area air pollution sources include prescribed and wildland fires and motor vehicle emissions.

While air quality in an air basin is usually determined by emission sources within the basin, pollutants transported from upwind air basins by prevailing winds can also affect it.

Status of ambient air quality designations for Shasta County

	California Standard	Federal Standard
Ozone (one hour)		⊙
Carbon monoxide	⊙	⊙
Nitrogen dioxide	⊙	⊙
Sulfur dioxide	⊙	⊙
Particulate matter		⊙
Lead	⊙	*

⊙ - Attainment of standard

* EPA does not designate areas for the lead standard in the same manner as for other pollutants. However, there are no areas in California that exceed the national standard for lead.

The Central California Ozone Study conducted in 2000, by researchers from the University of California, Davis and CARB have been inconclusive as to the origin of pollutants in Shasta County. The most recent designation from CARB is that emissions in the Sacramento Valley Air Basin are the result of "Inconsequential Transport." Air quality in the Sacramento Valley Air Basin is affected by pollutants generated locally, transported from metropolitan Sacramento, and sometimes is a combination of the two.

The California Air Resources Board has set ambient air quality standards that are stricter than the national standards to protect public health and welfare. Under the 1988 California Clean Air Act, air basins were designated as attainment, non-attainment, or unclassified for the state standards.

State implementation plans define control measures that are designed to bring areas into attainment. The Sacramento Valley Air Basin is currently in attainment for all NAAQS but is designated as non-attainment for ozone and PM10 NAAQS. There is only a Federal standard for PM2.5, for which a designation would be made shortly for Shasta County. The County has completed measuring three years worth of data for PM2.5 and it is likely that it would also be designated as non-attainment. Shasta County has ceased measuring carbon monoxide, nitrogen dioxide, and sulfur dioxide due to recordings well below the State and Federal standards. Basic components of a state implementation plan include legal authority, an emissions inventory, an air quality monitoring network, control strategy demonstration modeling, rules and emission limiting regulations, new source review provisions, enforcement and surveillance, and other programs as necessary to attain standards.

The California Air Resources Board is responsible for promulgating regulations pertaining to a variety of areas, including state ambient air quality standards and area designations, emissions from motor vehicles, fuels and consumer products, and airborne toxic control measures. Title 17 of the California Code of Regulations, entitled "*Smoke Management Guidelines for Agricultural and Prescribed Burning*," provides direction to air pollution control and air quality management districts (air districts) for the regulation and control of agricultural burning, including prescribed burning. These guidelines are intended to provide for the continuation of prescribed burning as a resource management tool, while

Federal and California ambient air quality standards

Pollutant	Averaging Time	Standards			Objective of Standard
		Federal		California	
		Primary	Secondary		
Ozone (O^3)	I hour	0.12 ppm	0.12 ppm	0.09 ppm	Prevent breathing difficulties, eye irritation, and biological impacts to sensitive species
	8 hours	0.08 ppm	0.08 ppm	NS	
Carbon monoxide (CO)	1 hour	35 ppm	35 ppm	20 ppm	Prevent carboxyhemoglobin levels greater than 2%
	8 hours	9 ppm	NS	9 ppm	
Nitrogen dioxide (NO^2)	1 hour	NS	NS	0.25 ppm	Prevent breathing difficulties, reduce smog formation, and improve visibility
	Annual average	0.053 ppm	0.053 ppm	NS	
Sulfur dioxide (SO^2)	1 hour	NS	NS	0.25 ppm	Prevent increased respiratory disease, acid rain, crop damage, odor nuisance and improve visibility
	3 hours	NS	0.5 ppm	NS	
	24 hours	0.14 ppm	NS	0.04 ppm	
	Annual average	0.03 ppm	NS	NS	
Respirable Particulate Matter (PM^{10})	24 hours	150 g/m^3	150 g/m^3	50 g/m^3	Prevent chronic respiratory tract diseases and improve visibility
	Annual mean	50 g/m^3 (arithmetic)	NS	30 g/m^3 (geometric)	
Fine Particulate Matter ($PM^{2.5}$)	24 hours	65 g/m^3	65 g/m^3	NS	
	Annual mean	50 g/m^3 (arithmetic)	50 g/m^3 (arithmeti-c)	NS	
Lead (Pb)	30 days	NS	---	1.5 g/m^3	Prevent neurological system damage
	Calendar quarter	1.5 g/m^3	1.5 g/m^3	NS	
Sulfates	24 hours	NS	NS	2.5 g/m^3	Improve visibility and prevent health impacts
Visibility	One observation	NS	NS	No reduction in prevailing visibility to <10 miles when relative humidity is <70%	Reducing particles
Hydrogen Sulfide	1 hour	NS	NS	0.03 ppm	Prevent odor nuisance

ppm = parts per million NS = no standard g/m^3 = micrograms per cubic meter

minimizing smoke impacts on the public. Shasta County Air Pollution Control District has the primary responsibility for control of air pollution from prescribed burning in Whiskeytown, with regulatory authority provided in Shasta County Air Quality Management District Rule 2:8 "*Agricultural Burning*" and Rule 2:9 "*Procedures and Requirements for District Smoke Management Program.*"

The air district rules generally specify that the agency planning a burn must notify the air district and provide basic information. These include burning location, acreage, vegetation type, fuel conditions, schedule, location of sensitive receptors, and other information.

EPA has promulgated regional haze regulations to improve visibility or visual air quality in national parks and wilderness areas across the country (EPA 1999). In developing these rules, EPA recognized that fires of all kind, including prescribed fire and wildland fires contribute to regional haze and that there is a complex relationship between what is considered a natural source of fire versus a human-caused source of fire. Given that in many instances the purpose of prescribed fires is to restore the natural fire cycles to forest ecosystems, EPA has, in conjunction with states and federal land managers, worked to support development of enhanced smoke management plans to minimize the impacts of fire emissions on pubic health and welfare. This has been completed through revisions made to Title 17 of the California Health and Safety Code. Shasta County adopted Rule 2:9 *"Procedures and Requirements for District Smoke Management Program"* in 2001.

As noted earlier in Chapter 1, a principal management objective is to manage air quality impacts of prescribed burning by working with county and state air resources personnel and using the latest technology to monitor and manage smoke-related impacts upon visitors, residents, and employees. In addition to complying with state and local air quality rules and regulations, the National Park Service also has developed guidance on air quality and smoke management related to wildland and prescribed fires. This guidance is contained in Chapter 14 of the National Park Service Reference Manual 18: *Wildland Fire Management* (1999). Guidance and policies from EPA also supplement the National Park Service guidance. These include the *Interim Air Quality Policy on Wildland and Prescribed Fires, Federal Wildland Fire Management Policy*, and *PM10 Natural Events Policy*. In 1998, EPA developed an interim policy for addressing public health and welfare impacts caused by wildland and prescribed fires that are managed to achieve resource benefits. Ambient air quality worse than the national ambient air quality standards for PM2.5 and PM10 is used as the principal indicator of public health impacts. Visibility impairment is used as the principal indicator of public welfare impacts. This policy complements the *PM10 Natural Events Policy* to address public health impacts caused by wildland fires.

One of the objectives of CARB and National Park Service mandates and policies is to minimize smoke impacts on people and sensitive receptor areas in and near the park. Such areas can include towns, villages, hospitals, schools, nursing homes, shopping centers, campgrounds, recreational areas, trails, public events, scenic vistas, and Class I areas.

Prominent sensitive receptors in the area adjacent to Whiskeytown were selected based on guidance in the California Code of Regulations Title 17 *Smoke Management Guidelines for Agricultural and Prescribed Burning*, regional demographics and population dynamics, local wind patterns, climate conditions, smoke transmission/fire behavior, and input from affected air districts.

In 1993, EPA adopted regulations implementing section 176 of the Clean Air Act as amended. This section requires that federal actions conform to state implementation plans for achieving and maintaining the national standards. Federal actions must not cause or contribute to new violations of any standard, increase the frequency or severity of any existing violation, interfere with timely attainment or maintenance of any standard, delay emission reduction milestones, or contradict State Implementation Plan requirements. The conformity rule applies only in federal non-attainment areas, such as Shasta County.

In addition to a diverse mosaic of natural and physical features, Whiskeytown contains an equally varied array of cultural resources within its boundaries. The National Park Service recognizes five types of cultural resources: archeological resources, structures, ethnographic resources, cultural landscapes, and museum objects. Archeological resources are the remains of past human activity and records documenting the scientific analysis of these remains. These include artifacts, ecofacts, and features. Structures are material assemblies that extend the limits of human capacity, and comprise such diverse objects as buildings, bridges, vehicles, monuments, vessels, fences, and canals. Ethnographic resources are basic expressions of human culture and the basis for continuity of cultural systems and encompasses both the tangible (languages, subsistence activities) and intangible (oral traditions, religious beliefs). The management of ethnographic resources entails the recognition that traditional cultures can have different world views and the right to maintain their traditions. Cultural landscapes are settings we have created in the natural world. They are intertwined patterns of natural and constructed features that represent human manipulation and adaptation of the land. Finally, museum objects are manifestations and records of behavior and ideas that span the breadth of human experience and depth of natural history. Examples of typical museum objects include field and laboratory notes, artifacts, and photographs (National Park Service 1997).

ARCHEOLOGICAL RESOURCES

To date, a total of 116 archeological sites and 299 isolated artifacts and/or features have been formally documented within Whiskeytown. Of the former, 43 comprise prehistoric orethnographic components, 41 with historic components, 25 with mixed prehistoric/ ethnographic and historic components, and seven of unknown vintage (Bevill and Nilsson 2001). Roughly 3250 acres, or 8% of the park, have been surveyed for archeological resources. The earliest archeological surveys were

Archaeological patterns in the Whiskeytown region

Pattern	Date	Diagnostic Artifact/Feature	Adaptive Modes
Augustine	1500-150 BP	Gunther barbed, desert series projectile points *Chert blades* *Stone pendants* *Incised bone/stone objects* *Shell beads and ornaments* *Bone tools* *Hopper mortars and pestles* *Baked clay figurines* *Flexed burials* *House depressions*	Represent occupation by Wintu peoples
Tehama	1800-700 BP	Gunther barbed, small & medium notched points *Hoppers mortars and pestles* *Milling stones and hand stones* *Notched pebble net weights*	Viewed as continuation of the Whiskeytown pattern adaptive mode. Marked by introduction of bow and arrow.
Whiskeytown	3000-1700 BP	Clikapudi/Whiskeytown notched projectile points *McKee unifaces* *Milling stones and hand stones* *Mortar and pestles* *Notched pebbles* *Abundant fire-cracked rock*	Large occupation sites located near major streams indicate seasonal utilization of riverine resources.
Squaw Creek	5000-3000 BP	Squaw Creek contracting stem and leaf/diamond-shaped projectile points *McKee unifaces* *Cobble spall tools* *Milling stone and hand stones* *Bowl mortars and pestlesIncised stones*	More intensive occupation than preceding Borax Lake pattern. Acorns and riverine resources adopted in diet.
Borax Lake	8000-5000 BP	Wide-stemmed projectile points *Milling stones and hand stones* *Schist and phylite knives*	Emphasis on large game hunting, seeds also utilized. Sites concentrated on major high, elevated ridges. Inhabitants highly mobile.

(adapted from Bevill and Nilsson 2001)

conducted in the late 1950s prior to the construction of the Clair A. Hill/Whiskeytown Dam. These were followed by inventories initiated to fulfill requirements set forth in Sections 106 and 110 of the National Historic Preservation Act (NHPA). Since at least the late 1980s, most survey projects in Whiskeytown have employed more rigorous methods in regard to the identification and evaluation of archeological resources than previous investigations. Recently, the scope and scale of archeological surveys has increased in response to the rapid growth of the Whiskeytown fire management program. Eleven archeological sites at Whiskeytown have been subjected to archeological excavations. These ranged from small-scale testing projects to full-fledged data recovery efforts.

Archeological investigations at Whiskeytown revealed Native American occupation spanning at least 8000 years (Bevill and Nilsson 2001). On the basis of shifts in artifact types and styles and adaptive modes through time, five distinctive archeological patterns have been identified in the archeological record of the Whiskeytown region. Native American archeological sites at Whiskeytown consist almost exclusively of habitation sites and lithic scatters. The former are characterized by the presence of dark midden soil, architectural remains, diverse artifact assemblages, faunal remains, and, on occasion, human remains. Habitation sites represent long-term seasonal or permanent use. Bevill and Nilsson (2001) identified 43 recorded habitation sites at Whiskeytown. Major excavations were conducted at the Tower House Site, a large habitation site located at the confluence of Clear and Willow creeks (Bevill and Nilsson 1999), and several others on lower Clear Creek and Boulder Creek have been subjected to limited testing (Eidsness 1988; Bevill and Nilsson 1996). Twelve lithic scatters have been documented at Whiskeytown (Bevill and Nilsson 2001). Lithic scatters are typically comprised of flaked stone tools and waste flakes, sometimes ground stone, and probably resulted from one or more occupational episodes. Obsidian from sources to the north and east of Whiskeytown account for the majority of the raw material represented in flaked stone tools and waste flakes, although locally available chert and igneous types are not uncommon. The distribution of Native American archeological sites at Whiskeytown appears to have been influenced by the occurrence of perennial or reliable intermittent water sources, with most sites found in close proximity to these features. The majority of these sites lie between 1000 and 2000 feet in elevation, although this may reflect survey coverage rather than actual settlement preferences.

Archeological resources related to the non-Native American presence at Whiskeytown have received little serious attention until relatively recently. Bevill and Nilsson (2001) identified 66 recorded sites with historical components, including 41 single component resources, and 25 of both historical and prehistoric vintage. The historical components relate to mining, homesteading, farming/ranching, and logging and commonly associated artifacts and features. Of those sites containing diagnostic artifacts or features, five date to the Gold Rush period (1848-1843), five to the hydraulic mining period (late 1800s), nine to the copper mining period (1884-1919), and 17 from 1920-1950s. Historical archeological components are found almost exclusively at elevations below 2000 feet, and often on gently sloping terrain near water. Again, this distribution is probably a reflection of survey coverage.

Affiliation of Historic Archaeological Sites

Site Type	Examples of Artifacts and Features	Number
Mining	Adits, prospect pits, ditches, ore cart tracks	44
Homestead	Foundation, domestic trash	9
Trash scatter	Cans, bottles or other non-industrial materials w/o associated features, structures	7
Settlement	Multiple foundations, domestic trash, economic activities	3
Sawmill	Mill features, lumber activities	1
Ranching/farming	Corrals, barn foundations, fences, irrigation ditches	2

(adapted from Bevill and Nilsson 2001)

To this point, submerged archeological resources at Whiskeytown have failed to receive much attention. Twenty-four archeological sites were documented within the high water mark of Whiskeytown Lake during the initial survey (Treganza and Heickson 1960); this number is unquestionably a major underestimation. Furthermore, the middle reaches of the Clear Creek watershed were a focus of activity from the 1850s onward, and these remains were virtually ignored during the first survey. However, the bed of the reservoir was prepared by removing and piling trees and brush with bulldozers, during which time the integrity of these resources was almost certainly compromised to at least some degree.

Two archeological districts and seven archeological sites in Whiskeytown are listed or have been formally determined eligible for listing on the National Register of Historic Places. The Tower House Archeological District comprises 10 archeological sites, and was listed on the National Register in 1985 (Bevill and Nilsson 2001). The contributing sites are located on and near the confluence of Clear, Willow, and Mill creeks. Among these are several habitation sites, one of which (Tower House Site) has undergone excavation on several occasions, and was occupied perhaps as early as 8000 BP (Bevill and Nilsson 1999). The Tower House Archeological District was nominated based on the potential to yield information on the initial occupation of the region, as well as prehistoric human adaptations to riparian and woodland environments, and the ability to perform comparisons of material cultural between sites. Although nominated due to association with Native American occupations, several of the contributing sites also contain historical components, including materials associated with the Tower House Historic District, described in greater detail below.

The Lower Clear Creek Archeological District is comprised of six archeological sites located in the Clear Creek watershed below Whiskeytown Dam (Anderson et al. 1979). Each of these possesses Native American components, including substantial villages containing house pits and midden. Historical components, reflecting mining and homesteading, are also found on four of the sites. One of the sites within the district, CA-SHA-177/H, was excavated in 1970 and 1971 in anticipation of proposed construction activities (Johnson and Skjelstad 1974). These investigations revealed a meter-deep midden deposit containing flaked stone tools and debitage, ground stone, and assorted historic artifacts. Several methods and analyses that were uncommon at the time were employed, including use of fine-meshed screens, flotation to recover botanical remains, and pH testing. The primary significance of the district was seen to lie in the potential for buried and surface deposits to provide comparative data for local and regional archeological and environmental studies. Specifically, the Native American components could contribute to an understanding of regional cultural history, social organization, and the use of available biotic and abiotic resources. The district was determined eligible for listing on the NRHP, but never formally entered. In 1986, small-scale subsurface testing was performed at several of the district sites with the intent of obtaining additional information on site content and integrity (Eidsness 1988).

The Clear Creek Ditch, a forty mile-plus long water conveyance system constructed in the early 1850s, was evaluated in conjunction with a Federal land exchange project east of Whiskeytown and determined to be National Register eligible (Bevill and Nilsson 2001). The ditch originates in Whiskeytown, and portions of it are maintained through use as a recreational trail. The Boulder Creek Site was tested in 1996 (Bevill and Nilsson 1996). Excavation revealed dark midden soil, flaked stone tools and waste flakes, and faunal remains dating to the last 3000 years. The site was interpreted as a seasonal field camp utilized for hunting and gathering forays, and was formally determined to possess National Register eligibility.

Hamusek-McGann et al. (1999) evaluated eighteen mining sites throughout Whiskeytown in conjunction with an Abandoned Mineral Lands project. The Mount Shasta Mine, Oro Fino/Gentle Annie Mine, Monitor Mine, Desmond Mine and Ganim Mine were all formally determined to be eligible for the National Register. Meanwhile, 10 other mine sites were found to lack attributes consistent with inclusion on the National Register.

The relative paucity of archeological sites at Whiskeytown listed on the National Register or formally evaluated for significance is more a reflection of the nature of National Park Service management practices than the condition of the archeological record. For example, the preservation mandate provides for the utmost consideration of the impacts of a given undertaking on the cultural, natural, and physical environment, and the project specifics and location would generally be revised if resources cannot be avoided as planned. Thus, relatively few sites are excavated and/or documented in greater detail. While probably no archeological resources at Whiskeytown have escaped at least some type of disturbance, those

Creation of the National Environmental Education Development (NEED) program led to the construction of many such environmental camps across the nation--such as the one located in Whiskeytown. Very few of these exist today, and only the Whiskeytown Environmental School, serves in its original capacity.

that remain assume even greater importance. Many large Native American habitation sites that formerly lined the margins of Clear Creek were destroyed during the construction of Whiskeytown Dam, lending to the significance of those habitation sites along Clear Creek above and below the dam. That the Boulder Creek Site was found to possess elements consistent with inclusion on the National Register suggests that other relatively intact habitation sites found at the middle elevations in Whiskeytown are also worthy of significant status. Irrespective of site significance and integrity, contemporary Native Americans with links to the Whiskeytown area are very concerned with the disposition of the physical and material remains of their ancestors (Emberson 2000). Finally, the construction of Whiskeytown Dam also resulted in the inundation of innumerable historical archeological resources, those dating to the earliest periods of use in particular. The sites that remain are critical for filling a void in local cultural history information.

While the region encompassing Whiskeytown is also rich in Native American and historical archeological resources, many of these are at risk from the rapid growth of the Redding metropolitan area, as well as multiple-use practices associated with those on adjacent public lands. As such, with proper management, Whiskeytown offers the potential to preserve and protect a large assemblage of diverse archeological resources in perpetuity.

Historic Structures

Relatively few historic structures are found in Whiskeytown. Thirty historic structures are listed on the List of Classified Structures, most of which are found in the vicinity of the Twer House area. The Tower House Historic District was listed on the National Register in 1973 (Bevill and Nilsson 2001). Centered on the confluence of Clear, Willow and Mill creeks, the district is composed of 14 individual features that encompass the period from about 1850-1920. This complex marks the location of the first permanent Euro American settlement in the region when two entrepreneurs, Levi Tower and Charles Camden, established a hotel and way station in 1851. While Tower died in 1865, Camden remained until the early 1900s and amassed a small fortune and solid reputation through mining and water diversion entrprises, as well as public works projects. Many of the features attributable to Tower and Camden were in an acute state of disrepair when the National Park Service took possession in the late 1960s. Restoration projects have rendered the Camden and Tenant houses habitable, and the grounds and other features cleaned up and variously restored.

Contributing features of the Tower House Historic District
Tower House Hotel site
Camden House
Camden House outbuildings, including a garage and carriage house
Remnants of footbridge over Willow Creek
Apple orchard
Levi Tower grave
Open pasture
Barn
Tenant House
Stone and concrete remnants of bridge over Clear Creek
El Dorado/Bickford Mine
Irrigation system from Crystal Creek to the Camden House
Graves of Kate Camden and two others
Camden sawmill site

(adapted from Bevill and Nilsson 2001)

The To wer House Irrigation System District has been determined eligible for inclusion on the National Register, but not yet formally listed (Bevill and Nilsson 2001). It comprises a water conveyance system tat originates at Crystal Creek and flows east to the Tower House area. Contributing elements include ditches, flumes, pipes, rock walls, a dam, a clean-out house, and redwood storage tank. A couple of ditches that are a part of this district were recently documented in greater detail (Davis-King 1997).

More recent structures and complexes, including the John F. Kennedy Commemorative Panel, Judge Carr Memorial, NEED Camp, and Central Valley Project features, have been recommended to lack National Register eligibility, often for failing to meet the 50 year-old minimum age requirement. Bevill and Nilsson (2001), however, recommended that some of these features be considered for significance due to the fact that many would soon be 50 years old, and for relation to bygone trends in local and/or national history. For example, the NEED Camp was born out of the cultural and intellectual renaissance of the 1960s. Implementation of the National Environmental Education Development (NEED) program led to the construction of many such environmental camps across the nation. Very few of these exist today, and only the NEED Camp, now called the Whiskeytown Environmental School, serves in its original capacity.

List of Classified Structures

Number	Name	Significance Level
PHS-CARR	Judge Carr Memorial	Not Significant
PKS-JFKM	John F. Kennedy Commemorative Panel	Not Significant
THB-500	Camden House	Local
THB-501	Camden House Servants' Quarters	Local
THB-502	Camden House Guest Quarters	Local
THB-503	Camden House Wood Shed	Local
THB-504	Camden House Carriage House	Local
THB-505	Camden House Garage	Local
THB-506	Camden House Pump House	Local
THB-507	Camden House Tenant House	Local
THB-508	Camden House Tenant House Barn	Local
THB-509	El Dorado Mine Stamp Mill	Local
THB-510	El Dorado Mine Equipment Shed	Local
THB-511	Blacksmith Shop Walls	Local
THB-512	Crystal Creek Ditch Clean Out Shed	Local
THB-517	Camden House Chlorination Tank	Local
THB-518	Camden Sawmill Foundation and Mill Race	Local
THS-BBQ	Camden House Outdoor Oven/BBQ	Local
THS-BRID	Covered Bridge Supports	Local
THS-CHIL	Chilean Mill at El Dorado Mine	Local
THS-CRYS	Crystal Creek Ditch	Local
THS-ELDO	El Dorado Mine Retaining Wall	Local
THS-FBRI	Camden House Foot Bridge	Not Significant
THS-FENC	Camden House Picket Fence	Local
THS-KATE	Kate Camden Grave Marker	Local
THS-LEVI	Levi Tower Grave Marker	Local
THS-MILL	Mill Creek Ditch	Local
THS-TANK	Crystal Creek Ditch Water Storage Tank	Local
THS-WALL	Camden House Retaining Wall	Local
THS-WILL	Willow Creek Ditch	Local

Ethnographic Resources

No unequivocal ethnographic resources, or Traditional Cultural Properties , at Whiskeytown are listed on the National Register. However, the recently completed *Ethnographic Overvew and Traditional Use Study of Native American Affiliation at Whiskeytown* identified a continuation of use and strong concern for the well being of natural and cultural resources in the park by the Wintu Indian community (Emberson 2000). The Wintu continue to utilize Whiskeytown for a variety of traditional purposes, including gathering (basketry materials, medicinal plants, religious purposes), subsistence activities (hunting and fishing), educational activities to promote traditional culture, and religious functions.

More than 100 species of native plants are currently utilized by the Wintu, many of which are found at Whiskeytown (Emberson 2000). The Wintu have expressed strong interest in developing a written gathering policy for Whiskeytown, including the identification and proper maintenance of gathering sites through such actions as pruning and prescribed burning. As their former territory is developed with increasing rapidity, the Wintu would look to Whiskeytown as a reliable source for diminishing traditional resources, and are fully supportive of any management practices that enhance the viability of those resources.

While Wintu consultants have declined or are unable to provide specifics, a number of locations with cultural/spiritual significance ("sacred sites") are found at Whiskeytown (Emberson 2000). Shasta Bally has been identified as a significant area in previous consultations, and a possible ceremonial site is recorded in that area. The Wintu suggest that the development of respectful and cooperative relationships with Whiskeytown staff would result in greater willingness to divulge the location and nature of such sites as needed for proper management and protection.

As noted above, contemporary Wintu are very concerned about the disposition of Native American archeological resources within Whiskeytown. Consultants felt that sites containing human remains should be left undisturbed, and measures taken to protect them from vandalism and inadvertent damage. Native American artifacts are seen as important educational tools, and it has been recommended that objects could be displayed in a cultural center.

The Wintu hold an annual camp at the Whiskeytown Environmental School for the purpose of educating children about traditional culture (Emberson 2000). The organizers are vitally concerned with the continued xistence of this camp in cooperation and conjunction with Whiskeytown staff. Along with this is a desire to work more closely with National Park Service staff, including guidance regarding the public interpretation of Wintu culture and cultural sensitivity training. This is supported by the preference of most consultants to favor Alternative C of the Whiskeytown General Management Plan, which proposed to reduce soil erosion, restore and improve vegetation communities with prescribed fire and other techniques, identification and protection of cultural resources, expansion of interpretive services, and promotion of assistance from the Wintu community in maintaining cultural traditions.

No extant Indian Trust Resources are found at Whiskeytown. However, Wintu families reportedly occupied several Indian Allotments within the park in the early to mid 1900s (Bevill and Nilsson 2001). Most of these were located along Clear Creek between the Tower House and Boulder Creek.

Cultural Landscapes

Three cultural landscapes potentially eligible for listing on the National Register have been identified at Whiskeytown. These include the Tower House Historic District, the Mount Shasta Mine complex, and the Lower Clear Creek Archeological District. A draft Cultural Landscape Report was recently prepared for the Tower House Historic District (Historical Research Associates 2001). The study focused on the 20 acre area encompassing the Camden and Tenant houses, as well as surrounding remnants of orchards, pastures and water ditches. A great deal of change was documented from the period of significance including overwhelming representation of elements dating from 1900 to 1940, loss of ornamental and agricultural vegetation, and construction of modern State Highway 299. Nonetheless, the cultural landscape does retain integrity, including the Camden and Tenant house complexes, and agricultural fields. It was recommended that the

boundary of the Tower House Historical District be altered to better reflect the land ownership of Charles Camden and Levi Tower, more thoroughly document the importance of Charles Camden, and change the period of significance to 1862 to 1935 (Historical Research Associates 2001). Suggested research included better documentation of fruit and ornamental trees, including extraction of fruit samples and cuttings, and additional archeological investigations.

Museum Objects

Whiskeytown maintains a significant collection of historical, archeological and natural history specimens. Presently, nearly 213,000 objects are found in the collection, the vast majority ofwhich are archeological remains. These materials have contributed significantly to the understanding of prehistory in the northern coast range and upper Sacramento Valley, and offer an excellent opportunity for education and future research. Uncataloged items include archival materials associated with the administrative history of Whiskeytown, including natural and cultural resources management and research. A large collection of mining tools retrieved from park archeological sites has yet to be adequately documented. In all likelihood, the Whiskeytown collections would continue to grow as a result of current and future management and research related projects.

The present curation facility at Whiskeytown meets National Park Service standards (36 CFR 79) in regard to environmental control, fire protection, and security. However, the facility is much too small to accommodate the existing collection, and is certainly inadequate to fulfill future needs. In addition, Whiskeytown lacks a full-time curator, resulting in frequent cataloging backlogs.

Whiskeytown actively works and plans with California Department of Forestry, Western Shasta Resource Conservation District (WSRCD), the USDA Forest Service and the Bureau of Land Management with joint projects such as burns and shaded fuel break construction, prevention programs, and the proposed fire management plan has been developed as a tool in accomplishing regional fire management and fuel reduction goals.

Social Environment

Compatibility with land use plans

The lands adjacent to Whiskeytown National Recreation Area are owned by a variety of public and private entities. Boundary land tracts vary from entir sections owned by imber companies, such as Sierra Pacific Industries, to small subsections of private parcels. Land uses vary from residential use to timber extraction and recreation. The National Park Service has direct fire protection authority for the lands within the boundaries of Whiskeytown National Recreation Area. The California Department of Forestry and Fire Protection has direct protection authority for the lands surrounding the Recreation Area. Several cooperative agreements are in place to jointly manage fire and fuels activities in the local area. The risk associated with the fuels buildup is well recognized as a regional problem that crosses administrative boundaries

Whiskeytown has a significant wildland/urban interface on its east and north boundaries. Fire managers at Whiskeytown work closely with adjacent landowners through fuels committees, such as the Upper and Lower Clear Creek Watershed Groups, and through regional cooperative land use teams, such as the Shasta-Tehema Bioregional Council. These groups develop cooperative plans and share fire information between government and private entities in the region.

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Health and Safety

The health and safety of fire fighters and the public is the highest priority in every action undertaken as it relates to fire fighting strategy and tactics. There are two major concens related to health and safety issues. One is the actual danger of fire-caused injuries or fatalities – fire fighters, visitors, or residents becoming trapped and directly burned by fire, or injuries that are indirectly caused by the fire incident such as injury or death from falling rocks and trees, or losing balance and falling. The second major health and safety concern comes from smoke inhalation - either by fire fighters on the fire line or by the public in areas away from the fire.

Since smoke is produced by individual fire events, it must be managed and mitigated at that level. Important elements in considering appropriate smoke management actions include distance of the fire from the population of concern, local weather conditions affecting smoke movement, duration of exposure, and the type of fuel being burned.

The direct risk to the health and safety of personnel on the fire line is a major issue and is addressed through adherence to standards designed to limit wildland fire personnel exposure to health and safety threats. Fire fighter and public safety is the first consideration on any fire event and all fire actions would be based on providing for safety. There is no history in the park of death or injury to visitors or residents directly caused by wildland fire, although the potential for injuries or fatalities exists. The park's fire program works to mitigate long-term threats to public safety by reducing hazardous fuels with the use of prescribed fire and mechanical fuel reduction around developments and along roadways where visitors could become trapped by fire.

Fire fighter and public safety is the first consideration on any fire event and all fire actions would be based on providing for safety.

Community Economics

Fire programs affect local community economics through several avenues – the most important variables include: the size of the fire management payroll, the amount of goods and services prchased by the program from local businesses, and impacts of fire operations and smoke events on the number of visitors moving through the community and presumably purchasing goods and services from local businesses.

For more information on the socioeconomic setting for Whiskeytown, please refer to the General Management Plan Environmental Impact Statement.

The frequency and size of fires also significantly affects the local economy, as the amount of money brought into a community varies from year to year. The suppression costs involved in fighting infrequent, large, unwanted fire events such as the 1990 Kanaka fire, which eventually burned over 3,000 acres of park land, benefit local merchants to a large degree.

Unwanted wildland fires also affect tourism, especially when road or facilities are closed due to fire operations. Over the past decade, such road closures have occurred infrequently for short periods of time on the primary thoroughfare through the park, California Highway 299. All of the closures were a result of fire suppression operations resulting from the need to fight unwanted wildland fires.

Offsetting potential tourism business lost in communities affected by closures is the financial impact of fire fighting efforts that are usually associated with such closures. In all cases over the past ten years where this has occurred, numerous commercial lodgings, restaurants, and other local business benefited providing for the needs of the fire fighters involved in the suppression effort.

Recreation

Approximately 775,000 visitors come to the park each year to enjoy the natural resources, participate in recreational and educational opportunities, and as a social experience. Primary recreational opportunities in the park include camping, hiking, swimming, boating, horseback riding, fishing, and wildlife viewing.

The vast majority of visitors to Whiskeytown come in the hot summer months to recreate by and in the lake. This is the time of year when campgrounds are open and more families visit the park on vacations. The average length of a visitor's stay also increases dramatically in the summer due to the overnight stays. Day use visitors in the summer also tend to stay longer due to relatively cooler temperatures and extended daylight hours, which provide visitors with the opportunity to seek relief from the heat for a longer period of time.

The area proposed for the relocation of a new fire cache facility, Oak Bottom, is the most popular overnight RV/camping area—in all

likelihood, as a result of the easy access from Highway 299. The Oak Bottom area is managed through a concession relationship and also contains a small store, a marina, an amphitheater and a day use swim beach. Currently one fire engine is stored in an administrative zone within the Oak Bottom area.

Visual Resources

Probably the best example of a visual resource at Whiskeytown can be appreciated from the parking lot at the Visitor Center at the junction of Highway 299 and Kennedy Memorial Drive. On a clear day, a stunning view westward captures majestic Shasta Bally looms protectively over Whiskeytown Lake. Shasta Bally and nearby points such as Kanaka Peak, South Fork Mountain and Buckhorn Bally are sometimes cloaked in snow, adding to the dramatic view. The lake is a stretch of blue water that starts just below the steep hillside below the vantage point and continues out along the south edge of Highway 299.

Upon closer viewing, however, a series of structures and human-caused landscape modifications are noticed. These are the legacy of dam construction, transportation, logging and mining activity upon which the economy of the area was built. Transmission lines lay across the foothills of Shasta Bally and transmit power from the Carr Powerhouse at the western edge of the lake. Immediately below the Visitor Center a string a buoys hold up a water curtain designed to moderates water temperature near the Spring Creek tunnel. Most noticeable is Highway 299 that connects Redding with the Pacific Coast. Highway road cuts in some areas are significant as the highway travels along the north side of the lake. Utility line corridors parallel the road and are also readily apparent—the vegetation along Highway 299 is primarily brush and requires utility companies to actively reduce the number and size of these plants so that access is facilitated and fire hazards are reduced.

Other visual resources in the park include areas from various vantage points alongside trails and many of the park's roads. Many of these focus on the lake and views of mountains outside of the park (Mt. Shasta, Lassen Peak, and the Trinity Alps). Vantage points that portray some of the park's other scenic resources are known to certain groups, such as equestrians and hikers, but are not as easily accessible or as well known as those along Highway 299. The park is embarking on an effort to recognize some of these less well known areas and increase visitation to them.

Fire management activities in the form of roadside shaded fuel breaks have occurred along some of the more traveled roads in the park (Kennedy Memorial Drive and Muletown Road). This activity consists of cutting back brush and some shrubs so drivers are better able to see into the woodland and around sharp corners and to also reduce fuel loading in proximity to the roadway. In some areas where very tall manzanita and other brush species dominate, 'feathering' occurs in which irregular patterns of plants are left in order to more closely approximate a natural growing pattern. In wooded areas, ladder fuels are removed, as are some shrubs and chipped on sight. The chipped surface inhibits native and invasive ground cover growth for a few years, and creates a 'park like' view. Inhibiting grass and herb growth along these roads has the added benefit of reducing the risks of human caused fire from careless cigarette litter or from vehicles.

Impact Topics Considered But Dismissed

Federal legislation, regulations and executive orders require that all Environmental Impact Statements consider a variety of resource issues. Mandatory topics that were considered, but not analyzed in detail are discussed below.

Energy requirement and conservation potential

Federal regulation (40 CFR 1502.16) requires that this document address a discussion of the energy requirements and conservation potential for each alternative and mitigation measure. Although the different management actions described in each of the alternatives differ in impact to the environment, none are noted as having significantly greater or lesser requirements. The use of mechanical treatment equipment may potentially require increased amounts of fossil fuels relative to vehicles transporting hand treatment crews. However this increase is not significant in either quantity of fuel and/or duration of use.

Mechanical treatment level 3 may increase accessibility of biomass material to be used in the production of electricity. This activity is found only in Alternative IV and would be employed on a site-specific basis. There is currently not enough information to conduct an analysis of the beneficial energy impacts that this action would have.

An argument can be made that the conservation potential of Alternative I, II and IV is greater than that of Alternative III because that alternative's emphasis on reactive actions (suppression) and associated increased resource expenses. A "conservation" cost-benefit analysis of suppression activity versus proactive actions (prescribed burning, mechanical treatment) would need to be completed—and is, in fact, the purpose of this document. No other discussion of energy requirements and conservation potential, aside from discussion of the environmental consequences of each alternative, is found in this document.

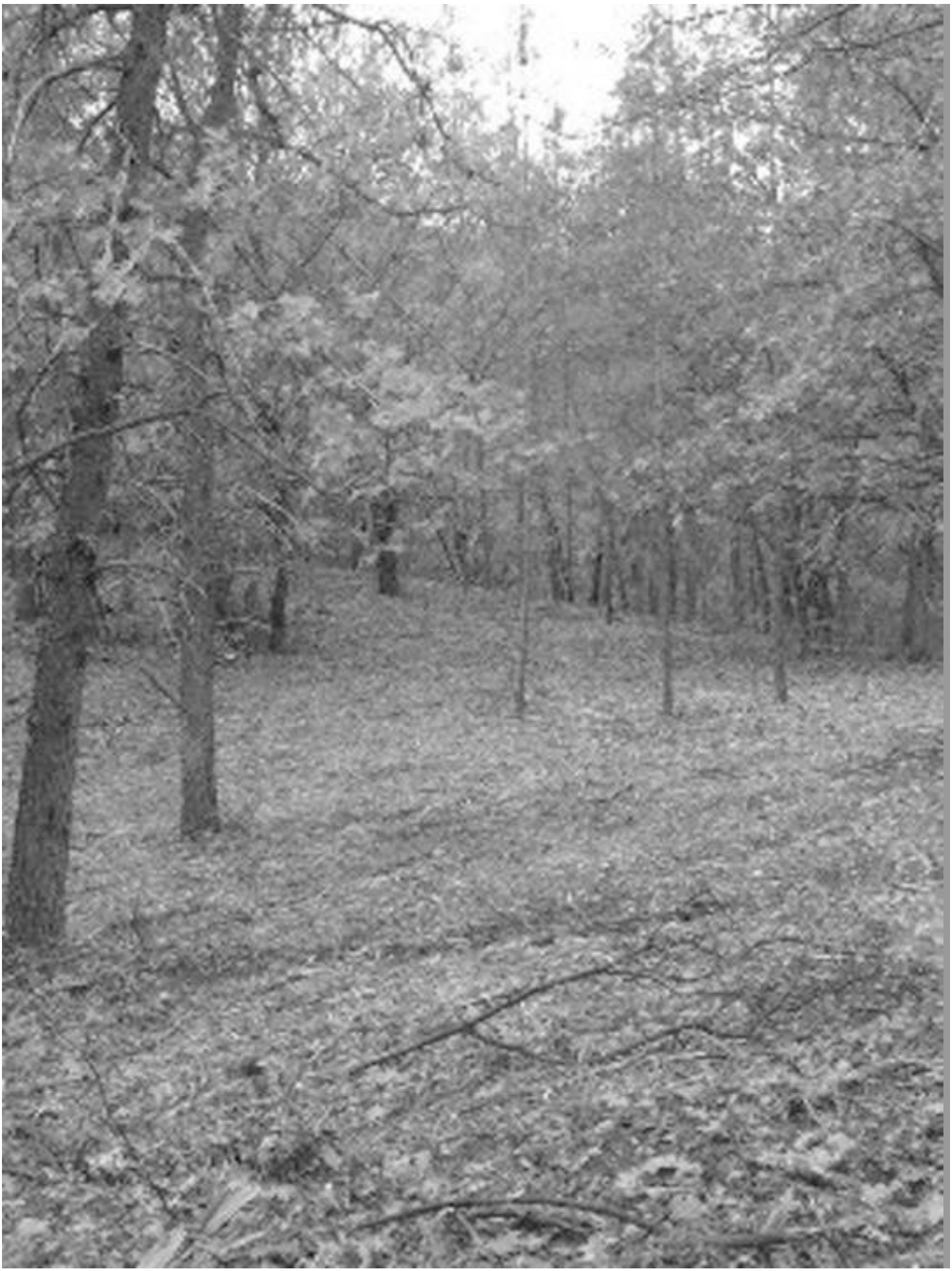
Unique agricultural lands

Federal regulation (40 CFR 1508.27) requires that impacts to prime or unique agricultural lands be addressed in every Environmental Impact Statement. There are no prime or unique agricultural lands in Whiskeytown National Recreation Area. No prime or unique agricultural lands would be affected by the adoption of any of the alternatives analyzed in this document. Accordingly, impacts on prime and unique agricultural lands are not analyzed in further detail in this document.

Environmental justice

Executive Order 12898, dated February 11, 1994, requires each Federal agency, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental impacts, including social and economic impacts, of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands.

None of the alternatives analyzed in this plan would result in a disproportionately high and adverse human health or environmental effect, including social and economic impacts, on minority populations or low-income populations. Outreach to local communities was conducted as part of the scoping process used to produce this Environmental Impact Statement. Residents of local communities and the general public had the opportunity to respond, and did, to the Draft Environmental Impact Statement during the official comment period, and substantive comments have been incorporated into this document. Consequently, environmental justice is not analyzed in further detail in this document.



Chapter 4 The Environmental Consequences

It is a general rule in natural resource agencies that there is always more money for management activities than for research. Given this situation, it follows that resource managers should utilize management actions as experiments and opportunities to observe the response of the vegetation. In the meantime, the public must recognize that resource managers are under severe pressure to act, and must justify their actions to a broad constituency. Resource managers in turn must acknowledge the complexity of the systems they are managing, and the impossibility of being able to predict if a particular research plan would be optimal, or even if it will be able to achieve the stated goals. Resource managers necessarily make decisions with partial information, on the basis of poorly tested hypotheses, and sometimes on pure speculation. The challenge is to integrate resource management activities and research without losing the capacity for critical examination and rigorous testing of ideas, which is the only means by which we will advance our knowledge of the complex ecosystems in which we work (P.H. Zedler).

Fire is a key evolutionary force that has influenced the Klamath ecosystems for millennia. Fire suppression has altered fire regimes, including its role as an evolutionary force, and created conditions that are very different from historic ecosystems. Human habitation in the wildland urban interface zones with existing wildland fuel conditions pose significant threats to human life and property; federal, state and county financial resources; wildlife and fish habitats; and socially valued ecosystems (Sierra Nevada Science Review 1988).

Additional planning would be required prior to implementing fire management projects described in this document if the potential for site-specific impacts is identified. Actions with the potential to impact federally listed threatened or endangered species would require compliance with the Endangered Species Act, and projects impacting cultural resources must comply with the National Historic Preservation Act. Additional site-specific analysis under NEPA may also be required if the potential for environmental impacts are identified but are not discussed in this document.

Concept of Impact Analysis

The purpose of this chapter is to present to the reader an analysis of what impacts can be expected under each of the alternatives discussed in this draft document. Through presenting impacts analysis, the reader—and decision-makers—would be better prepared to weigh advantages and disadvantages of the alternatives. Since a fire management plan is in fact a component of a vegetation management strategy, a great deal of this chapter focuses on the impacts of the various alternatives to the plant communities in Whiskeytown. The diversity of plant communities in the park and the manner in which they intergrade with each other present the writers of this document with a significant challenge—chiefly, how to best present the information in this chapter in a manner that allows full discussion of impacts, but also facilitates a clear understanding between each of the alternatives.

The pattern of analysis for this chapter is presented in outline form below:

1 Affected environment;

2 Methodology and standards associated with the affected environment;

3 Regulation and policies governing management of the affected environment;

4 Fire management plan alternatives;

5 Fire management action;

6 Impact issues; and,

7 Type, context, duration, intensity, and mitigations.

Each affected environment topic is introduced and followed by a short discussion of the methodology or standard most appropriate to use in assessing impacts. A brief section on government regulations and policies concerning the affected environment follows. Then each of the actions within an alternative is discussed in terms of their impacts on the affected environment topic.

Definition of terms

This chapter uses commonly accepted terminology to discuss environmental impacts. For the purposes of this document, a rough definition of terms follows to assist the reader in tracking differences between each of the alternatives. These rough definitions are presented for the benefit of the reader to understand the approach used to analyze impacts. The definitions are generalized—impacts are better discussed below according to each specific affected environment.

Type of impact

Adverse impacts are those that change the affected environment in a manner tending away from the natural range of variability.

Beneficial impacts are those that change the affected environment toward the natural range of variability.

Context of impact

Direct impacts include such impacts such as animal and plant mortality, damage to cultural resources, or creation of smoke, that occur at the time and place of the action.

Indirect impacts are those that occur at a different time and/or place than the action. Indirect impacts include changes such as species composition, structure of the vegetation, or range of wildlife. Indirect impacts also include impacts that occur off-site such as erosion-related impacts, or general economic conditions tied to park activities.

Cumulative impacts are the combination and interaction of individual direct and indirect impacts on the affected environment, both by the actions proposed in this document, and all previous actions, such as dam-building, developments, and logging.

Duration of impact

Generally, each affected environment has different time scale associated with the duration of an impact.

Short-term impacts are those that can be reversed relatively quickly. For the most part, short-term impacts are those that would be reversible during the period covered by this plan (approximately seven to ten years).

Long-term impacts are those that are reversed much more slowly. Longer-term impacts are those that would be reversible beyond the period covered by this plan (seven to ten years).

Intensity of impact

Negligible impacts are imperceptible or undetectable.

Minor impacts are slightly perceptible and localized.

Moderate impacts represent a notable change on a local basis.

Major impacts represent substantial changes on a landscape scale.

Mitigation of impacts

Avoid conducting management activities in an area of the affected environment.

Reduce the type of impact to an affected environment.

Minimize the duration or intensity of the impact to an affected environment.

Repair localized damage to the affected environment immediately after an adverse impact.

Rehabilitate an affected environment with a combination of additional management activities (i.e. planting trees in shaded fuel breaks, inoculating eroding soil with mycorrhizae and mulching).

Compensation of a major long-term adverse direct impact through additional strategies designed to improve an affected environment as much as is practical.

This section addresses impacts affecting plants and animals, including special status plants and animals, and invasive species. Fire management activities such as administration staffing, education and relocation of the fire cache and construction of a new administration building at park headquarters are not expected to have any noticeable impacts on the biological environment. New building construction will occur only within already developed sites within either the Oak Bottom compound or the park headquarters compound.

Vegetation communities

The patchy vegetation patterns in the park reflect variables such as elevation, topography, soil types, and natural and human disturbances. As noted in Chapter 3, for the purposes of this document, the diverse habitats have been grouped into seven plant communities; mixed conifer, ponderosa pine, knobcone pine, mixed oak woodland, blue oak grasslands, chaparral, and riparian.

Impact evaluation

Adverse impacts are those that change the plant communities in a manner tending away from the natural range of variability. Beneficial impacts those that change the plant communities toward the natural range of variability.

Direct impacts include such impacts such as mortality of individual species or entire plant communities. Indirect impacts are the alteration of the affected environment, individual plants, or plant communities which result in beneficial or adverse impacts after the time of the action, or in a location different from the action. These alterations encompass such changes as species composition or structure of the vegetation, erosion-related impacts, or impacts that occur long after the action.

Cumulative impacts are the combination and interaction of individual direct and indirect impacts on the affected environment in addition to all prior actions.

Short-term impacts are those that can be reversed relatively quickly. Short-term impacts are those that would be reversible during the period covered by this plan (approximately seven to ten years).

Long-term impacts are those that are reversed more slowly. Long-term impacts are those that would extend beyond the period covered by this plan (seven to ten years).

Negligible impacts are imperceptible or undetectable impacts upon plants or plant communities. Minor impacts are slightly perceptible and localized to an individual plant or plant community. Moderate impacts represent changes that would notably impact vegetation, and/or vegetation processes and associations. Impacts may be to individual plants, plant communities, or plant associations. Major impacts represent substantial changes that would alter vegetation processes, associations, and ecological functions on a landscape scale, or on a small-scale if rarity of the species were a factor.

Methodology and standards

Park staff through a review of available literature, discussion, experience, consultation, and professional judgment completed the analysis of vegetation communities. The standards used to analyze the impacts were developed through interdisciplinary team discussions and outside assistance.

Regulations and policies

There are a number of regulations and policies that affect vegetation in a national park. As with all Federal agencies, the Endangered Species Act and the Executive Order 13112 on Invasive Species play major roles in management methods. In addition, the National Park Service Management Policies (2001) define exactly what issues that parks must consider, unique to the National Park Service, in relation to laws and policies of the Federal government.

Mixed Conifer Community

Issues and Impacts Common to All Alternatives

Suppression: Construction of fire lines, helispots, safety zones and spike camps during suppression activities would result in mortality of individual plants and trees.

Construction methods range from the use of hand tools to bulldozers. These direct impacts range from beneficial to adverse, short-term to long-term, and from minor to major depending on the size, intensity and location of the fire and the type of line-cutting activity. Cutting fire lines with hand tools w ill have direct, long-term, major impacts to the individual non-sprouting plants that would be killed, but only minor to moderate adverse impacts to the plant community. The use of bulldozers would result in much more significant adverse impacts to vegetation and soils than cutting line with hand tools. The dozer line impacts would be moderate to major, and usually long-term.

The felling of large trees to facilitate fire suppression activities would result in direct, adverse, minor to major, long-term impacts. Intensity and duration of impact would vary depending on specifics. While the killing of large trees is thought to be detrimental to plant communities and associated wildlife, and is certainly a long-term action adverse to individual trees, the felling of one or two large trees would have a direct, minor impact to the community. The felling of a few large trees would have a direct, moderate impact, while the mortality of many large trees would be a direct, major impact.

Water drops from aircraft and high-pressure hoses used to suppress fire would result in mortality or damage to vegetation from the impact of the water. The impacts are expected to be direct, adverse, negligible to moderate, and short to long-term, depending on site specifics such as quantity and force of the water, degree of slope, and rarity of plants affected.

Most studies show the application of fire-fighting chemicals such as retardant and foam has impacts on vegetation. Impacts include decreased species richness, increased biomass, increase in density of exotic grasses, decrease in nitrogen-fixing native legumes, and decreased stem density. These impacts are for the most part indirect, adverse, short-term and negligible to moderate. (More significant impacts occur in aquatic environments to invertebrates, algae, and fish).

Fuel accidentally spilled during fire suppression activities may kill vegetation. Impacts would be direct, adverse, and negligible to major, and short to long-term depending on the size and location of spill. A very large spill, although unlikely, may result in the removal of hundreds of cubic yards of soil, and the death of many plants which would be considered direct and indirect, adverse, moderate to major, and long-term. A small spill that affects only a few plants would be considered minor to moderate and short-term. In the event a population of rare plants is decimated, the impact would be major and long-term.

Burn-outs and back-burns conducted as fire suppression activities would result in direct mortality and damage to vegetation as it is killed or damaged by burning. Intensity and duration of adverse impacts would range from negligible to moderate, and short to long-term depending on site specifics, fire spread, heat generation, and type and density of vegetation. A slow moving ground fire may affect only the herbaceous understory and a few shrubs, leaving most of the overstory untouched. Such impacts would be considered direct, adverse, short-term, and moderate, while a very fast moving hot fire could potentially burn all the vegetation, sterilize, soil, and inhibit reproduction for many years. While recovery would occur in the long run, these impacts could be considered direct, adverse, major, and long-term. From a standpoint of ecosystem health, however, these impacts could be considered beneficial. Impacts of burn-outs and backburns would be considered indirect, beneficial, moderate to major, and long term with regard to their effectiveness in the prevention or moderation of large, high severity fires.

Soil disturbance and compaction from suppression activities would result in mortality and damage to mycorrhizae and other beneficial soil microorganisms. These impacts would be direct and indirect, adverse, with negligible to moderate intensities and short to long-term duration depending on site specifics such as degree of disturbance and amount of litter left on the forest floor. Fire suppression reduces the potential for high-severity fire and subsequent severe fire impacts. This impact would be considered indirect, beneficial to adverse, moderate to major, and long-term.

Wildland fire suppression has adverse impacts because the beneficial impacts of fire are eliminated. The potential for high-severity fire would be increased because the fire was not allowed to burn and decrease fuel loads. Impacts would be indirect, adverse, negligible to major,

and short to long-term. Line cutting would have impacts similar to thinning. While killing individual plants and trees would be direct and adverse to those individuals, the indirect impact of line-cutting would be moderately beneficial in the overgrown mixed conifer community. Impacts from burn-outs and back-burns conducted as fire suppression activities can be adverse or beneficial. Beneficial, indirect impacts include the beneficial impacts of fire and halting the spatial extent of a high severity fire. Conversely, adverse, indirect impacts would occur under conditions in which a back-burn burns more intensely than intended and results in high-severity impacts. These impacts could be short to long term, and minor to major.

Fire line construction activity and the presence of fire crews would cause damage to vegetation that is not directly killed by line-cutting suppression activities. Damage to vegetation during suppression activities may result in mortality at a later time or decreased vigor due to damage. These indirect impacts could be beneficial to the mixed conifer community in that some thinning of overgrown communities is desirable. Damage or mortality to individual plant specimens would be direct, and adverse to that particular plant, and possibly indirectly as a whole if many, most, or localized populations suffer mortality, and/or damaged in such a way that no reproduction is possible. Degree of impacts would be minor to major, and duration short to long-term.

The application of retardant containing fertilizers may increase number or population densities of exotic species. Few studies are available, but most of them show increased populations of exotics, particularly grasses. These impacts appear to be short-lived in the few studies available. This effect would be indirect, adverse, and negligible to moderate, short to possibly long-term depending on species. More data is needed on retardant impacts on exotic as well as native species. The use of retardants may affect individual plant health and plant community composition. These impacts would be indirect, adverse, negligible to moderate, but probably short-term depending on species. Fire crews and equipment may introduce or spread exotic species through propagules on boots, vehicles, or equipment, and spread may be exacerbated by disturbance activities related to suppression. Exotic plant species may out-compete and replace native plant species in some areas. These impacts would be indirect, adverse, negligible to major, short to long-term impacts, depending on species, amount of seed transferred, and site specifics such as germination, rates, and moisture regimes.

Suppression activities would alter habitat through removal of individual plants and alteration of site characteristics such as soil, light and moisture. Habitat alterations would include habitat that contains sensitive plant species. While it may be surmised that sensitive plants are adapted to fire, or may not be affected due to their location, more data is needed. Impacts could be direct or indirect, beneficial or adverse, negligible to major, and short to long-term. Suppression activities have the potential to contribute to bark beetle or fungal infestations or other pathological processes as a result of injury to trees while conducting suppression activities. These impacts would be indirect, adverse, negligible to moderate, and short to long- term.

Habitat would be altered in areas where firelines, spike camps and helipads are constructed, and as a result of burnout/backburn activities. Habitat alterations would include changes in species composition, structure and function. These impacts would range from direct to indirect, beneficial to adverse, negligible to moderate, and short to long-term, depending on species and degree of damage. Vegetation in areas of soil compaction from suppression activities may exhibit reduced regeneration and vigor. These impacts would be indirect, adverse, negligible to moderate, and short to long-term, depending on species and degree of compaction.

Fuel spills or incomplete combustion of ignition compounds during suppression activities may impact vegetation. Large fuel spills may require removal of substantial amounts of native soils and vegetation and destruction of seed bank. These impacts would be direct or indirect, adverse, negligible to major, short to long- term impacts, depending on species and size and extent of spill. Mortality and damage to mycorrhizae and other soil microorganisms during suppression activities may have adverse impacts to residual vegetation and regeneration. These impacts would be indirect, adverse, negligible to moderate, and short to long- term impacts, depending on species and degree of damage. Sensitive plant species as well as old-growth trees are protected from fire where fire is suppressed; however, fire-adapted sensitive species may not do well if fire is suppressed. These impacts would be indirect, beneficial to adverse, negligible to major, and short to long-term. More data is needed. The potential for deforestation related to severe wildland fire would be eliminated or reduced if suppression

activities were successful. This impact would be indirect, beneficial, major, and long-term.

Lack of fire as a result of fire suppression alters the composition, structure, and function of the mixed conifer plant community. The natural fire cycle is interrupted, and fire adapted species would decrease over time as a result of fire suppression. Long-term fire suppression has resulted in increased fuel levels and thus fire hazard in the mixed conifer vegetation community. These impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management actions. These impacts are cumulative, adverse, moderate to major, and long-term.

Prescribed Fire: Mortality and damage to vegetation would occur during pre-fire thinning and construction of prescribed fire burn unit boundaries. These impacts would be direct, adverse to beneficial, negligible to major, and short-term. Mortality and damage to vegetation would occur as a result of management-ignited fires. These impacts may be adverse in areas where the fire exceeds prescribed parameters, but overall would be beneficial in that prescribed fire mimics natural fire in the ecosystem, creating gaps and increasing habitat diversity. Impacts would be direct, negligible to major, and short to long-term. Sensitive/uncommon plant species present in the burn area may be damaged or killed by pre-burn and burn activities if they are not identified in a pre-burn survey and avoided. Some herbaceous species may thrive as a result of disturbance, while tree species such as McNab Cypress continue to decline due to thinning activities. These impacts could be direct, adverse or beneficial, negligible to major, and short to long-term, depending on the requirements of specific species, and the degree of impact. Plant reproduction may be negatively impacted by the loss of seeds or other propagules such as acorns or bulbs. Seasonality may exacerbate this impact. Prescribed fire and pre-burn activities in the spring may kill plants, seeds and bulbs that would survive a similar burn in the fall, during the dormant season. These impacts would primarily be adverse but could be beneficial if reproduction is slowed in undesirable species such as exotic plants. These direct impacts would range from negligible to major, and short to long-term, depending on the requirements of particular species.

Fire would trigger germination of fire-adapted plants. This impact would be largely beneficial as it is a component of natural fire regimes. Impacts would be direct, negligible to moderate in intensity, with short to long-term impacts. This impact would be adverse if germination is triggered in exotic species (see indirect, below, for exotic plant impacts).

Prescribed fire escapes may become wildland fire; with possible undesirable, high-severity fire impacts. While these impacts would be adverse to developments, they would be beneficial to the ecosystem in the long-term. These direct impacts would range from negligible to major, and short to long-term depending on size, location and intensity of the escaped wildland fire.

Fuel spills that occur during prescribed fire activities may impact vegetation. Large fuel spills may require removal of substantial amounts of native soils and vegetation and destruction of seed bank. These impacts would be direct and indirect, adverse, negligible to major, and short to long- term. Fires would decrease nutrient availability and organic matter. This impact may be seen as adverse, but is likely to be beneficial in the long-term as it is a normal component of fire-adapted ecosystems. Loss of nutrients and litter and duff may favor certain pioneer species that are essential to post-fire recovery. These impacts would be direct and indirect, negligible to moderate, and long-term.

Fuel spills that occur during suppression activities may impact vegetation that is not burned during the fire. Large fuel spills may require removal of substantial amounts of native soil and vegetation and destruction or removal of the seed bank. These impacts would be indirect, adverse, negligible to major, and short to long- term depending on species, and size and extent of spill. The seeds of exotic plant species may be transferred to new areas inside prescribed burn units. Exotic annual grasses can increase the probability of ignition and spread of wildland fires and may compress the fire return interval. These impacts would be indirect, adverse, negligible to major, and short to long-term, depending on species, degree of infestation, and ability to treat infestation.

Some mortality of vegetation damaged during pre-fire and prescribed fire activities can be expected. While impacts are adverse to individual species, the beneficial impact of prescribed fire would outweigh the adverse impacts. These impacts would be indirect, negligible to moderate, and short to long-term. Vegetation in and around burn piles, including sensitive species and overstory trees, may be

damaged or killed if proximity of the pile or intensity of the fire is inappropriate. These impacts would be indirect, adverse, minor to major, and short to long-term.

Prescribed fire activities have the potential to contribute to bark beetle or fungal infestations or other pathological processes as a result of injury to trees resulting from suppression activities. These impacts would be indirect, adverse, negligible to moderate, and short to long- term.

Soil disturbance/compaction as a result of prescribed fire actions such as boundary line construction, crew activity, and burning piles may result in increased exotics, and/or decreased native plant vigor. These impacts would be indirect, adverse, negligible to major, and short to long-term.

Prescribed fire may escape, which would result in substantial mortality to mixed conifer community to an undesirable degree. While this impact may be seen as adverse, from the standpoint of the fire-adapted ecosystem, it would be a beneficial impact, even if it burns very hot and takes a very long time to recover. Impacts from escaped prescribed fire would be indirect, negligible to major, and short to long-term.

Thinning associated with prescribed fire would result in increased insolation and soil temperatures, and altered moisture regimes which would most likely result in decreased moisture availability. Some plants, especially herbaceous species, may decline rapidly due to loss of shade and moisture. Conversely, the new conditions may be favorable to other species whose populations may increase rapidly. These impacts would be indirect, beneficial to adverse, negligible to moderate, and short to long-term.

Prescribed fire would benefit fire-adapted species, and reduce overstocked understory trees and promote the growth of large, overstory species. This impact would be indirect, beneficial, moderate to major, and long-term. Prescribed fire would reduce the potential for high-severity wildland fire by decreasing fuel loads, and reduce the intensity and severity of subsequent wildland fires. These impacts would be indirect, beneficial, moderate to major, and short to long-term.

Prescribed fire would enhance the growth and subsequent use of ethnobotanical plants. This impact would be indirect, beneficial, moderate, and long-term. Prescribed fire would have long-term impacts on plants by either increasing or decreasing nutrient availability. These indirect impacts would range from beneficial to adverse, and be moderate, and short to long-term.

Prescribed fire activities may result in soils that are made sterile or hydrophobic by fire that burns very hot or by burn piles, which would inhibit re-growth of vegetation. This impact would be indirect, adverse, moderate to major, and short to long-term.

Prescribed fire alone cannot fully mimic the ecosystem functions of pre-settlement fire because forest structure and composition is significantly changed and prescribed fire impacts are quite different than those of pre-settlement fire. Several applications of prescribed fire may be necessary, especially in densely stocked stands with high concentrations of fuels. Thinning completed prior to prescribed fires can decrease the potential of large intense fires. These impacts would be adverse, moderate to major, and long-term. Prescribed fire is expected to re-create a more natural fire regime in mixed conifer forests, along with reduced potential for crown fire and extreme fire behavior, and reduced fire intensity at a landscape scale. These impacts would be cumulative, beneficial, moderate to major, and long-term.

All of the above impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Mechanical Treatment Level 1: Level 1 mechanical treatment would result in mortality and damage to vegetation. While this impact would be adverse to the individual plants that are killed or damaged, the overall impact of reducing fuel loads and providing safety for prescribed burn operations would be beneficial. Impacts would be direct, negligible to major in intensity, and short to long-term. Changes in species composition and vegetation structure would result from mechanical treatment. Indirect beneficial impacts would include the creation of more diverse habitat for a native species. Impacts would be negligible to major, and short to long-term, depending on site specifics.

Mechanical treatment level 1 would reduce and redistribute fuel loads, reduce crown bulk

densities and decrease fire intensity. These impacts would be direct, beneficial, moderate, and short to long-term.

The potential for fuel spills and the impact on vegetation would be approximately the same as that described under prescribed fire, direct impacts. The potential to cause damage or mortality to sensitive, or uncommon species would be approximately the same as that on under prescribed fire.

Some vegetation mortality is expected from damage that occurs during mechanical treatment. While this impact would be adverse to the individual plants that are killed or damaged, the overall impact of reducing fuel loads and providing safety for prescribed burn operations would be beneficial. Impacts would be indirect, negligible to major in intensity, and short to long-term, depending on site specifics and quantity of vegetation removal.

Mechanical treatment would result in habitat modification as a result of alterations to composition and structure. Beneficial impacts may be the creation of more diverse habitat for a native species, while adverse impacts may include an increase in exotic species. Impacts would be indirect, negligible to major, and short to long-term. Mechanical treatment may result in an increase or an introduction of disease and pest infestations as a result of slash piles and inadvertent injury to trees during treatment. Indirect, adverse to beneficial, negligible to major, short to long-term impacts. Reproduction may be slowed if chip layer is too thick, or if the burning of slash piles generated from treatment sterilizes the soil. These impacts would be adverse from the standpoint of ecosystem recovery and diversity but beneficial from a fuels reduction perspective. These indirect impacts would range from negligible to major, and short to long-term. Mechanical treatment would reduce fire intensity, and reduce risk of severe crown fire. These impacts would be indirect, beneficial, negligible to major, and short to long-term. Mechanical treatment would increase potential for wildland fire ignition as a result of canopy thinning making conditions favorable for annual grasses, and increased drying temperatures that contribute to ignition and spread of fire. These indirect impacts would be adverse, negligible to major, and short to long-term. Mechanical treatment activities have the potential to damage vegetation if fuel spills occur during treatment activities. These indirect impacts would range from adverse to beneficial, negligible to major, and short to long-term. Mechanical treatment would result in decreased probability of crown fire due to fuel reduction. This cumulative impact would be beneficial, moderate, and long-term. Mechanical treatment would increase potential for annual grasses and other exotic species due to repeated thinning. This impact would be cumulative, adverse, moderate, and long-term. Thinning impacts on nutrient cycling, seed scarification, plant and genetic diversity, disease and pest infestation are unknown (more data is needed). Injuries to trees during thinning operations may make them more susceptible to disease. Adverse, moderate, short to long term impacts. Thinning may increase growth and vigor of remaining plants resulting in beneficial, moderate, long term impacts.

All impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Alternative I

Please review what is stated in the section above (Issues and Impacts Common to All Alternatives) for the environmental impacts of suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative I for the mixed conifer vegetation community.

Shaded Fuel Breaks; This action would result in increased mortality and damage to vegetation (larger scale removal than mechanical Level 1) and change species composition and vegetation structure resulting from goal of maximizing fuel reduction as opposed to re-creation of more natural forest composition and structure. Would have direct, adverse and beneficial, negligible to major, short to long-term impacts.

Fuel levels would be reduced; and crown fire spread would be minimized. This impact would be direct, beneficial, negligible to major, and short to long-term. This action has the potential to cause damage or mortality to sensitive species. Impacts would be approximately the same as previously discussed above. Some vegetation would suffer inadvertent mortality from damage that occurred during treatment. These impacts would be indirect, adverse to beneficial, negligible to major, and short to long-term. Habitat fragmentation would occur as a result of 100-foot wide swaths of altered vegetation. These impacts would be adverse to the ecosystem, but beneficial from a fire standpoint. Range of intensity would be indirect, negligible

to major, and duration would be short to long-term. Shaded fuel break construction has the potential to introduce or expand exotic plant populations. This impact would be indirect, adverse, negligible to major, and short to long-term. Shaded fuel break construction increases the potential to introduce and spread disease and pest infestations. Depending on extent of infestation, these indirect impacts may be adverse or beneficial, negligible to major, and short to long-term. Reproduction may be affected if chip layer is too thick, or if the burning of slash piles generated from treatment sterilizes the soil. Would have indirect, adverse to beneficial, negligible to major, and short to long-term impacts.

Shaded fuel breaks may increase or decrease the likelihood of wildland fire ignition, due to decreased fuels but increased exotic annual grasses and temperatures. Also expected are reduced intensity of fire, and reduced risk of large, severe wildland fire. These impacts would be indirect, adverse to beneficial, moderate, and short to long-term. Treatment activities may result in fuel spills that impact vegetation. Impacts would be the same as those in previous discussion of fuel spills. Shaded fuel breaks may result in increased recreation use of shaded fuel breaks as trails for hiking, biking, equestrian, motorized use, which would result in potentially serious accelerated erosion. This impact would be adverse, negligible to major, and short to long-term. Long-term changes in composition, structure and function would occur. These would be cumulative, beneficial to the safety/fire component, but adverse to the ecosystem. Moderate to major intensities are expected. Repeated treatments would increase the potential for the introduction and spread of exotic plants, disease and pest infestations. Cumulative impacts would be the same as in other vegetation communities. Understory species, and those that were adapted to the pre-treatment conditions would be significantly reduced or eliminated. Cumulative impacts would be adverse, moderate to major, and long-term.

All impacts are cumulative to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large, intense wildland fires. Short-term adverse impacts related to project activity would result in beneficial impacts to restore more natural forest conditions. Long-term adverse impacts are acceptable due to the beneficial impacts provided, and most long-term adverse impacts could be mitigated. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources would occur under Alternative I. Although not anticipated, impairment of the mixed conifer vegetation community would constitute loss of old-growth trees and forest characteristics, and soil horizon loss in sensitive decomposed granite soils.

Unavoidable adverse impacts : Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fire risk would increase over time as a result of the increase in hazardous fuels. Second growth stands in the mixed conifer community would continue to be overstocked, stressing overall stand health and increasing susceptibility to pathogens. The length of time required to return the mixed conifer community to that approximating the early 1800s would be longer under Alternative I than under other alternatives with a broader range of fire management tools.

There may be additional long-term impacts to mixed conifer communities related to management actions proposed for this alternative, particularly related to the reactive installation and irregular maintenance of a shaded fuel break network that cannot be predicted at this time.

Alternative II

Please review what is stated above in the Issues and Impacts Common to All Alternatives for the environmental impacts of suppression, prescribed fire and mechanical treatment Level 1. The direct and indirect impacts discussed in actions to common to all alternatives are expected to have the same impacts as in Alternative I, but to a greater extent due to

increased use of prescribed fire. The direct and indirect impacts for mechanical treatment level 1 for Alternative II are expected to have the same impacts as in Alternative I, but would occur mainly in prescribed fire burn unit boundaries. Discussed below are the impacts specific to Alternative II for the mixed conifer vegetation community.

Shaded Fuel Breaks: Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to regrow. Impacts would be direct, beneficial to the ecosystem, but adverse to fire objectives, negligible to major, and short to long-term. Firefighter access routes and backfiring lines would have to be developed quickly, increasing the probability of bulldozers use. These impacts would be direct, adverse, negligible to major, and short to long-term. Without shaded fuel breaks, crown fires have the potential to continue to burn without dropping down to a surface fire, thus increasing the difficulty of control, and the probability of large scale, high severity fire impacts. This impact would be indirect, adverse, negligible to major, and short to long-term.

No long-term changes in composition and structure would occur under Alternative II. Cumulative accumulation of high fuel loads would continue with the potential for large, high intensity, high severity fires. No potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions would occur under Alternative II. No potential for habitat fragmentation would occur as a result of the construction of linear features, since no shaded fuel breaks would be constructed under Alternative II. The potential for high-severity fire is increased over Alternative I since continuous distribution of high fuel loads across the landscape reduces potential to control size of fires.

All impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Short-term use versus long-term enhancement of resources: Fire management activities under Alternative II would result in some mortality, but would reduce threat of large, intense, wildland fire, but may also increase the threat over the long run. Short-term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources would occur under Alternative II.

Unavoidable adverse impacts : Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning could result in decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing.

Conclusion: Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan (Alternative I). Shaded fuel breaks would not be maintained and plant regrowth would occur. The prescribed fire program would be expanded, and necessitate an increase in the number of spring burns to meet fuel reduction objectives. This alternative meets several of the park's stated fire management objectives. Reliance on prescribed fire as the primary tool for landscape vegetation restoration would require a longer period of time than other alternatives with a broader range of fire management tools. No impairment of mixed conifer vegetation community would occur under Alternative II.

Alternative III

Please review what is stated above for the environmental impacts of suppression and mechanical treatment level 1. In addition to what is described above for prescribed fire impacts, under Alternative III there would be reduced cumulative impacts, mainly through the use of pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives. Impacts would be the same as prescribed fire in Alternative I, but limited to pile burning impacts only. What follows is a discussion of the impacts specific to Alternative III for the mixed conifer community.

Mechanical Treatment Level 2: No mechanical Treatment Level 2 will occur in the mixed conifer community due to the potential for unacceptable adverse impacts to sensitive soils that would constitute impairment.

Shaded Fuel Breaks : Under Alternative III, width of shaded fuel breaks would be increased from 100 to 200 feet, and shaded fuel breaks would be reviewed to determine maintenance needs on a three year cycle. Appropriate maintenance requirements would be completed as needed according to this cycle. See Shaded Fuel Break direct impacts in Alternative I, above; impacts are expected to be similar but approximately doubled in scope since width of shaded fuel breaks is doubled.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality of vegetation in the short term, but would enhance vegetation in the long term by the reduced threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, the reduced risk or wildland fire ignition and high severity wildland fires offset this risk when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources would occur under Alternative III.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values.

Alternative IV

Review what is stated above (in Issues and Impacts Common to All Alternatives) for the environmental impacts of suppression, prescribed fire and mechanical treatment Level 1. Under Alternative IV, mechanical level 3 (small-scale logging) is added to mechanical level 1 and mechanical level 2.

Mechanical Treatment Level 2: Under this alternative, it is expected that there will be both beneficial, moderate, long-term changes in composition and structure. Mechanical treatment level 3, small-scale logging, includes a higher intensity of impacts than Level 1 and Level 2 mechanical treatment. Mechanical level 3 will not occur in the Mixed Conifer plant community due to the potential degree of adverse impacts that would constitute impairment on the sensitive decomposed granite soils in the Mixed Conifer Community.

Shaded Fuel Breaks : Under Alternative IV, the number of shaded fuel breaks is expanded from the current management activities and the width is doubled to 200 feet along roads. Along ridges, the system stays the same as current standards. The Shaded Fuel Break system would be similar to that described in Alternative III, and impacts for shaded fuel breaks under Alternative IV would be the same as those described under Alternative III.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, the reduced risk of wildland fire ignition and high severity wildland fires offset this risk.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources will occur under Alternative IV.

Unavoidable adverse impacts : Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative IV would utilize all known available fire management and fuel reduction techniques to reduce the risk of high severity wildland fire while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives goals. Under Alternative IV, it is expected that the number wildland fires would be reduced over time, using a combination of fire management techniques, compared to the current fire management program. The National Park Service may not impair park resources or values.

Ponderosa Pine Community

Impacts and issues common to all alternatives

The issues and impacts for this vegetation community area are expected to be similar to those found in the Mixed Conifer Community.

Alternative I

Many of the issues and impacts specific to Alternative I for the ponderosa pine community are expected to be similar to those found in the Mixed Conifer Community.

Shaded Fuel Breaks: The preferred percentage of retained canopy in ponderosa pine community shaded fuel breaks has not been determined at this point. Impacts may range from beneficial to adverse, negligible to major, and short to long-term. More data is needed to determine what is appropriate for this community.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large, intense wildland fires.

Short-term adverse impacts related to project activity would result in beneficial impacts to restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources will occur under Alternative I.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values. There may be additional long-term impacts to ponderosa pine communities related to management actions proposed for this alternative, particularly related to the installation and maintenance of a shaded fuel break network, that cannot be predicted at this time.

Alternative II

Please review Issues and Impacts Common to All Alternatives for this community for a review of suppression, prescribed fire and mechanical treatment level 1. Impacts under Alternative II in the Ponderosa Pine community are expected to be the same as those under Alternative II in the Mixed Conifer community.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources will occur under Alternative II.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result in decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing.

Conclusion: Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained and plant regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fire frequency and intensity would increase over time and could result in stand replacement, including loss of old-growth stands and leading to type conversion.

Alternative III

Please review Issues and Impacts Common to All Alternatives for a review of suppression and mechanical treatment level 1. Prescribed fire impacts discussed in that section would be the same as in this alternative, but reduced, mainly through pile burning used to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives. What follows is a discussion of impacts specific to Alternative III in the ponderosa pine community.

Mechanical Treatment Level 2 : Brush mastication is added in Alternative III; using medium equipment for large scale brush removal with higher intensity and extent than Level 1

mechanical treatment. Mechanical level 2 will be limited to slopes less than 30% slope, below 3,000 feet in elevation. Large numbers of acres would be treated, resulting in individual and plant community mortality and damage to vegetation. Direct impacts would range from beneficial to adverse. Impacts would be major and long-term; vegetation may never return to pre-treatment conditions. Mechanical treatment level 2 changes species composition and vegetation structure to a much greater extent than level 1, and would result in unnatural forest structure. These direct impacts are expected to range from beneficial from a fuels standpoint to adverse for the ecosystem, major and long-term. Mechanical treatment level 2 would reduce fuel levels. This impact would be direct, beneficial, major, and long-term.

Impacts regarding the potential for fuel spills would be approximately the same as mechanical level 1. The exception to this comparison would be that quantities of potential fuel spills would be increased due to the fact that large brush masticators would be used that contain significantly larger quantities of fuel than chain saws and other equipment used in level 1. Mechanical level 2 treatment has the potential to cause damage or mortality to sensitive species and non-target vegetation. These impacts would be direct, adverse, negligible to major, and short to long-term. Mechanical level 2 treatment would result in mortality to vegetation from inadvertent damage that occurred during treatment. Impacts would be beneficial to fire program objectives, but adverse and very destructive to the vegetation community. These impacts would be indirect, major, and long-term.

The potential to increase exotics and its impacts would be the same as in other vegetation communities previously discussed in this document. Habitat modification impacts would be the same as in other vegetation communities. Mechanical level 2 treatment has the potential to increase pathogenic processes as a result of injury to trees during treatment. This impact would be indirect, adverse, negligible to major, short to long-term.

Reproduction rate of native plant species, including that of sensitive species, may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae, or if the burning of slash piles generated from treatment sterilizes the soil. These impacts would be direct and indirect, adverse, negligible to major, and short to long-term. Level 2 treatment would decrease the likelihood of wildland fire ignition, reduce intensity of fire, and reduce risk of high severity wildland fire. These impacts would be beneficial, negligible to major, and short to long-term, depending on site specifics.

Mechanical level 2 treatment would result in long-term changes in vegetation composition and structure, including unknown impacts, as more studies are needed.Level 2 treatment would eliminate or significantly reduce understory species that were adapted to the pre-treatment conditions.

Shaded Fuel Breaks: Under Alternative III, width of shaded fuel breaks would be increased from 100 to 200 feet, and shaded fuel breaks would be reviewed to determine maintenance needs on a three year cycle. Appropriate maintenance requirements would be completed as needed according to this cycle. See Shaded Fuel Break impacts discussed in Alternative I. The impacts are expected to be similar but approximately doubled in scope since width of shaded fuel breaks is doubled.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, the reduced risk or wildland fire ignition and high severity wildland fires offset this risk when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources would occur under this Alternative.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. Wildland fire intensity would be expected to increase over time. The National Park Service may not impair park resources or values.

Alternative IV

Please review Issues and Impacts Common to All Alternatives for a review of suppression, prescribed fire and mechanical treatment level 1. Please review the discussion of mechanical treatment level 2 impacts in the previous alternative.

Mechanical Treatment Level 3: Small-scale logging is introduced in this alternative; with similar impacts expected as in mechanical levels 1 and 2, though at a higher intensity. Small-scale logging would result in mortality and damage to vegetation, and removal of trees. This direct impact would be beneficial and adverse, negligible to major, and short to long-term, depending on methods used. Species composition and vegetation structure would be changed to a greater extent than mechanical levels 1 and 2. This direct impact would be both beneficial to adverse, negligible to major, and short to long-term, depending on site specifics and methods used. Small-scale logging would reduce fuel levels. This direct impact would be beneficial, moderate, and long-term. The potential for fuel spills is increased in this alternative due to increased number of trucks and logging equipment. This impact would be direct, adverse, and negligible to major, and short to long-term. There would be the potential to cause damage or mortality to sensitive species. This impact would be direct, adverse, and negligible to major, short to long-term impacts. Small-scale logging would result in mortality to vegetation from inadvertent damage that occurs during treatment. This impact would be indirect, adverse, and negligible to major, and short too long-term. Small-scale logging may increase exotic plant populations. This impact would be indirect, adverse, and negligible to major, and short too long-term.

Habitat modification would occur as a result of alterations to composition and structure. This impact would be beneficial to fire objectives but may be adverse to the ecosystem. Impacts would be indirect, negligible to major, and short too long-term. Increase in pathogenic processes may be expected as a result of injury to trees during treatment. This impact would be indirect, adverse, and negligible to major, with short to long-term impacts.

Reproduction of native species may be negatively affected as a result of logging equipment damage to root structures, bulbs, or mycorrhizae. These impacts would be adverse, negligible to major, and short too long-term.

Reproduction of native species may be negatively affected if the burning of slash piles generated from treatment sterilizes the soil. This impact is adverse, negligible to major, and short too long-term.

Small-scale logging would decrease fire intensity, and reduce the risk of high severity wildland fire. This impact would be beneficial, negligible to major, and short too long-term. There would be a potential for impacts to vegetation if fuel spills occur during treatment activities. These impacts would be increased over other alternatives due to increase in number of trucks and equipment using fuel. This impact would be adverse, negligible to major, and short too long-term, depending on size of spill and other site specifics.

Cumulative : Small-scale logging treatment would result in long-term changes in vegetation composition and structure, including unknown impacts, as more studies are needed. Mechanical treatment level 3 would eliminate or significantly reduce understory species that were adapted to the pre-treatment conditions. All impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Shaded Fuel Breaks: Under Alternative IV, the number of shaded fuel breaks is expanded and the width is maintained along ridges at 100 feet and widened along roadsides to 200 feet. Impacts would be the same as previous sections, but over a larger area.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, the reduced risk or wildland fire ignition and high severity wildland fires offset this risk when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources would occur under this Alternative.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative IV would utilize all known fire management and fuel reduction techniques to reduce the risk of high severity wildland fire while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. Despite a broader range of fire management tools, it is expected that wildland fire frequency and intensity would increase over the short-term, until such time as the actions implemented on the ground begin to promote a return of the fire return interval and naturally occurring fire intensity. The National Park Service may not impair park resources or values.

Knobcone Pine Community

Issues and Impacts Common to All Alternatives

Suppression: Suppression activities would result in mortality and injury of individual plants/trees as a result of construction of fire lines, heli-spots, safety zones and spike camps (ranging from use of hand tools to bulldozers). Additionally, soil disturbances would adversely impact soil mycorrhizae and other soil microorganisms that would affect long-term health of vegetation. Since most of the knobcone pine community has heavy fuel loadings and is located in the wildland urban interface where suppression activities would likely be aggressive, impacts due to suppression activities would be of higher severity in this community than in most other communities. These direct adverse impacts would be minor to major over a short duration. Alternatives emphasizing fuel reduction through prescribed fire, shaded fuel break construction and mechanical fuel reduction techniques likely would reduce the level of adverse suppression impacts, but this benefit can not be easily quantified. Where appropriate, MIST techniques will be employed to lessen impacts, but options would be limited due to the level of values at risk in this urban interface zone. Post-fire rehabilitation would assist in mitigating many effects that were severely impacting. Since the plant community is adapted to high severity disturbance events, including soil churning as a result of fire damaged windfall trees and other severe soil impacts directly or indirectly relating to high severity fire, significant long-term recovery would be expected. This would result in negligible to minor long-term adverse impacts to the Knobcone community.

Additional impacts from suppression activities would occur via the application of water, chemicals such as retardant and foam, and residual fuel from backfire burnout activities or accidental spills. These impacts are expected to be mitigated by ensuring proper training of staff, pre-planning, and application of appropriate suppression technologies. Still, some uncertainty remains pertaining to unplanned activities. If a major fuel or chemical spill did occur, extensive post incident mitigation would be employed to lessen impacts. As a result, most of the foreseeable direct and indirect effects from water, chemical and fuel spills would be adverse negligible to major short-term and negligible to moderate long-term.

One threat to the plant community exists as a result of the introduction of pathogens and exotic plant species. Fire crews and equipment may introduce or spread exotic plant species or forest pathogens through boots, vehicles, or

equipment, and this effect may be exacerbated by disturbance activities related to suppression. Exotic plant species may out-compete and replace native plant species. Introduced pathogens may kill or weaken vegetation making it more susceptible to other stresses. Mitigation measures will lessen this effect to a large degree, although some uncertainty and risk will remain, particularly from the introduction of pathogens such as sudden oak death. Overall, this threat would be adverse, negligible to major, with short to long- term effects. Successful suppression of unplanned fire events would reduce the area where fire effects occurred in the knobcone community. Since fire is a beneficial process to this community, this would result in negligible to minor short to long term impacts, with a slight potential for moderate to major cumulative impacts, although the assumption that fire suppression would continue to be successful over an extended period of time (50-100+ years) is uncertain and not probable. Alternatives that include prescription fire as components will effectively mitigate this potential impact.

Burn-out and back-fire operations may cause mortality and damage to vegetation. It is likely that the fire effects resulting from such operations would be of a lower severity than if burning in an uncontrolled wildland fire, thus fire severity effects would be lessened as a result of this activity. These operational tools also provide flexibility in line location and can be coordinated to take advantage of preexisting man-made or natural barriers, indirectly allowing for less disturbance than would otherwise occur as a result of line construction activities. Overall, some risk of short-term adverse negligible to moderate effects exists due to the uncontrolled and unplanned nature of wildland fire. Still, such adverse risks are not high, and the probable beneficial negligible to moderate short and long-term impacts of burn-out and back-fire operations would likely be greater than any adverse impacts.

Prescribed Fire: The use of prescribed fire to achieve fire and resource management goals is a common component of all the alternatives, although levels of treatment do vary considerably by alternative. The level of pile burning in the knobcone plant community would vary based on the level of mechanical treatments that required post-treatment of fuels by burning. Pile burns would result in localized high severity effects to soil, and could cause damage to on site and surrounding vegetation, but mitigation will limit the severity of these effects. The expected result would be a significant adverse short-term impact, but the localized nature of the treatments would contribute to only a negligible to moderate adverse effect, with negligible to minor long-term adverse impacts. Broadcast prescribed fires in the knobcone pine community would be applied under a prescription dominated by low to moderate severity fire effects, with only small pockets experiencing high severity effects. This range of effects would support a mosaic of age classes and forest structures that would increase ecosystem diversity, and sustain fire as a process that is beneficial to the vegetation type. In general, this would result in a long-term indirect benefit to the knobcone pine community, although some increased threats may exist from exotic species that could gain dominance after burning. Mitigation measures would involve removal of many exotic species pre and post-fire, but some species, particularly small annual grasses, would be very difficult to control. These plants could out-compete native flora, but shrub and tree species would eventually dominate the site and provide a canopy cover to partially shade out these lower herbaceous species. Overall, the use of prescribed fire would result in a beneficial negligible to moderate impact to the community, although some risk would remain for an adverse short to long-term negligible to moderate impact as a result of exotic species increases.

Line construction activities that occurred in support of a prescribed fire would be very similar to those that occurred from suppression activities, except that prescribed fire activities would never include the use of dozers or similar ground scraping equipment. The prescription parameters for a prescribed fire would also be such that impacts resulting from the clearing for line construction would be less than those from suppression activities, and pre-planning would incorporate more flexibility to deal with exotic species or pathogens. The risk of escaped fire does make some of these impacts uncertain, but overall, line construction effects would be less than under a suppression scenario, with the result of a minor to moderate adverse short-term and negligible to minor adverse long-term impact to vegetation.

The frequency of out of season, or spring burning vary by alternative, but are generally very low. Spring burning that occurred soon after leaf out of deciduous trees and other vegetation may result in adverse impacts since most plants are more sensitive to thermal effects during this time frame. Mitigation that reduced the level of spring burning or timed spring burning to occur before leaf-out would limit these effects. Overall, however, the effects of

spring burning are not well understood. Some literature purports that spring burning may be a benefit in reducing the cover of exotic grasses, although such generalizations should not be made since literature on the knobcone pine community is sparse, and site specific data that compares treatments is lacking. Overall, out of season prescribed fire impacts in this community are expected to be directly and indirectly adverse, negligible to major in the short-term. In the long-term, impacts would range from minor beneficial to moderate adverse, although a great deal of uncertainty does exist relating to this topic.

If exotic annual grasses did increase over a short-term period following a prescribed fire, the probability of ignition and potential spread of wildland fires would increase. If a fire did establish and re-burn over a short rotational period, a compressed fire return interval could result that would alter the vegetative structure of the plant community. This scenario is not highly probable, but it does pose a threat of adverse impacts estimated to be a negligible to major over the long-term. If exotic species did proliferate, prescribed fires would not be implemented, so no cumulative impacts are anticipated.

Cumulative impacts resulting from the use of prescribed fire in the knobcone pine plant community are not certain, since other occurrences such as uncontrolled wildland fire could have additive impacts. Barring any unplanned events, it is estimated that prescribed fire would result in negligible to moderate benefits, with a potential for some negligible to moderate effects relating to exotic species. Alternatively, effective fire suppression in the absence of prescription fire or some other alternative fuel reduction method could contribute to conditions that promoted very high severity effects over a large scale. The risk of exotic species under this alternative scenario would likely be much higher than would be expected under a prescribed fire treatment regime. Given this scenario, it is expected that a range of effects from prescribed fire would occur and would include negligible to minor adverse and negligible to minor beneficial impacts.

Mechanical Treatment Level 1: The use of mechanical treatment level 1 to achieve fire and resource management goals is a common component of all the alternatives, although levels of treatment vary. In the knobcone pine community mechanical treatments will focus on the reduction of dead and live standing ladder fuels. Both shrub and tree species would be targeted, with treatments favoring rare and unique shrubs, hardwood tree species, and larger conifer trees. These treatments will result in direct mortality and damage to vegetation that could indirectly lead to mortality. In the long-term, retained vegetation would be healthier as a result of lowered competition for soil resources, although changes may result in greater damage via wind or snow events. Removed vegetation would be limited to common species, thus no individual species would be impacted beyond a negligible to moderate degree in the short-term. Over the long-term, maintenance activities would result in some changes to the vegetation structure on a very localized level, but not on a landscape or forest stand basis. These activities would, overall, result in beneficial to adverse, negligible to major, short to long-term effects.

Trampling and soil compaction would occur during treatment, resulting in adverse short-term negligible to moderate impacts, with negligible long-term impacts. Fuel spills are another potential risk, and could result in negligible to moderate short-term impacts, although mitigation should effectively eliminate this potential adverse impact. Mechanical treatment 1 would also facilitate greater probability of fire control during suppression events, and would support greater ease in implementation of prescribed fire. These indirect effects would lead to a decrease in high impacting fire suppression control activities, and high severity fire effects. This would be a beneficial negligible to major short-term benefit, and negligible to minor long-term benefit. The mechanical treatments would also facilitate low to moderate severity fire effects by allowing greater flexibility and expanding abilities to burn in this plant community (see previous section on prescribed fire for impacts relating to prescribed fire).

Mechanical treatment level 1 may result in the introduction and/or spread of disease and pest infestations in slash piles, plus the inadvertent injury to trees during treatment. Mitigation measures will limit this threat, but it is still a negligible to minor adverse impact. Repeated maintenance of locations may result in cumulative adverse impacts, but monitoring and flexibility in repeat treatments will be established to limit these to only minor effects. A chip layer would be applied over much of the mechanical level 1 treatment area. This chip layer will have a moderate impact on soil and plant interactions by moderating temperature and soil moisture, altering nutrient exchanges, and inhibiting germination or growth of some plant species. Overall, short-term impacts will be

extremely variable, from minor adverse to minor beneficial. Some uncertainty exists pertaining to the effects from chipping, particularly in the long term, but in general, these are expected to be minor and beneficial as a result of increased growth potential of the soil.

Alternative I

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. What follows is a discussion of the impacts specific to Alternative I for the knobcone pine community.

Shaded Fuel Breaks: Shaded fuel breaks would involve the removal of vegetation, with impacts similar to mechanical Level 1, but on a larger scale. The resulting treatment would produce linear features with a forest composition and structure that is more open than would be in an unmanaged, natural forest. This would result in a change in conditions that would alter understory vegetation, with an increase cover of both native and non-native herbaceous species. Impacts would be similar to those discussed under mechanical Level 1 except that exotic plant species may be introduced or populations spread via these linear corridors. Monitoring and mitigation measures will limit this effect, but some uncertainty remains. Expected impacts are adverse, negligible to major, and short to long-terms.

Shaded fuel breaks may be used for increasing or improving recreational opportunities or on the contrary, for unintended recreation use (hiking, biking, equestrian, motorized), with a result of increased compaction and accelerated erosion on shaded fuel breaks. Monitoring and mitigation measures would be expected to limit these unintended uses to adverse, negligible to minor, short and long-term impacts. Continued maintenance would be flexible and be based on monitoring data, with the end result of a minor adverse cumulative impact to the vegetation.

Conclusion: Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. A mix of beneficial and adverse impacts would occur under this alternative. Long term adverse impacts to the community would likely occur from an increase of exotic species, but vigilant monitoring and appropriate mitigation would limit these to negligible to minor impacts, although some uncertainty remains.

Alternative II

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the suppression, prescribed fire, and mechanical level 1 treatment impacts. Exceptions to these impacts are that prescribed fire treatments would increase and mechanical level 1 treatments as fuel breaks would be reduced to those minimally needed to support prescribed fires.

The increase in prescribed fire will involve greater out of season, spring burning due to the limited prescription windows that exist during the dormant season and added challenges that would exist in the implementation of prescribed fire units without a pre-established shaded fuel break. As previously discussed a great deal of uncertainty remains pertaining to the application of such burning. In general, expectations are that this level of spring burning will result in minor beneficial to moderate adverse long-term impacts.

The elimination of maintained shaded fuel breaks would partially reduce the treat of expanded exotic species, but the need for control lines for implementation of prescribed fires will still retain some level of threat. This threat will pose a negligible to minor short and long-term adverse impact. The absence of shaded fuel breaks will result in a few other adverse and beneficial impacts. Most notably, it is doubtful that the fire program could safely implement the level of burning desired, thus the ecosystem would be susceptible to large scale fire events. While adapted to high severity fire, the knobcone pine community would be susceptible to invasion by exotic species resulting in a minor to negligible long-term adverse impact. Still, without the fuel breaks as a source of exotics from which to disperse, these impacts should be less than in other scenarios.

Conclusion: Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained and plant re-growth would occur. The prescribed fire program would be expanded, and necessitate increased level of spring burning to meet resource and fire management objectives. This alternative meets several of the park's stated fire management objectives. A mix of beneficial and adverse impacts would occur under this alternative. Long term adverse impacts to the community would likely occur from an increase of spring burning, although many of these effects are poorly understood. Phasing out fuel breaks

would result in a lessening of risk associated with exotic species, although eliminating fuel breaks will pose significant challenges to the implementation of prescribed fires.

Alternative III

Please review the Issues and Impacts Common to All Alternatives for this vegetation community for a discussion of the suppression and pile burning impacts. Additional discussion of issues and impacts are included below for pile burning. The type and degree of impacts from mechanical level 1 treatment are consistent with those of Alternative I, while additional impacts relating to level 2 mechanical treatment are also discussed below.

Under this alternative prescribed fire would not occur as a landscape scale treatment. This removal of fire as an ecosystem process would result in adverse negligible to minor long-term impacts to the community assuming no wildland fires occurred. Pile burning activities would be higher in this alternative than in any others. Pile burning would include effects ranging from minor beneficial to moderate adverse short-term and long-term impacts. Cumulative impacts to soil from pile burning would be mitigated. Cumulative impacts from effective fire suppression would probably not occur since fire risk would still be relatively high and an unplanned event would likely occur at some point in the future. Impacts from such an unplanned event are, however, too difficult to predict.

Mechanical treatment level 2 would be used in varied locations in this plant community, with a focus on reducing ladder fuel levels consisting of shrubs and small trees. Effects are poorly understood, but are expected to be wide ranging from this treatment. Mitigation should protect most uncommon or high value species, but some desired plants would be locally reduced or lost, resulting in a minor to major short-term impact and negligible to major long-term impact. In addition, damage to residual specimens would occur even with the relatively small equipment that would be employed. Some compaction and disturbance to soil would also occur. Another uncertainty is the potential risk of pathogen spreading or introducing pathogens. The response of herbaceous species is also uncertain, and probably species specific. These issues would be partially offset by an increased growth of residual desired species as a result of a reduction of competitive stresses from the treatment. Overall there is significant level of uncertainty, but these impacts are expected to range from negligible to moderate adverse short-term impacts and from minor beneficial to minor adverse long-term impacts.

Under Alternative III, width of shaded fuel breaks would be increased from 100 (current program) to 200 feet. This treatment would expand beneficial and adverse impacts discussed under the shaded fuel break section for alternative 1.

Conclusion: Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives. Many uncertainties exist in relation to this alternative, with the potential for numerous adverse impacts including an increase in exotic species, a decrease in sensitive or high value species, and an increase in forest pathogens. The chipped materials may eventually increase soil growth potential, but this benefit is uncertain.

Alternative IV

Please review the Issues and Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1treatment impacts. Please review Alternative III for a discussion of mechanical level 2 treatment impacts. Additional comments on these treatments are included in the following discussion. This alternative also includes the mechanical level 3 (small-scale logging) as a fire management action. Mechanical level 1 and 2 impacts would Mechanical Treatment Level 3 impacts would include impacts to soil and residual forest vegetation, in addition to impacts be of higher intensity than mechanical level 1, but less than mechanical level 2. Impacts would be the same or very similar to mixed conifer and ponderosa pine communities.

Small-scale logging would result in mortality and damage to vegetation, and removal of trees. This impact would be both beneficial and adverse, negligible to major, and short to long-term, depending on site specifics, and methods used. Species composition and vegetation structure would be changed to a greater extent than Level 1 and Level 2. This impact would be both beneficial to adverse, negligible to major, and short to long-term, depending on site specifics and methods used. Small-scale logging would reduce fuel levels. This impact would be beneficial, moderate, and long-term. There would be the

potential for fuel spills. Same as discussed in earlier sections on the impacts of mechanical treatment, but somewhat increased due to increased number of trucks and logging equipment. Adverse, negligible to major, short to long-term effects. There would be the potential to cause damage or mortality to sensitive species. Impacts would be adverse, negligible to major, short to long-term effects.

Small-scale logging would result in mortality to vegetation from inadvertent damage that occurs during treatment. This impact would be adverse, negligible to major, and short to long-term. Small-scale logging may increase exotic plant populations. This impact would be adverse, negligible to major, and short to long-term. Habitat modification would occur as a result of alterations to composition and structure. This impact would be beneficial to fire objectives but may be adverse to the ecosystem. Impacts would be negligible to major, and short to long-term, depending on site specifics.

Increase in pathogenic processes may be expected as a result of injury to trees during treatment. This impact would be adverse, negligible to major, with short to long-term effects, depending on site specifics. Reproduction of native species may be negatively affected as a result of logging equipment damage to root structures, bulbs, or mycorrhizae. These impacts would be adverse, negligible to major, and short to long-term, depending on degree of damage and other site specifics. Reproduction of native species may be negatively affected if the burning of slash piles generated from treatment sterilizes the soil. This impact is adverse, negligible to major, and short to long-term.

Small-scale logging would decrease fire intensity, and reduce the risk of high severity wildland fire. This impact would be beneficial, negligible to major, and short to long-term. Associated with this action is the potential for impacts to vegetation if fuel spills occur during treatment activities—with impacts similar to those discussed in the mixed conifer and knobcone pine communities. This impact would be adverse, negligible to major, and short to long-term, depending on size of spill and other site specifics.

Small-scale logging treatment would result in long-term changes in vegetation composition and structure, including unknown impacts as more studies are needed. Level 3 treatment would eliminate or significantly reduce understory species that were adapted to the pre-treatment conditions. These impacts are additive to impacts from historical land use and management actions, including logging, mining, development, road building, dam construction, recreational use, and watershed restoration, as well as current management practices.

Shaded Fuel Breaks: Under Alternative IV, the number of shaded fuel breaks is expanded from the current program, and the width of shaded fuel breaks is 200 feet along roads and remains at 100 feet along ridges.

Mortality and damage to vegetation would occur on a larger scale than mechanical treatment used to recreate more natural forest conditions (decreased percent cover). Beneficial to adverse, negligible to major, short to long-term effects. Changes species composition and vegetation structure would occur that are not designed to mimic natural forest conditions. May have both beneficial and adverse impacts, negligible to major, short to long-term effects. The percent of retained canopy in knobcone pine is not determined at this time—more data is needed. Fuel levels would be reduced with beneficial, negligible to major, short to long-term effects. There would be the potential fuel spills that may cause damage to vegetation. Adverse, negligible to major, short to long-term effects. Damage or mortality to individual sensitive species may occur which may be possibly beneficial (if species respond favorably to disturbance) to adverse, negligible to major, short to long-term effects.

Vegetation may exhibit mortality from damage that occurred during treatment. Beneficial to adverse, negligible to major, short to long-term effects. Habitat fragmentation effects would be magnified as a result of 200-foot wide swaths of altered vegetation along roadside fuel breaks. Impacts would be adverse, negligible to major, short to long-term effects. Greater potential for introduction or expansion of exotic plant species due to increased width of shaded fuel breaks. Impacts would be adverse, negligible to major, short to long-term effects. Increased pathogenic processes as a result of injury to trees during treatment may occur. Impacts would be beneficial to adverse, negligible to major, short to long-term effects. Vegetation reproduction may be affected if chip layer is too thick, or if the burning of slash piles generated from treatment sterilizes the soil. Impacts would be beneficial to adverse, negligible to major, short to long-term effects. Treatment would decrease likelihood of wildland fire ignition, reduce intensity of fire, reduce risk of high

severity wildland fire, provides access and escape route for fire crews. Impacts would be beneficial, negligible to major, short to long-term effects. Treatment may impact vegetation if fuel spills occur during treatment activities. Impacts would be adverse, negligible to major, short to long-term.

Treatment may increase impacts to knobcone pine community resulting from recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks. Impacts would be adverse, negligible to major, short to long-term effects.

Long-term changes in composition and structure would occur. Understory species, and those that were adapted to the pre-treatment conditions would be significantly reduced or eliminated. There may be long-term effects that are unknown at this time.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of high severity wildland fire. Burn piles may escape to become wildland fires. However, this risk is offset by the reduced risk or wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of high severity wildland fire while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives. The National Park Service may not impair park resources or values.

Mixed Oak Woodland Community.

Issues and Impacts Common to All Alternatives

Suppression: There may be some mortality of individual plants/trees related to construction of fire lines, heli-spots, safety zones, and spike camps (ranging from use of hand tools to bulldozers). There would be adverse, negligible to moderate, short-term to long-term impacts from minor to major depending on the size, intensity and location of the fire and the type of suppression activity. Felling of large trees to facilitate fire suppression activities. There would be a range of beneficial to adverse, moderate to major, short-term to long-term impacts depending on site specifics. Damage to vegetation from fire crews, engines, and fire line construction activity could result in beneficial to adverse, negligible to major, short-term impacts depending on site specifics.

There may be some mortality or damage to vegetation from aircraft water drops and high-pressure hoses used to suppress fire resulting in adverse, negligible to moderate, short to long-term impacts depending on site specifics. Fuel accidentally spilled during fire suppression activities may kill vegetation resulting in adverse, negligible to major, short to long-term impacts depending on size and location of spill. There may be some mortality and damage to vegetation from management-ignited fires (burn-outs/back-burns) resulting in beneficial to adverse, negligible to moderate, short to long-term impacts depending on site specifics. Potential impacts to vegetation from retardants could result in adverse, negligible to moderate, short-term impacts, depending on site specifics.

Threatened and endangered species may experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known, resulting in beneficial or adverse, minor to major, short to long-term impacts depending on species, activity, level of intensity. Mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression. Adverse, negligible to moderate, short to long-term impacts depending on site specifics.

The potential for a large, severe, and unmanageable wildland fire is reduced, and the consequential adverse fire impacts resulting in beneficial and adverse, moderate to major, long-term impacts. There may be some mortality occurring after fire suppression resulting from damage during suppression activities resulting in beneficial to adverse, moderate to major, short to long-term impacts, depending on site

specifics. Retardant containing fertilizers may increase exotic species resulting in adverse, negligible to major, short to long-term impacts, depending on species and site specifics. Fire crews and equipment may introduce or spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out-compete and replace native plant species resulting in adverse, negligible to major, short to long- term impacts, depending on species, site specifics, and amount of seed transfer, germination.

Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that negatively impacts vegetation, including threatened and endangered species. This would result adverse, moderate to major, short to long-term impacts.

There are potential impacts relating to use of retardants that may affect individual plant health and plant community composition, including aquatic communities resulting in adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics—more data needed. There is the potential to contribute to bark beetle, fungal infestations or other pathological processes as a result of injury to trees resulting from suppression activities resulting in adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Habitat would be altered in areas where firelines, spike camps, safety zones, and heli-spots were constructed. Alterations include species composition, structure and function resulting in beneficial to adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor resulting in adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, and degree of compaction. There may be increased potential for impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed resulting in adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, size and extent of spill.

Mortality and damage to mycorrhizae during suppression activities may have adverse impacts to residual vegetation and regeneration resulting in adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics. Sensitive, threatened and endangered species and large overstory trees are protected where fire is suppressed; fire-adapted sensitive species may not do well if fire is suppressed resulting in beneficial to adverse, negligible to major, short to long-term impacts.

The potential for type-conversion related to a high severity wildland fire would not occur if suppression activities are successful resulting in beneficial, major, long-term. Damage to vegetation/ soil organisms may occur as a result of incomplete combustion of fuels used to conduct burnouts resulting in adverse, minor to moderate, short-term impacts.

Fire suppression would alter the composition, structure, and function of this plant community; this impact can be additive in regards to historical land abuse and management actions, including logging, mining, development, road building, dam construction, recreational use, watershed restoration, and ironically, fire suppression. Fire adapted species would decrease over time as a result of fire suppression, since the natural fire cycle interrupted. Long-term fire suppression has increased fuel levels and fire hazard in this vegetation community.

Prescribed Fire: There may be some mortality and damage to vegetation during pre-fire thinning and construction of prescribed fire burn unit boundaries. Adverse to beneficial, negligible to major, short to long-term impacts. There may be some mortality and damage to vegetation as a result of management ignited fires resulting in adverse to beneficial, negligible to major, short to long-term impacts. Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre-burn and burn activities if they are not identified in a pre-burn survey. Adverse to beneficial, negligible to major, short to long-term impacts.

Plant reproduction would be enhanced with prescribed burning in the fall, but decreased in spring burns. Adverse to beneficial, negligible to major, short to long-term impacts. Fire would trigger germination of fire-adapted plants – seasonality depending resulting in negligible to major, adverse to beneficial, short to long-term impacts. There would be potential for prescribed fire to escape, possibly becoming a large and severe wildland fire resulting in

moderate to major, adverse to beneficial, short to long-term impacts. There would be the potential for damage or mortality resulting from accidental fuel spills resulting in negligible to major, adverse, short to long-term impacts.

Exotic plant species may be introduced and spread within prescribed burn units resulting in negligible to major, adverse, short to long-term impacts. Loss of canopy cover can lead to exotic annual grasses, which in turn can increase the probability of ignition and spread of wildland fires and potentially compress the fire return interval resulting in negligible to major, adverse, short to long-term impacts. There may be some mortality of vegetation damaged during pre-fire and prescribed fire activities resulting in negligible to major, adverse, short to long-term impacts. Vegetation in and around burn piles may be damaged or killed if proximity or intensity is inappropriate, including sensitive species and overstory trees. Burn piles can also sterilize the soil is localized spots, which enables wind-dispersed and weedy species the upper hand in colonization, resulting in patches of infestations. There would be the potential to introduce and/or spread pathogens such as beetles and fungi resulting in negligible to major, adverse, short to long-term impacts.

Fire and soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor which would be negligible to major, adverse, short to long-term impacts. There would be the potential for prescribed fire to escape, resulting in substantial mortality to mixed oak woodland plant community resulting in moderate to major, adverse, short to long-term impacts. Thinning associated with prescribed fire may result in increased insolation and soil temperatures, and decreased moisture resulting in negligible to major, beneficial to adverse, short to long-term impacts.

Prescribed fire can reduce overstocked and suppressed understory brush and trees, while favoring large overstory species resulting in beneficial, moderate, long-term impacts. Prescribed fire mimics natural fire in the ecosystem which would be beneficial, moderate, long-term impacts. Fire adapted species benefit from prescribed fire which would be beneficial, moderate, long-term happy impacts. Prescribed fire also reduces the potential for large and intense wildland fires which would be a beneficial, moderate, long-term impacts . It also reduces the intensity of subsequent wildland fires resulting in beneficial, moderate, long-term impacts. There is the potential to enhance ethnobotanical uses which would be a beneficial, moderate, long-term impact.

Fires may have a long-term effect on plants by either increasing or decreasing nutrient availability resulting in beneficial to adverse, moderate, long-term impacts. Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re-growth of vegetation which is an adverse, moderate to major, short to long-term impacts. Fires would decrease nutrient availability and organic matter which is a negligible to major, adverse to beneficial, short to long-term impacts. There would be the potential for fuel spill to damage vegetation not consumed during prescribed burn activities resulting in adverse, negligible to major, short to long-term impacts. If prescribed fire escapes it can lead to plant damage or mortality with impacts ranging from minor to major depending on size and intensity of fire.

Prescribed fire is expected to mimic a more natural fire regime in mixed oak woodlands with beneficial, long-term, moderate to major impacts. Prescribed fire would reduced potential for crown fire and extreme fire behavior, reduced fire intensity at landscape scale resulting in beneficial, long-term, moderate to major impacts.

Mechanical Treatment Level 1: There may be some mortality and damage to vegetation that would be beneficial to adverse, negligible to major, short to long-term impacts. There would be changes species composition and vegetation structure that would be beneficial and adverse, negligible to major, short to long-term impacts. There would be a reduction in ladder fuels and fuel loads are redistributed, thus decreasing fire intensity if the surface fuels are treated that would have beneficial, moderate, short to long-term impacts. There would be the potential to cause damage or mortality to sensitive and overstory tree species that would have adverse, negligible to major, short to long-term impacts. There would be the potential for slash piles to damage/kill overstory tree species that would have adverse, negligible to moderate, short to long-term impacts.

There may be some mortality from damage that occurred during treatment that would be adverse to beneficial, negligible to major, short to long-term impacts. Habitat modification could occur as a result of alterations to composition and structure resulting in adverse to beneficial, negligible to major, short to long-

term impacts. There may be an increase in the introduction and/or spread of disease and infestation due to slash piles and inadvertent injuries to trees during treatment that would result in adverse to beneficial, negligible to major, short to long-term impacts. Reproduction may be slowed if chip layers are too thick that would be adverse to beneficial, negligible to major, short to long-term impacts. Reproduction may be slowed if the burning of slash piles generated from treatment sterilizes the soil, resulting in adverse to beneficial, negligible to major, short to long-term impacts. Slash piles can also lead to infestations of wind-dispersed exotic plant species that would have adverse, negligible to major, short to long-term impacts. There may be an increased likelihood of wildland fire ignition (reduced canopy from thinning can make conditions favorable to annual grasses – which can make ignition and spread of fire much more likely, plus conditions near the ground surface are warmer and wind can dry fuels out quicker), reduced intensity of fire, reduced risk of crown fire. This impact would be adverse to beneficial, negligible to major, short to long-term. There is the potential to damage vegetation if fuel spills occur during treatment activities, resulting in adverse to beneficial, negligible to major, short to long-term impacts.

Reduction of fuels decreases the probability of crown fire. Repeated disturbance from thinning operations can increase potential for annual grasses and other exotic species. Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are almost unknown.

Alternative I

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. What follows is a discussion of the impacts specific to Alternative I in the mixed oak woodland community.

Prescribed Fire: It should be noted that prescribed fire alone cannot fully mimic the ecosystem functions of pre-settlement fire because the forests have changed greatly and the impacts of reintroduced fire are likely to be different than those of pre-settlement fire. If fire alone is used, several applications of prescribed fire would be necessary, especially in densely stocked stands with heavy fuel concentration. Thinning before prescribed fire can decrease the probability of large intense fires, with beneficial, moderate to major, long-term impacts.

Shaded Fuel Breaks: Increased mortality and damage to vegetation resulting from maximizing fuel reduction rather than mimicking a more natural oak woodland composition and structure. This may result in adverse and beneficial, negligible to major, short to long-term impacts. However, fuel levels are reduced, which is a beneficial, negligible to major, short to long-term impacts. Crown fire spread would be minimized, which is a beneficial, negligible to major, short to long-term impacts. There could be an increased potential for fuel spills, which would be adverse, negligible to major, short to long-term impacts. There is a potential to cause damage or mortality to sensitive species which would be adverse, negligible to major, short to long-term impacts.

Incidental mortality may occur from damage that happens during treatment that would be adverse to beneficial, negligible to major, short to long-term impacts. Some habitats will be fragmented as a result of 100-foot wide swaths of altered vegetation that would be adverse, negligible to major, short to long-term impacts. There will be landscape heterogeneity – including edge effects for some species that would be beneficial, negligible to moderate, short to long-term impacts. There is the potential for introduction or expansion of exotic plant species that would be adverse, negligible to major, short to long-term impacts. There is increased potential to introduce and spread diseases and infestations which would be adverse, negligible to major, short to long-term impacts. Vegetation reproduction may be affected if chip layer is too thick and may have adverse to beneficial, negligible to major, short to long-term impacts.

Vegetation reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil and may have adverse to beneficial, negligible to major, short to long-term.

Annual grasses can increase the potential of ignition and spread of wildland fires, while at the same time fire intensity is reduced, and there is a reduced risk of large and intense fires. This may result in adverse to beneficial, moderate, short to long-term impacts. There is the potential for impacts to vegetation if fuel spills occur during

treatment activities which would be adverse, negligible to major, short to long-term impacts. There is the potential for increased recreation use (hiking, biking, and equestrian, motorized), and potential accelerated erosion on shaded fuel breaks, with adverse, negligible to major, short to long-term impacts.

Under Alternative I, there would be long-term changes in vegetation composition, structure and function. Repeated treatments in this habitat type would be repeatedly increasing the chance to introduce and spread exotic plant species, disease, and infestations.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large and intense wildland fires. Short-term adverse impacts related to project activity would result in beneficial impacts to restore more natural forest conditions Prescribed fires may escape to become wildland fires; this risk is offset by the removing ladder fuels and redistributing fuel loads to reduce the chance of a large and intense fire.

Irreversible/irretrievable commitments of resources: There would be no irreversible/irretrievable commitments of resources under this alternative.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fires would increase in frequency and intensity. There may be additional long-term impacts to mixed oak woodlands that are related to management actions proposed for this alternative, (particularly related to the installation and maintenance of a shaded fuel break network) that cannot be predicted at this time. The National Park Service may not impair park resources or values.

Alternative II

Please review the Issues and Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts.

Prescribed Fire: The following impacts are expected to have the same impacts as in Alternative I, but to a greater extent due to increased use of prescribed fire. Additionally, reliance on prescribed fire to treat the number of acres anticipated would undoubtedly require some amount of spring burning.

Spring burning can result in the direct mortality of overstory trees with adverse, negligible to major, short to long-term.

Spring burning can result in loss of overstory trees and herbaceous species with adverse, negligible to major, short to long-term impacts.

There is the potential for undesirable alteration of habitat due to plant loss resulting from spring burning.

Mechanical treatment level 1 would occur mainly in prescribed fire burn unit boundaries.

Shaded Fuel Breaks: Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to regrow that would have beneficial to adverse, negligible to major, short to long-term impacts. Firefighter access routes and backfiring lines would have to be developed quickly, potentially including the use of bulldozers that would have adverse, negligible to major, short to long-term impacts. There would be less of a chance to control the fire size that would have adverse, negligible to major, short to long-term impacts.

No long-term changes in composition and structure, hopefully moving towards a more natural, pre-suppression condition. Continuous distribution of high fuel loadings across the landscape would reduce the potential to control the fire size.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Short-term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity/extreme fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing. This would also increase overstory mortality of desired large trees.

Conclusion: Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives. However, it is expected that wildland fires would increase in frequency and intensity.

Alternative III

Please review the Issues and Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. What follows is a discussion of the impacts specific to Alternative III in the mixed oak woodland plant community.

Prescribed Fire: Impacts discussed at the beginning of this vegetation community would be reduced; mainly because of pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives.

Mechanical Treatment Level 1: Short- term changes in composition and structure, hopefully moving towards a more natural, pre-suppression condition. There is the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions.

Mechanical Treatment Level 2: Brush mastication is added in Alternative III; using medium-sized equipment for brush removal with higher intensity and extent than Level 1 mechanical treatment.

There may be some mortality and damage to vegetation that would have beneficial to adverse, negligible to major, short to long-term impacts. Changes in species composition and vegetation structure to a greater extent than Level 1 that would have beneficial to adverse, negligible to major, short to long-term impacts. Hazardous fuel levels would be reduced that would have beneficial, negligible to major, short to long-term impacts. There is the potential for fuel spills that would have adverse, negligible to major, short to long-term impacts. There is the potential to cause damage or mortality to sensitive species and non-target vegetation that would have adverse, negligible to major, short to long-term impacts. There is the potential to damage or destroy sensitive or uncommon species that would have beneficial, negligible to major, short to long-term impacts.

There may be inadvertent mortality from damage that occurred during treatment that would have beneficial to adverse, negligible to major, short to long-term impacts. There may be increased potential to introduce and spread exotic plant species that would have adverse, negligible to major, short to long-term impacts. There may be some habitat modification as a result of alterations to understory composition and structure that would have beneficial to adverse, negligible to major, short to long-term impacts. There may be increased introduction and spread of disease and infestation as a result of injury to trees during treatment that would have adverse, negligible to major, short to long-term impacts. Vegetation reproduction, including sensitive species, may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae that would have adverse, negligible to major, short to long-term impacts.

Reduced canopy cover and increased disturbance can lead to an increased likelihood of wildland fire ignition and spread, and consequently compressed fire regimes that would have adverse, negligible to major, short to long-term impacts. There may be reduced risk of crown fire and extreme fire behavior or large and unmanageable fires that would have beneficial, negligible to major, short to long-term impacts. There may be the potential for impacts to vegetation if fuel spills occur during treatment activities that would have adverse, negligible to major, short to long-term impacts.

Long-term changes in composition and structure, some of which are unknown. There may be the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions. Fire management actions (all mechanical treatment

levels and prescribed fire – basically repeated disturbance of any kind) would greatly enhance exotic plant infestations.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Burn piles may escape to become wildland fires. However, this risk is offset by the reduced risk or wildland fire ignition and high severity wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction would have a direct effect on the vegetation.

Conclusion: Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives.

Alternative IV

Please review the Impacts Common to All Alternatives for this vegetation community for a discussion of the prescribed fire, suppression, and mechanical level 1 treatment impacts. Please review the impacts of mechanical level 2 and 3 treatment in Alternative III above. What follows is a review of the impacts specific to Alternative IV in the mixed oak woodland community.

Shaded Fuel Breaks: Under Alternative IV, the number of shaded fuel breaks is expanded from the present, and the width is doubled from the current 100 feet to 200 feet along roads, and remains 100 feet along ridges.

There may be some mortality and damage to understory vegetation on a larger scale that would have adverse, negligible to major, short to long-term impacts. There may be changes in species composition and vegetation structure that would have beneficial to adverse impacts, negligible to major, short to long-term impacts. Fuel levels and ladder fuels are reduced that would have beneficial, negligible to major, short to long-term impacts. Increased potential to cause damage or mortality to sensitive species and overstory tree species that would have adverse, negligible to major, short to long-term impacts.

There may be inadvertent mortality from damage that occurred during treatment that would have adverse, negligible to major, short to long-term impacts. There may be the potential for fuel spills that would have adverse, negligible to major, short to long-term impacts. There may be increased potential for habitat fragmentation impacts as a result of 200-foot wide swaths of altered vegetation with adverse, negligible to major, short to long-term impacts. There may be greater potential for introduction or expansion of exotic plant species with adverse, negligible to major, short to long-term impacts. There may be increased probability to introduce and pathogens as a result of inadvertent injury to trees during treatment that would have adverse, negligible to major, short to long-term impacts. Vegetation reproduction may be affected if chip layer is too thick that would have beneficial to adverse, negligible to major, short to long-term impacts.

Vegetation reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil and/or damages overstory canopy trees. This can also lead to localized infestations of wind-dispersed weedy species that would have adverse, negligible to major, short to long-term impacts. There may be increased potential for ignition, reduced fire intensity, reduced risk of large and intense fires, provides access and escape routes for fire crews that would have adverse to beneficial, negligible to major, short to long-term impacts.

There may be potential for impacts to vegetation if fuel spills occur during treatment activities that would have adverse, negligible to major, short to long-term. There may be increased potential to introduce and spread pathogens – especially if slash piles are not burned and or chipped immediately. There may be potential for increased impacts to mixed oak woodland plant community resulting from recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks that would have adverse, negligible to major, short to long-term impacts.

There may be potential to introduce and spread exotic plant species. There may be long-term impacts that are unknown at this time. More data is needed.

Short-term use versus long-term enhancement of resources: Fire management activities would

result in some mortality, but would reduce threat of large and intense fires. Burn piles may escape to become wildland fires. However, this risk is offset by the reduced risk (potential for ignition is increased) of crown fire and large and unmanageable wildland fires when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives.

Blue Oak Grassland

Issues and Impacts Common to All Alternatives

Suppression: There may be some mortality of individual plants/trees and shrubs related to construction of fire lines, heli-spots, safety zones, and spike camps (ranging from use of hand tools, engines, to bulldozers). The range of impacts would be beneficial or adverse short-term to long-term from minor to major depending on the size, intensity and location of the fire and the type of suppression activity. Some removal of shrubs and overstory trees may occur to facilitate fire suppression activities with a range of beneficial to adverse, moderate to major, short-term to long-term impacts depending on site specifics. There may be damage to vegetation from fire crews and fire line construction activity that would have beneficial to adverse, negligible to major, short-term impacts depending on site specifics. There may be some mortality or damage to vegetation from aircraft water drops and high-pressure hoses used to suppress fire that would have adverse, negligible to moderate, short to long-term impacts depending on site specifics. There may be fuel accidentally spilled during fire suppression activities may kill vegetation that would have adverse, negligible to major, short to long-term impacts depending on size and location of spill.

There may be mortality and damage to vegetation from management-ignited fires (burn-outs/back-burns) that would have beneficial to adverse, negligible to moderate, short to long-term impacts depending on site specifics. There may be some potential impacts to vegetation from retardants that would have beneficial to adverse, negligible to moderate, short-term impacts, depending on site specifics. Threatened and endangered species may experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known; that would have beneficial or adverse, minor to major, short to long-term impacts depending on species, activity, level of intensity. There may be mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression that would have adverse, negligible to moderate, short to long-term impacts depending on site specifics.

There may be mortality occurring after fire suppression resulting from damage during suppression activities that would have beneficial to adverse, moderate to major, short to long-term impacts, depending on site specifics. Retardant containing fertilizers may increase exotic species that would have adverse,

negligible to major, short to long-term impacts, depending on species and site specifics. Fire crews and equipment may introduce or would most likely continue the spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out-compete and replace native plant species. These impacts would be adverse, negligible to major, short to long- term impacts, depending on species, site specifics, and amount of seed transfer, germination.

Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that adversely impacts vegetation, including threatened and endangered species that would have adverse, moderate to major, short to long-term impacts. There may be some potential impacts relating to use of retardants that may affect individual plant health and plant community composition, including aquatic communities that would have adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. More data is needed.

There may be the potential to contribute to fungal infestations or other pathological processes as a result of foot traffic and equipment during suppression activities that would have adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. Some habitat may be altered in areas where firelines, spike camps, safety zones, and heli-spots were constructed. Alterations include changes in species composition, structure and function that would have beneficial to adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor and if significant, this can negatively affect the roots of old oaks that would have adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, and degree of compaction. There may be the potential for impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed, this would be adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, size and extent of spill.

There may be some mortality and damage to mycorrhizae during suppression activities may have impacts to residual vegetation and regeneration that would have adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics.

Sensitive and threatened and endangered species are protected where fire is suppressed; fire-adapted sensitive species may not do well if fire is suppressed that would have beneficial to adverse, negligible to major, short to long-term. More data is needed. Fire-dependent species and blue oak acorns might be denied the beneficial impacts of fire during suppression activities resulting in adverse, negligible to major short to long-term.

Fire-adapted plant species in the blue oak woodlands are denied the beneficial impacts of fire. Fire suppression would lead to further shrub and pine encroachment, which could potentially create a fire severe enough to kill large blue oaks.

Prescribed Fire: There may be mortality and damage to vegetation during pre-fire thinning and construction of prescribed fire burn unit boundaries that would have adverse to beneficial, negligible to major, short to long-term impacts. There may be mortality and damage to vegetation as a result of management-ignited fires that would have adverse to beneficial, negligible to major, short to long-term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre-burn and burn activities if they are not identified in a pre-burn survey that would have adverse to beneficial, negligible to major, short to long-term impacts. Plant reproduction would be enhanced with prescribed burning in the fall, but decreased in spring burns resulting in adverse to beneficial, negligible to major, short to long-term impacts. Fire would trigger germination of acorns and fire-adapted plants – seasonality depending resulting in negligible to major, adverse to beneficial, short to long-term impacts.

There may be the potential for prescribed fire to escape, possibly to a large, severe and unmanageable fire with negligible to major, adverse to beneficial, short to long-term impacts. There may be the potential for damage or mortality resulting from accidental fuel spills with negligible to major, adverse, short to long-term impacts. Fires would decrease nutrient availability and organic matter with negligible to major, adverse to beneficial, short to long-term impacts.

There may be the potential for fuel spill to damage vegetation not consumed during prescribed burn activities with adverse, negligible to major, short to long-term impacts. If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Exotic annual grasses are now pretty much a part of this plant community, though more exotic plant species would be introduced and spread within prescribed burn units with negligible to major, adverse, short to long-term impacts. Management ignited fires in the spring can potentially help control the extensive star thistle infestations in this plant community. However, overstory blue oaks and acorns would be negatively affected with adverse to beneficial, negligible to major, short to long-term. Management ignited fires in the fall may further spread star thistle in this plant community, at the same time facilitating the germination of seedlings with adverse to beneficial, negligible to major, short to long-term impacts.

There may be mortality of vegetation damaged during pre-fire and prescribed fire activities with negligible to major, adverse, short to long-term impacts. Vegetation in and around burn piles may be damaged or killed if proximity or intensity is inappropriate, including sensitive species and overstory trees. Burn piles can also sterilize the soil is localized spots, which enables wind-dispersed and weedy species the upper hand in colonization, creating patches of infestations with adverse, negligible to major, short to long-term impacts.

There may be the potential to introduce and/or spread pathogens such as fungi with negligible to major, adverse, short to long-term impacts. Fire and soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor with negligible to major, adverse, short to long-term impacts. Prescribed fire can stimulate fire-adapted species with beneficial, moderate, long-term impacts. Prescribed fire mimics natural fire in the ecosystem with beneficial, moderate, long-term impacts.

There may be the potential to enhance ethnobotanical uses with beneficial, moderate, long-term impacts. Fires may have a long-term effect on plants by either increasing or decreasing nutrient availability with beneficial to adverse, moderate, long-term impacts. Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re-growth of vegetation with adverse, moderate to major, short to long-term impacts.

Prescribed fire is expected to re-create a more natural fire regime in the blue oak woodlands. Prescribed fire is expected to stimulate diversity in both native and non-native plant species. Blue oaks and star thistle would both benefit from fall burns, and both be reduced for spring burns. Prescribed fire would reduce the density of understory shrubs that may be encroaching into this area.

Mechanical Treatment Level 1: There may be mortality and damage to vegetation with beneficial to adverse, negligible to major, short to long-term impacts. There may be changes species composition and vegetation structure with beneficial and adverse impacts (could increase exotics, could also provide more diverse habitat for a range of native species, negligible to major, short to long-term impacts. Fuel levels are reduced, resulting in beneficial, moderate, short to long-term impacts. There is the potential for fuel spills with adverse, negligible to major, short to long-term impacts. There may be potential to cause damage or mortality to sensitive and overstory tree species with adverse, negligible to major, short to long-term impacts. There may be potential for slash piles to damage/kill overstory tree species with adverse, negligible to moderate, short to long-term impacts. There may be potential to adversely impact sensitive or uncommon plants with adverse, negligible to major, short to long-term impacts.

There may be mortality from damage that occurred during treatment with adverse to beneficial, negligible to major, short to long-term impacts. There may be increases in the introduction and/or spread of disease and infestations due to slash piles and inadvertent injuries to individual plants during treatment with adverse to beneficial, negligible to major, short to long-term impacts. Vegetation reproduction may be slowed if chip layer is too thick with adverse to beneficial, negligible to major, short to long-term impacts. Vegetation reproduction may be slowed if the burning of slash piles generated from treatment sterilizes the soil with adverse to beneficial, negligible to major, short to long-term impacts. Slash piles and soil disturbance can also lead to infestations of wind-dispersed exotic plant species with adverse, negligible, short to long-term.

There may be potential to damage vegetation if fuel spills occur during treatment activities with

adverse to beneficial, negligible to major, short to long-term impacts. Thinning of understory species can mimic natural structural patterns with beneficial, negligible to minor, short-term impacts.

Reduction and rearrangement of fuels increases the chances of managing wildland fires effectively. Repeated disturbance from thinning operations can increase potential for annual grasses and other exotic species. Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are almost unknown.

Alternative I

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. What follows is a description of the impacts specific to Alternative I for the blue oak woodlands community.

Shaded Fuel Breaks: Direct mortality and damage to vegetation may have adverse and beneficial, negligible to major, short to long-term impacts. Changes species composition and vegetation structure not designed to mimic natural oak woodland condition may have both beneficial and adverse impacts, negligible to major, short to long-term. Fuel levels are reduced or rearranged and may be beneficial, negligible to major, short to long-term impacts. There may be the potential for fuel spills with adverse, negligible to major, short to long-term impacts. There may be potential to cause damage or mortality to sensitive species with adverse, negligible to major, short to long-term impacts.

There may be mortality from damage that occurred during treatment with adverse to beneficial, negligible to major, short to long-term impacts. There may be habitat fragmentation as a result of 100-foot wide swaths of altered vegetation with adverse, negligible to major, short to long-term impacts. There may be potential for introduction and further spread of exotic plant species. Current populations would definitely benefit from disturbance and would be an adverse, negligible to major, short to long-term impact. There may be increase potential to introduce and spread disease and infestations, with adverse, negligible to major, short to long-term impacts. Vegetation reproduction may be affected if chip layer is too thick and may have adverse to beneficial, negligible to major, short to long-term impacts. Vegetation reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil and may have adverse to beneficial, negligible to major, short to long-term. The potential of ignition and spread of wildland fires (e.g., lack of canopy cover and disturbance promotes annual grasses) may reduce intensity of fire, and reduce risk of large and intense fires with adverse to beneficial, moderate, short to long-term impacts.

There may be the potential for impacts to vegetation if fuel spills occur during treatment activities with adverse, negligible to major, short to long-term impacts. There may be potential for increased recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks with adverse, negligible to major, short to long-term impacts.

Exotics would be exacerbated. Repeated treatments in this habitat type would be repeatedly increasing the chance to introduce and spread exotic plant species, disease, and infestations.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but can alter fuels in such a way that wildland fires may become more manageable. Prescribed fires may escape to become wildland fires. However, this risk is offset by the removing ladder fuels and redistributing fuel loads, which can reduce the chance of a large and intense fire.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. There may be additional long-term impacts to blue oak woodland communities related to management actions

proposed for this alternative, particularly related to the installation and maintenance of a shaded fuel break network that cannot be predicted at this time.

Alternative II

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative II in the blue oak woodland community.

Prescribed Fire: Prescribed fire impacts are expected to have the same impacts as in Alternative I, but to a greater extent due to increased use of prescribed fire.

Shaded Fuel Breaks: Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to re-grow with beneficial to adverse, negligible to major, short to long-term impacts. Firefighter access routes and backfiring lines would have to be developed quickly, potentially including the use of bulldozers with adverse, negligible to major, short to long-term impacts. There would be less of a chance to control the fire size with adverse, negligible to major, short to long-term impacts.

No potential to eliminate or significantly reduce understory species, or those adapted to the pre-treatment conditions.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Short-term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity/extreme fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing. This would have a adverse effect on the overstory blue oaks, seedlings and acorns, but a positive effect on the start thistle that makes up a major portion of the blue oak woodlands.

Conclusion: Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel breaks would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives.

Alternative III

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative III in the blue oak woodland community.

Prescribed Fire: Prescribed fire would be reduced; mainly through pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives.

Mechanical Treatment Level 1: There may be short- term changes in composition and structure. There may be the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions.

Mechanical Treatment Level 2: Brush mastication is a component of Alternative III; using medium to equipment for brush removal with higher intensity and extent than Level 1 mechanical treatment. Brush masticate would not occur in the blue oak woodlands.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce make large and intense fires more manageable. Burn piles may escape to become wildland fires – greater chance of exotics and increased probability of ignition and spread.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction with direct effect on the vegetation is likely to occur.

Conclusion: Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. However, mechanical or repeated disturbance of this community could really be harmful to this plant community in terms of seedling regeneration and the spread of exotic plant species. We need prescribed fire for this community. This alternative meets several of the park's stated fire management objectives.

Alternative IV

Please review Impacts Common to All Alternatives for this vegetation community for information on suppression, prescribed fire and mechanical treatment level 1. Alternative IV adds mechanical level 3 (small-scale logging) to mechanical levels 1 and 2. However, there would be no brush mastication or small-scale logging in the blue oak woodlands. Doing so would seriously impact seedling regeneration of oaks would make conditions absolutely fabulous for all the exotics. Soil compaction could damage overstory trees too. What follows is a discussion of the impacts specific to Alternative IV to the blue oak woodlands.

Shaded Fuel Breaks: Under Alternative IV, the number of shaded fuel breaks is expanded form the current strategy, and shaded fuel break width is doubled to 200 feet along roads. Ridge shaded fuel breaks would remain at 100 feet. The blue oak woodland forest structure already mimics that of a shaded fuel break. Shrubs that encroach over time can be removed along designated ridgelines. But overall, shaded fuel break construction would not occur in the same manner and scale as in other vegetation communities.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would make wildland fire more manageable.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives.

Chaparral

Issues and Impacts Common to All Alternatives

Suppression: There may be some mortality of individual plants/trees and shrubs related to construction of fire lines, heli-spots, safety zones, and spike camps (ranging from use of hand tools to bulldozers). There would be a range of beneficial or adverse short to long-term impacts from minor to major depending on the size, intensity and location of the fire and the type of suppression activity. There may be removal of shrubs and overstory trees (e.g., knob cones and black oaks) to facilitate fire suppression activities. There would be a range of beneficial to adverse, moderate to major, short-term to long-term impacts depending on site specifics. There may be damage to vegetation from fire crews, engines, and fire line construction activity with beneficial to adverse, negligible to major, short-term impacts depending on site specifics.

There may be mortality or damage to vegetation from aircraft water drops and high-pressure hoses used to suppress fire with beneficial to adverse, negligible to moderate, short to long-term impacts depending on site-specifics. There may be fuel accidentally spilled during fire suppression activities may kill vegetation with adverse, negligible to major, short to long-term impacts depending on size and location of spill. There may be mortality and damage to vegetation from management-ignited fires (burn-outs/back-burns) with beneficial to adverse, negligible to moderate, short to long-term impacts depending on site specifics.

There may be some potential impacts to vegetation from retardants with adverse, negligible to moderate, short-term impacts, depending on site specifics. Threatened and endangered species may experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known, with beneficial or adverse, minor to major, short to long-term impacts depending on species, activity, level of intensity.

There may be some mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression with adverse, negligible to moderate, short to long-term impacts depending on site specifics. Chaparral plant community may be denied the numerous beneficial impacts of fire with adverse, moderate to major, long-term impacts.

There may be mortality occurring after fire suppression resulting from damage during suppression activities with beneficial to adverse, moderate to major, short to long-term impacts, depending on site specifics Retardant containing fertilizers may increase exotic species with adverse, negligible to major, short to long-term impacts, depending on species and site specifics. Fire crews and equipment may introduce or spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out-compete and replace native plant species resulting in adverse, negligible to major, short to long- term impacts, depending on species, site specifics, and amount of seed transfer, germination. Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that negatively impacts vegetation, including threatened and endangered species, and could compress the fire regime with adverse, moderate to major, short to long-term impacts. More data is needed on the potential impacts relating to use of retardants that affect individual plant health and plant community composition, including aquatic communities. There may be potential to contribute to fungal infestations or other pathological processes as a result of foot traffic and equipment during suppression activities resulting in adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. Some habitat would be altered in areas where firelines, spike camps, safety zones, and heli-spots were constructed. Alterations include species composition, structure and function with beneficial to adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics.

Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor with adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics, and degree of compaction. There may be potential for impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed with adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, size and extent of spill. Mortality and damage to mycorrhizae during suppression activities may have adverse impacts to residual vegetation and regeneration.

Sensitive and threatened and endangered species and large overstory trees are protected where fire is suppressed; fire-adapted sensitive species may not do well if fire is suppressed; resulting in

beneficial to adverse, negligible to major, short to long-term. More data needed. The potential for type-conversion related to a high severity wildland fire is avoided if suppression activities are successful—a beneficial, major, long-term impact. Some fire-dependent chaparral plant species are denied the beneficial impacts of fire during suppression activities with adverse, negligible to major short to long-term.

Some fire-adapted plant species in the chaparral plant community are denied the beneficial impacts of fire. The chaparral vegetation community fire regime ranges from 30-120 years, so Whiskeytown's fire history is well within the normal range of variation. Although commonly described as "stand decadence" chaparral plant community accumulation of fuels reaches a maximum at about 15 years. Beyond that time period, individual plants don't get much bigger or denser. Therefore, there really aren't very many cumulative impacts of fire suppression.

Prescribed Fire: There may be mortality and damage to vegetation during thinning and construction of prescribed fire burn unit boundaries with adverse to beneficial, negligible to major, short to long-term impacts. There may be mortality and damage to vegetation as a result of management-ignited fires with adverse to beneficial, negligible to major, short to long-term impacts.

Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre-burn and burn activities if they are not identified in a pre-burn survey, ranging in adverse to beneficial, negligible to major, short to long-term impacts. Plant reproduction would be enhanced with prescribed burning in the fall, but decreased in spring burns with adverse to beneficial, negligible to major, short to long-term impacts.

Fire would trigger germination of fire-adapted plants – seasonality depending with negligible to major, adverse to beneficial, short to long-term impacts. There may be potential for prescribed fire to escape, possibly a large, severe and unmanageable fire with negligible to major, adverse to beneficial, short to long-term impacts. There may be potential for damage or mortality resulting from accidental fuel spills with negligible to major, adverse, short to long-term impacts. Fires would decrease nutrient availability and organic matter with negligible to major, adverse to beneficial, short to long-term impacts. There may be the potential for fuel spill to damage vegetation not consumed during prescribed burn activities, resulting in adverse, negligible to major, short to long-term impacts. If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Exotic plant species may be introduced and spread within prescribed burn units with negligible to major, adverse, short to long-term impacts. Exotic annual grasses can increase the probability of ignition and spread of wildland fires and potentially compress the fire return interval with negligible to major, adverse, short to long-term impacts. Management ignited fires in the spring can result in a type conversion to chamise. This can increase the probability of ignitions and rates of spread with adverse, major, long-term impacts.

There may be some mortality of vegetation damaged during pre-fire and prescribed fire activities with negligible to major, adverse, short to long-term impacts. Vegetation in and around burn piles may be damaged or killed if proximity or intensity is inappropriate, including sensitive species and overstory trees. Burn piles can also sterilize the soil is localized spots, which enables wind-dispersed and weedy species the upper hand in colonization, resulting in patches of infestations. These actions can result in adverse, negligible to major, short to long-term impacts.

There may be the potential to introduce and/or spread pathogens such as fungi with negligible to major, adverse, short to long-term impacts. Fire and soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor with negligible to major, adverse, short to long-term impacts. There may be the potential for prescribed fire to escape, resulting in substantial mortality to overstory trees. Moderate to major, adverse, short to long-term impacts. Thinning associated with prescribed fire may result in increased insolation and soil temperatures, and decreased moisture with negligible to major, beneficial to adverse, short to long-term impacts. Thinning associated with prescribed fire activities may release a seed bank of native and exotic plant species. Beneficial to adverse, negligible to major, short to long-term impacts.

Prescribed fire can stimulate fire-adapted species. Prescribed fire mimics natural fire in the ecosystem. Prescribed fire reduces the potential for large and intense wildland fires. Prescribed fire reduces the intensity of subsequent wildland fires. There may be the potential to enhance

ethnobotanical uses. These points would all result in beneficial, moderate, long-term impacts. Fires may have a long-term effect on plants by either increasing or decreasing nutrient availability with beneficial to adverse, moderate, long-term impacts. Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re-growth of vegetation with adverse, moderate to major, short to long-term impacts.

Prescribed fire is expected to stimulate diversity in both native and non-native plant species. It is also expected to break-up the continuity of fuels across the landscape in such a way that increases the chance of controlling wildland fires.

Mechanical Treatment Level 1: There may be some mortality and damage to vegetation. Prescribed fire changes species composition and vegetation structure with beneficial and adverse impacts (could increase exotics, could also provide more diverse habitat for a range of native species, negligible to major, short to long-term impacts. Fuel levels are reduced with beneficial, moderate, short to long-term impacts. There may be the potential for fuel spills. There may be the potential to cause damage or mortality to sensitive and overstory tree species. Adverse, negligible to major, short to long-term impacts. There may be the potential for slash piles to damage/kill overstory tree species. There may be the potential for slash piles to damage mycorrhizae if too hot. There may be the potential to adversely impact sensitive or uncommon plants. These are all adverse, negligible to major, short to long-term impacts.

There may be some mortality from damage that occurred during treatment. There may be habitat modification as a result of alterations to composition and structure. There may be increases in the introduction and/or spread of disease and infestation due to slash piles and inadvertent injuries to individual plants during treatment. These are adverse, negligible to major, short to long-term impacts. Reproduction may be slowed if chip layer is too thick with adverse to beneficial, negligible to major, short to long-term impacts. Reproduction may be slowed if the burning of slash piles generated from treatment sterilizes the soil with adverse to beneficial, negligible to major, short to long-term impacts. Thinning of the chaparral plant community creates a very unnatural species composition and structure with beneficial to adverse, negligible to major, short-term impacts. Slash piles can also lead to infestations of wind-dispersed exotic plant species with adverse, negligible, short to long-term. There may be increased likelihood of wildland fire ignition (reduced canopy from thinning can make conditions favorable to annual grasses – which can make ignition and spread of fire much more likely, plus conditions near the ground surface are warmer and wind can dry fuels out quicker), reduced intensity of fire, and reduced risk of crown fire with adverse, negligible to major, short to long-term impacts. There may be the potential to damage vegetation if fuel spills occur during treatment activities with adverse to beneficial, negligible to major, short to long-term impacts.

Reduction and rearrangement of fuels increases the chances of managing wildland fires effectively. Repeated disturbance from thinning operations can increase potential for annual grasses and other exotic species. Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are almost unknown.

Alternative I

Please review the Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1.

Prescribed Fire: Prescribed fire is expected to stimulate diversity in both native and non-native plant species and to break-up the continuity of fuels across the landscape in such a way that increases the chance of controlling wildland fires. Chaparral Vegetation Community is still well within the normal range of variation in regards to the natural fire regime.

Shaded Fuel Breaks: There may be direct mortality and damage to vegetation that may have adverse and beneficial, negligible to major, short to long-term impacts. There would be unnatural vegetation and structure for this plant community with beneficial to adverse impacts, negligible to major, short to long-term. Fuel levels are reduced or rearranged with beneficial, negligible to major, short to long-term impacts. There may be the potential for fuel spills with adverse, negligible to major, short to long-term impacts. There may be the potential to cause damage or mortality to sensitive species with adverse, negligible to major, short to long-term impacts.

There may be some mortality from damage that occurred during treatment. Habitat fragmentation would be a result of 100-foot wide swaths of altered vegetation with adverse, negligible to major, short to long-term impacts. Shaded fuel breaks create landscape heterogeneity – causing edge effect for some species with beneficial, negligible to moderate, short to long-term impacts. There may be the potential for introduction or expansion of exotic plant species with adverse, negligible to major, short to long-term impacts. There may be an increased potential to introduce and spread disease and infestations with adverse, negligible to major, short to long-term impacts. Reproduction may be affected if chip layer is too thick which may have adverse to beneficial, negligible to major, short to long-term impacts. Reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil which may have adverse to beneficial, negligible to major, short to long-term.

There may be an increased potential of ignition and spread of wildland fires (lack of canopy cover promotes annual grasses), as well as reduced risk of large and intense fires with adverse to beneficial, moderate, short to long-term impacts. There may be the potential for impacts to vegetation if fuel spills occur during treatment activities with adverse, negligible to major, short to long-term impacts. There may be the potential for increased recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks with adverse, negligible to major, short to long-term impacts.

Cumulative: There may be long-term changes in composition, structure and function. Repeated treatments in this habitat type would increase the chance to introduce and spread exotic plant species, disease, and infestations. Increase in annual grasses and higher temperatures at the soil surface would result in higher probability of wildland fire ignition, and a greater chance of type-conversion. Understory herbaceous species would be significantly reduced or eliminated.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but can alter fuels in such a way that wildland fires may become more manageable. Prescribed fires may escape to become wildland fires. However, this risk is offset by the removal of ladder fuels and redistributing fuel loads, which can reduce the chance of a large and intense fire.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur - annual grasses would be selected for under this alternative.

Conclusion: Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. However, it is expected that wildland fires would increase in frequency and severity over time. There may be additional long-term impacts to chaparral plant communities related to management actions proposed for this alternative, (particularly related to the installation and maintenance of a shaded fuel break network) that cannot be predicted at this time.

Alternative II

Please review the Issues and Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative II in the chaparral community.

Prescribed Fire: The impacts for this action are expected to have the same impacts as in Alternative I, but to a greater extent due to increased use of prescribed fire.

Prescribed fire is expected to stimulate diversity in both native and non-native plant species. It is also expected to break-up the continuity of fuels across the landscape in such a way that increases the chance of controlling wildland fires.

Shaded Fuel Breaks: Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to re-grow with beneficial to adverse, negligible to major, short to long-term impacts. Firefighter access routes and backfiring lines would have to be developed quickly, potentially including the use of bulldozers with adverse, negligible to major, short to long-term impacts. There would be less of a chance to control the fire size with adverse, negligible to major, short to long-term impacts.

Continuous distribution of high fuel loadings across the landscape can reduce the fire management staff's ability to control the fire size. Understory herbaceous species would be selected for and habitat fragmentation reduced.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Short-term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity of fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Expanded spring burning would result decreased reproduction of herbaceous species, depending on plant stage of development, phenology, and timing. This could also increase overstory mortality of desired large trees. Spring burning can also result in more flammable fuels in the chaparral plant community (e.g., chamise).

Conclusion: Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel break s would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives.

Alternative III

Please review the Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative III in the chaparral community.

Prescribed Fire: Compared to the impacts discussed above, prescribed fire impacts are reduced; mainly pile burning to treat slash generated by mechanical treatment as opposed to landscape scale treatment to reduce fuels and modify habitat as in other alternatives.

Mechanical Treatment Level 2: Brush mastication is added in Alternative III and uses medium-sized mobile equipment for brush removal with higher intensity and extent than Level 1 mechanical treatment.

There may be some mortality and damage to vegetation. Changes in species composition and vegetation structure to a greater extent than Level 1. Results in unnatural forest structure not as much control as with Level 1 treatment. Fuel levels are rearranged; all with beneficial, negligible to major, short to long-term impacts. There may be the potential fuel spills with adverse, negligible to major, short to long-term impacts. There may be the potential to cause damage or mortality to sensitive species and non-target vegetation with adverse, negligible to major, short to long-term impacts. There may be the potential to damage or destroy sensitive or uncommon species with beneficial, negligible to major, short to long-term impacts.

There may be inadvertent mortality from damage that occurred during treatment with beneficial to adverse, negligible to major, short to long-term impacts. There may be an increased potential to introduce and spread exotic plant species with adverse, negligible to major, short to long-term impacts. There may be habitat modification as a result of alterations to understory composition and structure. Seasonality of burning off the slash would either greatly enhance exotics or suppress them. Leaving the slash could mitigate this with beneficial to adverse, negligible to major, short to long-term impacts. There may be increased introduction and spread of disease and infestation as a result of injury to trees during treatment with adverse, negligible to major, short to long-term impacts. Reproduction, including sensitive species, may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae with beneficial to adverse, negligible to major, short to long-term impacts. Increased likelihood of wildland fire ignition and spread reduced risk of crown fire and extreme fire behavior or large and unmanageable fires with beneficial, negligible to major, short to long-term impacts. There may be the potential impacts to vegetation if fuel spills occur during treatment activities with adverse, negligible to major, short to long-term impacts.

There may be long-term changes in vegetation composition and structure. There may be the

potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions. Some management actions (all mechanical treatment levels and prescribed fire – basically repeated disturbance of any kind) would greatly enhance exotic plant infestations. Impacts would be similar to mechanical level 1, but greatly increased – both beneficial and adverse.

Shaded Fuel Breaks: Please review impacts associated with Shaded Fuel Breaks found in Alternative II for this vegetation community.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce make large and intense fires more manageable. Burn piles may escape to become wildland fires, with a greater chance of exotics and increased probability of ignition and spread.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction would result in direct impacts on the vegetation.

Conclusion: Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. Thinning and other fire surrogate treatments can mimic the impacts of fire on structural patterns of woody vegetation, but without fire, the affects on nutrient cycling, seed scarification, non-woody response, plant diversity, disease and insect infestation, and genetic diversity are unclear. More data is needed. This alternative meets several of the park's stated fire management objectives. Impairment of the chaparral community would include type conversion and loss or hydrophobicity of soils.

Alternative IV

Please review the Impacts Common to All Alternatives section of this vegetation community for impacts from suppression, prescribed fire and mechanical treatment level 1. Alternative IV adds mechanical level 3 (small-scale logging) to mechanical treatment options. What follows is a discussion of the impacts specific to Alternative IV in the chaparral community.

Mechanical Treatment Level 2: In addition to the impacts discussed for this vegetation community in Alternative III, there may be long-term changes in composition and structure and the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions.

Mechanical Treatment Level 3: Small-scale logging with a higher intensity than mechanical treatments for both level 1 and 2 would occur. This approach would be considered for dense thickets of knobcone pine that occur within the chaparral community.

There would be some obvious mortality and damage to vegetation—the removal of trees with beneficial to adverse, negligible to major, short to long-term impacts. Changes species composition and vegetation structure would occur to a greater extent than with mechanical Level 1 and Level 2, with beneficial to adverse, negligible to major, short to long-term impacts. Fuel levels are reduced with beneficial, negligible to major, short to long-term impacts. There may be the potential fuel spills with adverse, negligible to major, short to long-term impacts. There may be the potential to cause damage or mortality to sensitive species with beneficial to adverse, negligible to major, short to long-term impacts. There may be the potential to damage or destroy sensitive or uncommon species with beneficial to adverse, negligible to major, short to long-term impacts. There may be the potential to damage soil microorganisms with adverse, negligible to major, short to long-term impacts.

There may be some mortality from damage that occurred during treatment with beneficial to adverse, negligible to major, short to long-term. There may be the potential to increase exotics with adverse, negligible to major, short to long-term impacts. There may be habitat modification as a result of alterations to composition and structure with beneficial to adverse, negligible to major, short to long-term impacts. There may be increased introduction and spread of pathogens with beneficial to adverse, negligible to major, short to long-term impacts. Reproduction may be affected if chip layer is too thick, or if tracked vehicles damage root structures, bulbs, or mycorrhizae with beneficial to adverse, negligible to major, short to long-term impacts. Reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil with beneficial to adverse, negligible to major, short to long-term impacts. Slash piles could increase the introduction and spread of exotic plant species with adverse, negligible to major, short to long-

term. There may be reduced fire severity with beneficial to adverse, negligible to major, short to long-term impacts. There may be the potential impacts to vegetation if fuel spills occur during treatment activities with beneficial to adverse, negligible to major, short to long-term impacts.

Long-term changes in composition and structure with understory herbaceous species selected against.

Shaded Fuel Breaks: The number of shaded fuel breaks is expanded from Alternative III, and the width is doubled from the present 100 feet to 200 feet along roads. Ridge shaded fuel breaks remain at 100 feet in width.

There may be some mortality and damage to understory vegetation on a larger scale than mechanical treatment with beneficial to adverse, negligible to major, short to long-term impacts. There may be species composition and vegetation structure outside the range of natural variability. This may have both beneficial and adverse impacts, negligible to major, short to long-term impacts. Fuel levels and ladder fuels are reduced with beneficial, negligible to major, short to long-term impacts. There may be the potential fuel spills with adverse, negligible to major, short to long-term impacts. There may be an increased potential to cause damage or to sensitive species and overstory tree species with adverse, negligible to major, short to long-term impacts.

There may be inadvertent mortality from damage that occurred during treatment with adverse, negligible to major, short to long-term impacts. Increased habitat fragmentation impacts as a result of 200-foot wide swaths of altered vegetation with adverse, moderate to major, short to long-term impacts. There may be greater potential for introduction or expansion of exotic plant species with adverse, negligible to major, short to long-term impacts. There may be increased probability to introduce and pathogens as a result of inadvertent injury to trees during treatment with beneficial to adverse, negligible to major, short to long-term impacts. Reproduction may be affected if chip layer is too thick with beneficial to adverse, negligible to major, short to long-term impacts. Reproduction may be affected if the burning of slash piles generated from treatment sterilizes the soil and/or damages overstory canopy trees. This can also lead to localized infestations of wind-dispersed weedy specie with adverse, negligible to major, short to long-term impacts. Increased potential for ignition, reduced fire intensity, reduced risk of large and intense fires, provides access and escape routes for fire crews with adverse to beneficial, negligible to major, short to long-term impacts. There may be the potential impacts to vegetation if fuel spills occur during treatment activities with adverse, negligible to major short to long-term. Increased potential to introduce and spread pathogens – especially if slash piles are not burned and or chipped immediately. There may be the potential increased impacts to the chaparral plant community resulting from recreation use (hiking, biking, equestrian, motorized), and potential accelerated erosion on shaded fuel breaks with adverse, negligible to major, short to long-term impacts.

There may be the potential long-term changes in composition and structure with understory herbaceous species are selected against. There may be long-term impacts that are unknown at this time.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would make wildland fire more manageable.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire and some natural ignitions to meet resource management objectives. This alternative meets several of the park's stated fire management objectives.

Riparian Vegetation

Issues and Impacts/Issues Common to All Alternatives

Suppression: The following standards should be recognized in order to evaluate suppression actions in the riparian vegetation community. Hand line construction in riparian areas is a possibility. Engine crews may lay hose across riparian areas. Fire fighters may create safety zones by clearing vegetation in a riparian area. Aircraft may drop water in a riparian area. Port-a-pumps may be needed to pump water from a water source surrounded by a riparian area. Fuel spills from chainsaws and drip torches may occur in a riparian area. Management ignited backfires may burn riparian areas. Fire retardant drops are to stay 300 feet from intermittent and perennial streams. Foam could be used on vegetation in riparian areas.

There may be some mortality of individual trees, shrubs, and understory species related to construction of fire lines (mostly from the use of hand tools and chain saws and engines filling up their tanks). There may be adverse short to long-term impacts from minor to major depending on the size, intensity and location of the fire and the type of suppression activity. There may be felling of large trees to facilitate fire suppression activities. There may be beneficial to adverse, negligible to major, short-term to long-term impacts depending on site specifics. There may be damage to vegetation from fire crews and fire line construction activity and engines. There may be some mortality or damage to vegetation from aircraft water drops and high-pressure hoses used to suppress fire, with adverse, negligible to moderate, short to long-term impacts depending on site specifics. There may be fuel accidentally spilled from port-a-pumps, chain saws and drip torches during fire suppression activities may kill vegetation, with adverse, minor to major, short to long-term impacts depending on size and location of spill. There may be some mortality and damage to vegetation from management-ignited fires (burn-outs/back-burns), with beneficial to adverse, negligible to major, short to long-term impacts depending on site specifics. There may be some potential impacts to vegetation from foams (ingredients of foam include detergents) with adverse, negligible to moderate, short-term impacts, depending on site specifics.

Threatened and endangered species may experience mortality or damage if present in suppression area; many areas lack surveys and presence/absence of species not known with beneficial or adverse, minor to major, short to long-term impacts depending on species, activity, level of intensity. There may be some mortality and damage to mycorrhizae resulting from soil disturbance and compaction at time of suppression with adverse, negligible to moderate, short to long-term impacts depending on site specifics.

There may be some mortality occurring after fire suppression resulting from damage during suppression activities. There may be beneficial to adverse, moderate to major, short to long-term impacts, depending on site specifics. Fire crews and equipment may introduce or spread exotic species through boots, vehicles, or equipment; may be exacerbated by disturbance activities related to suppression. Exotic plant species can out-compete and replace native plant species with adverse, negligible to major, short to long-term impacts, depending on species, site specifics, and amount of seed transfer, germination. Suppression activities may alter habitat through removal of individual plants, altering site characteristics (light, moisture, etc.) in a way that negatively impacts vegetation, including threatened and endangered species with adverse, moderate to major, short to long-term impacts. Potential impacts relating to use of retardants that may affect individual plant health and plant community composition, including aquatic communities with adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics. More data is needed.

There may be the potential to contribute to bark beetle, fungal infestations or other pathological processes as a result of foot traffic and equipment during suppression activities with adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics. Habitat would be altered in areas where firelines, safety zones, were constructed. Alterations include species composition, structure and function with beneficial to adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics. Areas where soil compaction occurred during suppression activities may see reduced regeneration and vigor with adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics, and degree of compaction. There may be the potential impacts to vegetation if fuel spills occur during suppression activities. Large fuel spills may require removal of substantial amounts of native soils and vegetation; seed bank would be destroyed, and adverse, negligible to moderate, short to long- term impacts, depending on species, site specifics, size and extent of spill. Mortality and damage to mycorrhizae during

suppression activities may have adverse impacts to residual vegetation and regeneration with adverse, negligible to moderate, short to long-term impacts, depending on species, site specifics. Sensitive and threatened and endangered species and large overstory trees are protected where fire is suppressed; fire-adapted sensitive species may not do well if fire is suppressed with beneficial to adverse, negligible to major, short to long-term. More data is needed. The potential for type-conversion related to a high severity wildland fire would not occur if suppression activities are successful with beneficial, major, long-term. Reduction of overstory trees can increase the amount of light that reaches streamside and aquatic plant species. This can negatively impact light intolerant and temperature dependent species.

Most riparian plants are not adapted to fire, although historically and rarely, fire has played a role in riparian ecosystems. Overall, fire suppression activities in the riparian plant community would alter the composition, structure, and function of this plant community; this impact is additive to historical uses and management actions, including logging, mining, development, road building, dam construction, and recreational use. The natural fire cycle is interrupted and fire adapted species are denied the beneficial impacts of fire. If suppression activities are successful, the adverse impacts of a large and intense fire with extreme fire behavior are prevented. Riparian plant communities would benefit at the landscape and watershed scale.

Prescribed Fire: The following standards should be recognized in order to evaluate prescribed fire actions in the riparian vegetation community. No hand ignition would occur in the riparian areas. Fire would be allowed to back into a riparian area. Hand-lines construction would not be allowed in a riparian area. Hose lays would not be conducted, and port-a-pumps would be avoided because of contamination to creeks. Fuel spills from chainsaws and drip torches may occur. No foam or retardant use would occur. Site-specific thinning (mechanical treatment level 1) would be conducted in a manner that protects overstory trees and species of concern. These overstory trees provide canopy cover along the riparian corridor and would be protected - especially along perennial streams. Intermittent streams would be protected as well, but this is less critical because fire probably occurred in these systems naturally. Spring burning in riparian areas would be avoided due to wildlife concerns.

There may be some mortality and damage to vegetation during pretreatment operations. There may be some mortality and damage to vegetation as a result of management-ignited fires. Threatened and endangered species and large overstory trees present in the burn area may be damaged or killed by pre-burn and burn activities if they are not identified in a pre-burn survey with adverse to beneficial, negligible to major, short to long-term impacts. Plant reproduction may be negatively impacted by the loss of seeds, acorns, and bulbs with adverse to beneficial, negligible to major, short to long-term impacts. Fire may trigger germination of fire-adapted plants (native and exotic). There may be the potential prescribed fire to escape, possibly a becoming wildland fire; possibly large, severe and unmanageable fire. There may be the potential damage or mortality resulting from accidental fuel spills. Fires would decrease nutrient availability and organic matter. These would all have negligible to major, adverse to beneficial, short to long-term impacts. If management ignited fire escapes it can lead to plant damage or mortality with impacts ranging from negligible to major depending on size and intensity of fire.

Exotic plant species may be introduced and spread within prescribed burn units. Exotic annual grasses can increase the probability of ignition and spread of wildland fires and potentially may compress the fire return interval. There may be some mortality of vegetation damaged during pre-fire and prescribed fire activities. Potential to introduce and/or spread contribute to beetles and pathogens such as fungi. These would all be negligible to major, adverse, short to long-term impacts.

Soil disturbance/compaction as a result of prescribed fire actions (boundary line construction, crew activity, burning piles) may result in increased exotics, or decreased native plant vigor.

There may be the potential prescribed fire to escape, resulting in substantial mortality to overstory trees. These would have moderate to major, adverse, short to long-term impacts. Thinning associated with prescribed fire may result in increased insolation and soil temperatures, and decreased moisture with negligible to major, beneficial to adverse, short to long-term impacts. Thinning associated with prescribed fire activities may release a seed bank of native and exotic plant species with beneficial to adverse, negligible to major, short to long-term impacts.

Prescribed fire can stimulate fire-adapted species; it mimics natural fire in the ecosystem; it reduces the potential for large and intense wildland fires and reduces the intensity of subsequent wildland fires.

It can increase the potential to enhance ethnobotanical uses. These are all beneficial, moderate, long-term impacts.

Fires may have a long-term effect on plants by either increasing or decreasing nutrient availability, with beneficial to adverse, moderate, long-term impacts. Soils that are sterilized or made hydrophobic by fire that burns too hot would inhibit re-growth of vegetation with adverse, moderate to major, short to long-term impacts.

Overall, most riparian plants and overstory trees (e.g., yew and alder) are not adapted to fire whereas some respond vigorously.

Mechanical Treatment Level I: The following standards should be recognized in order to evaluate mechanical treatment level 1 actions in the riparian vegetation community. Site-specific thinning may occur to protect overstory trees and shrubs for prescribed fire. Shaded fuel breaks would provide a 100-foot buffer on both sides of perennial creeks and streams and a 50-foot buffer for intermittent streams. No slash piles or pile burning would occur in riparian areas.

In addition to impacts mentioned above in previous vegetation communities, there may be the potential to adversely impact sensitive or uncommon plants, with adverse, negligible to major, short to long-term impacts.

In addition to the impacts discussed above in previous vegetation communities for this action, there may be microhabitat modification as a result of alterations to composition and structure, with adverse to beneficial, negligible to minor, short-term impacts.

Cumulative: If done correctly, pre-treating specific areas that are heavily stocked with decadent and dead-standing fuels can increase the chances of preserving riparian areas from the adverse impacts of a severe wildland fires.

Alternative I

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would but can alter fuels in such a way that wildland fires may become more manageable. Prescribed fires may escape to become wildland fires. However, this risk is offset by the removing ladder fuels and redistributing fuel loads, which can reduce the chance of a large and intense fire. From a watershed standpoint, the treatment of fuels in the high elevation mixed conifer and ponderosa plant communities, can reduce the size and intensity of wildland fires. In doing so, this lessens the chance of debris flows and other watershed events that can permanently alter riparian communities.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative I would continue the current fire management plan. This alternative meets several of the park's stated fire management objectives. There may be additional long-term impacts to riparian plant communities related to management actions proposed for this alternative, (particularly related to suppression activities and the indirect effect of activities in neighboring plant communities) that cannot be predicted at this time.

Alternative II

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1. What follows is a review of the impacts specific to Alternative II in the riparian community.

Shaded Fuel Breaks: Shaded Fuel Breaks would not be developed under Alternative II, and existing shaded fuel breaks would be allowed to re-grow. Impacts would be similar to those mentioned for other vegetation communities for this alternative's Shaded Fuel Break action.

Cumulative: Continuous distribution of high fuel loadings across the landscape reduces the

potential to control the fire size. No potential to eliminate or significantly reduce understory species, or those adapted to the pre-treatment conditions. No potential for habitat fragmentation resulting from the construction of linear features (burn-unit boundaries).

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would reduce threat of large and intense fires. Short-term impacts related to project activity would restore more natural forest conditions. Prescribed fires may escape to become wildland fires. However, this risk is offset by the reduced risk of wildland fire ignition or large and intense fires and crown fire (so spatial extent and severity/extreme fire behavior is reduced) when projects are completed.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Some native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative II would phase out the shaded fuel break system that is being developed under the current fire plan. Shaded fuel break s would not be maintained, regrowth would occur. The prescribed fire program would be expanded, and necessitate spring burning to meet fuel reduction objectives. This alternative meets some of the park's stated fire management objectives.

Alternative III

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1. What follows is a review of the impacts specific to Alternative III in the riparian community.

Mechanical Treatment Level 1: Short- term, negligible to moderate changes in composition and structure with the potential to eliminate or significantly reduce understory species, or those that were adapted to the pre-treatment conditions.

Mechanical Treatment Level 2: Brush mastication would not be applicable in the riparian plant communities. Brush masticators would provide a 100-foot buffer on both sides of perennial creeks and streams, and a 50-foot buffer for intermittent streams.

Shaded Fuel Breaks: Shaded fuel break construction would not be applicable in riparian plant communities.

Irreversible/irretrievable commitments of resources:: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts : Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur. Soil compaction would have direct effect on the vegetation.

Conclusion: Alternative III would emphasize fuel reduction using mechanical, as opposed to prescribed fire treatments. This alternative meets several of the park's stated fire management objectives.

Alternative IV

Please review the above section, Issues and Impacts Common to All Alternatives for this vegetation community for suppression, prescribed fire, and mechanical treatment level 1. What follows is a discussion of the impacts specific to Alternative IV in the riparian community.

Mechanical Treatment Levels 2 and 3: Brush mastication and small-scale logging would not be applicable in the riparian plant communities. Brush masticators and small-scale logging would provide a 100-foot buffer on both sides of perennial creeks and streams, and a 50-foot buffer for intermittent streams.

Shaded Fuel Breaks: Shaded fuel break construction would not occur in riparian plant communities.

Cumulative: Overall, most riparian plants and overstory trees (e.g., yew and alder) are not adapted to fire whereas some respond vigorously.

Short-term use versus long-term enhancement of resources: Fire management activities would result in some mortality, but would make wildland fire more manageable.

Irreversible/irretrievable commitments of resources: No irreversible/irretrievable commitments of resources.

Unavoidable adverse impacts: Native vegetation would be removed to reduce fuel levels and suppress wildland fires. Mitigation measures may minimize exotic plant species introduction and expansion, however, some adverse impact would still occur.

Conclusion: Alternative IV would utilize all available fire management and fuel reduction techniques to reduce the risk of large, intense and unmanageable wildland fires while managing prescribed fire to meet resource management objectives. This alternative meets several of the park's stated fire management objectives.

Special status plants

Fire management is an intrinsic part of managing sensitive species and habitats. The methodology and purpose for the fire management process may vary substantially, to protect and preserve native species in their natural environments and to promote the continued functioning of natural ecosystems. Plant species that are Federally or State listed as Threatened or Endangered, listed by the California Native Plant Society, or considered sensitive or uncommon may experience mortality, damage, or decreased reproduction rates if present in suppression areas. Impacts would be identical to those outlined above for various actions to other plants, but severity of impact would be increased due to the fact that these are rare species. While the location of some of these species is well documented, most of the park lacks surveys and presence/absence of species is not known. Protection of Threatened, Endangered, rare, or sensitive plant species cannot reasonably be taken into consideration during initial attack/ suppression activities. No permanent field markers are installed to alert crews to environmentally sensitive areas, and--with the exception of the use of resource advisors to prevent severe impacts to park resources during suppression--no system is in place to ensure that responding crew leaders be made aware of the need to try to protect rare species. Impacts would range from beneficial to adverse, minor to major, and short to long-term depending on species, activity, and level of intensity. For example, Shasta County arnica (Arnica venosa) seems to thrive in disturbed areas such as road cut banks and shaded fuel breaks. Such a species may experience beneficial impacts from suppression activities; however, more data is needed.

Suppression: Suppression actions may have no direct impacts on sensitive plants in some areas, as many sensitive species occur in relatively steep inaccessible sites. Initial attack activities could have adverse direct impacts on sensitive species if firefighters are not made aware of the location of the plants and the need to avoid trampling, retardant and water drops, hose lays, and other actions. More data is needed on the impacts of fire and impacts from fire suppression to the sensitive species that are found in the park and their status. Some species may be adapted to fire and other disturbance regimes, and those species would be expected to increase in numbers. These impacts would be indirect, beneficial, long-term, and moderate. Decrease or elimination of sensitive plant species may occur if they are sensitive to fire or trampling and these impacts would be direct or indirect, adverse, long-term, and major. Seasonality of fire is also a factor to consider in assessing potential impact; for example, fire in spring may wipe out entire populations of plants and

therefore seed for the following year. Spring burning may also affect top parts of bulbs and thus the ability of the plant to store food for next year, or seeds on and under the soil. These impacts could be direct/indirect adverse/ beneficial, short to long term, negligible to major. Disturbance across slopes and drainages can result in loss of topsoil, and seeds or bulbs of sensitive plants; mop-up churns up ash and soil that may contribute to loss of seed and below-ground structures by exposing them to heat and flames. Hand lines and mop-up actions disturb vegetation and soil, and trample or bury sensitive plants. Ground disturbance would also result from the establishment of helispots, dozer lines and spike camps. These impacts would be direct, adverse, short term, negligible, minor, and moderate.

Some sensitive species require frequent burning; others are early successional taxa, while others prefer a specific microenvironment for optimal population size and vigor. Timing, intensity, and frequency of proposed actions are key factors in the biological evaluation of proposed activities. A fire activity could have no affect, adverse affect, or beneficial effect depending on if the action was evaluated with the specific ecological needs of the plant in mind. Data needed includes type of management individual species need to assure long-term conservation, as some require prescribed management treatments, while others just need to be protected and left alone.

Long range species and/or habitat management guides must be prepared and incorporated into management plans. Potential adverse impacts to sensitive plants from suppression actions can be mitigated by surveying shaded fuel breaks and prescribed fire units in the spring at the appropriate flowering time to locate sensitive species. Thick brush makes it impossible to survey in some areas to accurately identify isolated individuals, and no consideration of sensitive species can reasonably be given during wildland fire initial attack activities when safety is the highest priority.

Geographic information system (GIS) layers are being developed for sensitive plants and other ecologically sensitive areas, enabling fire managers the ability to eliminate or control ground-disturbing activities in these areas as much as possible. Soil disturbance may be mitigated by rehabilitation of topography by replacing soil layers and rocks. Other mitigations include consultation with natural resources staff, checking the park GIS layer for locations, avoidance of known sensitive species when possible, the restoration of local litter and duff, and rehabilitation of natural grade and drainage.

Mechanical treatment and prescribed fire: Potential impacts to sensitive species from thinning or burning depend on a number of variables such as the timing of those events (cumulative impacts). The life form, habitat, and phenology of these rare species must be taken into consideration as described in the table below. All plants are listed in the California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California, 6th Edition (2001).

Under normal circumstances, *Eleocharis parvula, Juncus marginatus, Puccinellia howellii,* and *Sagitarria sanfordii* would be protected from the impacts of wildland fire and fire management activities due to their wetland habitats. Species that tend to occur on rock outcrops such as *Penstemon purpusii,* and *Sedum paradisum* may also be protected from impacts. These species would be top killed and would resprout, if they burn in a wildland fire. Mechanical treatment levels 1 and 2 could have direct adverse impacts on sensitive plants due to foot and/or machine traffic trampling annuals and bulb plants, particularly in spring. When the tops of bulb plants are lost for the year, annual carbohydrate storage could be reduced, resulting in less energy for the next season.

Similarly, annuals could lose seed production for a year. Most species of Clarkia, for example, do not form persistent seed banks, and rely on annual seed production for growth the following year. (Baskin and Baskin 1998). More data is needed. Surveying for rare plants ahead of time in spring and summer and avoiding them could mitigate these impacts. Indirect adverse impacts from thinning include increased solar radiation, which would increase light and temperature and lower soil moisture, and may negatively impact species such as *Trillium ovatum*, and possibly *Cypripedium fasciculatum*. Growth could be suppressed if material is chipped into areas inhabited by these species. In particular, the annuals could germinate and fail to emerge through the chips (Bond and van Wilgen 1996). Prescribed fires are not anticipated to affect wetland or rock outcrop plants under normal circumstances. Plants with bulbs or rhizomes have deeply buried tissues that typically survive fire. Natural fires historically occurred during summer or fall, when most sensitive plants are dormant, and

contain seasonally low tissue moisture, which contributes to fire tolerance. Spring burning could have adverse impacts on these species by consuming green leaves and because bulbs are less fire tolerant in the spring. Decreased fire tolerance may be mitigated by reduced soil heating during spring, when fuel and soil moisture is relatively high. Annual species would lose their seed crop if prescribed fires were conducted prior to seed release. This is not likely to be before mid-summer for Clarkia species. If annuals such as most Clarkia species do not maintain a persistent seed bank, continuation of the species is dependent on annual seed production. Interrupting this production with fire could result in temporary extirpation, although with windblown seed, Clarkia can re-colonize a site. For species that maintain a persistent seed bank such as Linanthus and Navarretia, a spring burn when soils are moist would cause greater mortality compared to a dry season burn, because seed that absorbs moisture seasonally is sensitive to heating unless it is relatively desiccated (Sweeney 1956).

Fire eliminates accumulations of thatch from annual grasses, and may create more favorable conditions for native species such as Clarkia in grasslands. On the other hand, fire can promote the spread of invasive exotics like broom and thistles (Odion and Haubensak, In Press). Although the sensitive plants have existed with wildland fire throughout their existence, fires today could have impacts differing from those in the past. In particular some areas where past logging has occurred may be more prone to crown fire. However, sensitive plants are not likely to be found in these areas, or are confined to rocky situations where fire impacts would be unchanged. Where grass is the primary fuel, fires may occur earlier in the season now than historically because the introduced exotic European annuals cure faster than the native perennial grasses. Suppression activities during a wildland fire may damage or kill rare plants. Of particular concern, dozer lines may cut deeply enough into the soil to dislodge bulb plants. This impact would be direct, adverse, moderate, and long term to the individual dislodged bulb plants. Sensitive plants in areas of crown fire may survive, but resulting changes in the conditions in the forest understory may have beneficial or adverse indirect impacts. Sunlight, warmth, and soil nutrients would increase initially, and competition from adjacent plants may decrease. Moisture may become more limiting earlier in the summer because of decreased infiltration due to hydrophobic soils.

Invasive and exotic plants

Most exotic plant species are adapted to disturbance, and fire and fire suppression activities as well as other disturbances generally appear to increase existing exotic plant populations, and may result in exotics being introduced to new areas. Seed and plant material is constantly supplied along road and drainage corridors and brought into un-infested areas on equipment, clothing, and footwear. Exotic seed makes its way to relatively un-infested land by wind, water, livestock, vehicles, and equipment. Fire management activities can inadvertently lead to the spread of exotics. Shaded fuel breaks create gaps that allow the spread of invasive plants. Preventing the cutting of fire lines through established patches of exotics, and washing equipment and vehicle tires before they leave the area can minimize spread. The spread of exotics resulting from rehabilitation following fire can be minimized with the use of certified weed-free mulch and native grass seed. Prescribed fire can be used as a tool to decrease certain exotics if applied at the correct time and re-treated annually with by fire or herbicide (Brooks 2001). Other studies support the hypothesis that exotic annuals proliferate in frequently disturbed areas, and native plants would dominate when disturbance frequencies are low (Giessow and Zedler 1996).

The effect of burning as a control strategy for star thistle shows conflicting results. Some studies show that repeated burning can be an effective tool to reduce star thistle by 62 to 85 percent (DiTomaso 1995). Correct timing of the burns is critical to achieve desired results, reducing or eliminating the number of live plants, as well as reducing the seed bank by significant amounts (Hastings and DiMataso 1996). Burns conducted at the incorrect phenological stage, or not conducted for several consecutive years, have been shown to actually increase star thistle. Other studies show that prescribed burning used alone in not effective as very little seed kill occurs (Huston, et al 1984), and that burning, in most cases, increases plant size and seed production by providing additional nutrients (Sheley, et al circa 1996). Sufficient fuels such as dry grasses must be available to carry the fire effectively, and plants that are scorched but not consumed by fire may resprout from the base (Martin and Martin, 1999). The effect of fire on broom species is probably mixed; although fire would remove the above-ground portion, it may stimulate seed production (Mobley 1954, Johnson 1982). Some studies show a significant decrease in exotic grasses and an increase in native forbs and shrubs following fire (Kan and Pollack 1977).

Other studies and anecdotal evidence appear to support the increase of some grasses such as brome (Bromus rubens) following fire (Johnson and Smathers 1974). The potential spread of exotics from fire and fire-related activities would be mitigated by the use of previously disturbed sites for helispots and spike camps when available, treatment of exotics prior to fire, education, and requirements that all equipment, clothing and boots would be free of exotic seed, and care in restoration techniques so as to not spread exotic seed banks already existing in soil. Whether any fire improves or degrades species habitat depends on their life requirements in comparison to the nature of the new vegetation. However, the enhancement of growing condition for aggressive exotic species changes the scenario. The exotic giant reed (Arundo donax) grows readily in the same habitat as willow thickets. Willows normally resprout vigorously after fire and would quickly occupy a site but the invasion of Arundo caused a dramatic adverse impact(Keeley and Fotheringham 2001). Fire suppression impacts on the spread of exotics may be beneficial or adverse.

Densities of existing exotic plant infestations may increase, exotic plant species may be introduced to new areas, and exotic plant species previously unknown in the park could be introduced by fire suppression activities including initial attack. Fire itself may decrease the seed bank of some exotic species if it occurs at the time of year that coincides with the height of seed production for that particular species. Broom populations appear to increase following a single fire, but decrease with repeated applications of fire (Odion). Exotic avenues may be opened with hand lines, the creation of helispots and spike camps, and restoration efforts. Following wildland fire, ideal seedbed conditions favor the germination of weed seeds. Yellow star thistle seed, for example, appears to be dependent on light, which accounts for high densities in exposed areas. (Martin and Martin) Other factors that may favor exotics are reduced competition from native plants, and increased nutrient availability. Many studies have demonstrated that exotic grasses are good competitors against herbaceous and woody species (Bush et al 1989, Knoop and Walker 1985, Litave et al 1963, Schultz et al 1955).

The presence of exotic species appears to influence fire intensity and shorten fire intervals. Repeated, frequent fires in California coastal scrub offer opportunities for the establishment of exotic grasses and forbs and favor their growth, and have a correlating increase in densities with shorter fire free intervals. This increases the probability of wildland fire by providing more fine fuels in vegetation that is repeatedly burned (Giessow and Zedler 1996). Exotic grasses such as cheatgrass are promoted by repeated burning while natives such as Idaho fescue are susceptible to severe damage by fire due to hot lingering fire burning in the basal tufts where incipient buds are located (Johnson, Charles, 1998). Fine size classes of fuel, characteristic of sites invaded by exotic annual grasses, ignite and spread fires under a broader range of conditions than woody material or leaf litter (Rundel 1981). High cover of exotic species in shrub systems enable fires to occur in a greatly compressed cycle (Zedler et al 1982), allowing for abruptly changing succession patterns, even in fire adapted communities (Giessow and Zedler 1996). More grass cover is associated with more damage while forbs retard impacts of fire, and damage decreases with increased elevation. These impacts would be direct, adverse, and short to long-term, negligible to major.

Whiskeytown sensitive plant species type, habitat and seasonality

Species	Life form	Habitat	Blooming
Allium sanbornii	perennial herb (bulb)	chaparral, oak woodland	May-September
Allium tribracteatum	perennial herb (bulb)	chaparral, oak woodland	April-July
Arnica venosa	perennial herb	mixed conifer, oak woodland	May-June
Clarkia mildrediae	annual	mixed conifer	June-July
Clarkia virgata	annual	oak woodland, mixed conifer	May-July
Cypripedium fasciculatum	perennial herb (rhizome)	mixed conifer	March-July
Eleocharis parvula	perennial herb	alkali wetland	June-September
Juncus marginatus	perennial herb (rhizome)	alkali wetland	July
Linanthus rattanii	annual	oak woodland	May-July
Navarretia heterandra	annual	vernal wetland	May-June
Penstemon purpusii	perennial herb	mixed conifer (rock outcrop)	June-August
Puccinellia howellii	grass	alkali wetland	April-June
Sagittaria sanfordii	perennial herb	Freshwater marsh	May-August
Sedum paradisum	perennial herb	chaparral (rock outcrops)	May-June
Trillium ovatum	perennial herb	mixed conifer forest	February-May
Triteleia crocea	perennial herb (bulb)	mixed conifer (rocky)	May-June

Target Exotic Invasive Plants in Whiskeytown National Recreation Area

Spanish Broom	Spartium junceum
Scotch broom	Cytisus scoparius
French broom	Genista monspessulanas
tree of heaven	Ailanthus altissima
Himalayan blackberry	Rubus discolor
yellow star thistle	Centaurea solstitialis
giant reed	Arundo donax
common mullein	Verbascum thaspus
bull thistle	Cirsium vulgare

Wildlife

Fire has played an important part in the formation of the structure, distribution, and diversity of wildlife habitats in the Klamath Mountains. As a result, wildlife native to the area have developed behaviors and characteristics that are adapted to the influence of fire on their habitat. Natural increases and decreases in different wildlife species occur as habitats change in response to fire. Historic mining and logging activities along with fire suppression activities throughout the 20th century have caused some wildlife habitats to be dramatically changed and, in many cases, increasingly susceptible to catastrophic stand-replacing fires. Such changes have been detrimental to the natural diversity, abundance, and distribution of wildlife within the park. In addition, fire control activities can adversely affect wildlife through direct disturbance of animals and habitats, management actions designed to benefit habitat, such as prescribed fire, can have inadvertent adverse effects on wildlife. With these factors in mind, the following parameters were used to evaluate the effects of the various alternatives given in this document.

Type of Impact

Adverse: Likely to result in unnatural changes in the abundance, diversity, and distribution of wildlife species. Changes could occur through direct disturbance of mortality, or through destruction of alteration of habitat.

Beneficial: Likely to protect and/or restore the natural abundance, diversity, and distribution of wildlife species. This would occur through protection and restoration of the natural structure, succession, and distribution of habitat.

Duration of Impact

Short-term: Immediate changes in the abundance, diversity, and distribution of wildlife species, but a return to the original condition within 20 years, without further impacts.

Long-term: Changes in the abundance, diversity, and distribution of wildlife species that persist for more than 20 years.

Intensity of Impact

Negligible: Imperceptible or undetectable impacts.

Minor: Slightly perceptible, and limited in extent. Without further impacts, adverse impacts would reverse and the resources would recover.

Moderate: Readily apparent, but limited in extent. Without further impacts, adverse impacts would eventually reverse and the resource would recover.

Major: Substantial, highly noticeable, and affecting a large area. Changes would not reverse without active management.

Impairment Statement

No alternative considered in this document has a goal which could be considered impairment of wildlife resources.

Impacts Common to all Alternatives

Suppression

Wildland fire suppression at Whiskeytown typically involves the use of numerous techniques and strategies to control wildland fire. Techniques typically used to control wildland fire typically include hand-constructed firelines with accompanying hose lays from fire engines, aerial water drops from helicopters, retardant drops from fixed-wing aircraft, snagging operations, and bulldozer-constructed fireline. Construction of helispots, spike camps, and firefighter safety zones are sometimes used to get firefighters and necessary gear into areas that are difficult to access or to ensure safety of personnel. Mop-up activities occur once the fire is contained by a fireline.

Construction of hand lines removes and disturbs soil and forest litter, possibly affecting animals such as small mammals, amphibians, invertebrates, and ground-nesting birds. Compared to other methods of line construction, impacts can be minimized by on-site avoidance of valuable or sensitive wildlife resources encountered (e.g., raptor nests). Hand line construction often involves snag removal, the impacts of which are described below. Removal of forest litter and vegetation can lead to soil erosion and increased siltation in adjacent lakes and streams. This could have an adverse effect on aquatic species, such as fish, amphibians, and invertebrates. Impacts associated with handline construction will likely be moderate, adverse, and short-term for all alternatives. Impacts can be mitigated by careful planning of fire line construction to avoid sensitive wildlife resources and habitats, rehabilitation of fire lines, and avoidance of unnecessary line construction.

Construction of fireline by bulldozers differs from hand-constructed fireline both in magnitude and spatial extent. Dozerlines tend to result in impacts deeper in the soil profile, as well as being wider and longer. These impacts cause

increases in erosion and siltation of streams, negatively impacting fish, amphibians, and aquatic invertebrates. Dozer lines also contribute to habitat fragmentation and may limit dispersal or movement among some species. Dozer lines have historically been used on high intensity wildland fires in the lower elevations of Whiskeytown where handline is often not adequate for containment. Dozer lines will not be utilized in the decomposed granitic soils of the higher elevations of the park. Impacts associated with dozer-constructed fireline are adverse, moderate, and long-term. Mitigation for this action would be through post-fire rehabilitation efforts such as mulching, seeding, planting, and construction of water bars or installation of water diversion devices.

Air drops of fire retardant would have their most serious effect on wildlife through potential contamination of aquatic habitats, which could affect organisms such as fish, aquatic invertebrates, and amphibians. Park policy restricts retardant drops to 300 feet distant from streams, although accidental drops in or near streams are possible. Some terrestrial wildlife could be affected by retardant drops if they were struck by the chemicals, resulting in injury or contamination. Wildlife could also be disturbed by the low-flying aircraft. Impacts to wildlife from retardant drops is expected to be minor, adverse, and short-term. Mitigation: Avoidance of aquatic habitats and minimizing use of retardant will partially mitigate impacts.

Dropping water on fires from helicopter buckets would not carry the risk of chemical contamination that retardant drops would, but there would be inherent risks to wildlife. Water that is removed from small bodies of water may adversely affect aquatic organisms by depleting their habitat, or resulting in the habitat drying up prematurely in the year, although this is unlikely as Whiskeytown Lake and Clear Creek are the primary sources of water for helicopters. Helicopter buckets, either through dipping or drops, could also potentially spread aquatic diseases to non-infected populations of aquatic species. The physical impact of a water drop could adversely affect individual small animals. On the positive side, water drops can, in some circumstances, be used instead of hand lines ("wet-lining") to control fire movement. This tactic would result in less impact to soil, forest litter, and vegetation than line construction and, therefore, would have less impact on wildlife, both in intensity and duration. The impacts of water drops on wildlife would be minor, adverse, and short-term based upon possible impacts to aquatic ecosystems, especially in relation to amphibians. Mitigation: Avoid dipping from small bodies of water or waters that are known to contain aquatic diseases.

Construction of helispots often results in the felling of trees and snags, which are potential wildlife habitat, especially in the case of snags. In addition, helicopter traffic would likely disturb sensitive wildlife, such as nesting raptors. Impacts of helispots on wildlife are expected to be minor, adverse, and short-term. Mitigation: Limit helispot construction; site helispots away from sensitive resources; use natural clearings for helispots.

Fire crews staying in spike camps can have an adverse effect on some wildlife by allowing them access to human food. This will potentially lead to such animals becoming conditioned to human foods, and leading to human-wildlife conflicts. In such cases, animals are often eventually killed to protect human safety. Presence of hand crews in remote areas would also introduce an element of disturbance, which could affect sensitive species, such as nesting raptors. Impacts to wildlife from spike camps are expected to be minor, adverse, and short-term. Mitigation: Locating spike camps away from sensitive resources and providing strict control of availability of food will help minimize these impacts.

Snags are probably the most valuable tree-form to wildlife (Brown and Bright 1997), providing cavities and loose bark for nesting and roosting, and food in the form of wood-boring insects. Any holding or line construction action that requires the felling of snags to protect human safety and the integrity of the fire line would potentially effect wildlife by reducing the availability of snags to species such as pileated woodpeckers, northern flying squirrel, and several bat species. Mortality of these and other species would likely occur during felling. The number of snags lost would vary, depending upon factors such as the type and age of tree stand, its history of fire and/or disease or insect infestation, and the intensity of the fire. Impacts to wildlife from snag removal associated with holding and line construction actions would be minor, long-term, and adverse because of the relatively small area that is affected. Mitigation: Minimize impacts by limiting snag removal to those snags identified as a clear threat to human safety and fireline integrity.

The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a fire, would cause some mortality of buried organisms by exposing them to heat and flames.

Mop-up activities also may cause some localized increases in erosion due to loosening of the soil layer. Such impacts, however, would be localized and affect few species. Impacts of mop-up would, therefore, be negligible, adverse, and short-term. Mitigation: Minimize mop-up activities to areas that are a threat to fireline integrity.

Conclusion: Wildland fire suppression activities will occur for all alternatives, although the size and intensity of wildland fires, as well as the difficulty of controlling wildland fires, will vary between the alternatives. It is anticipated that wildland fires and the associated impacts to wildlife species due to suppression activities will be greatest under Alternative III due to the lack of active management of fuels and the likelihood of continuing high intensity wildland fires over time. These high intensity wildland fires generally are larger in size and require more aggressive strategies such as dozer-constructed fireline and numerous retardant drops to ensure containment. Alternatives II and IV will significantly decrease impacts associated with wildland fire suppression over time as both will decrease fuel loadings to levels where wildland fires will burn with significantly lower severity and intensity. Containment of these lower intensity fires can normally be contained without the use of dozers or numerous retardant drops, which have the potential for the greatest impacts to wildlife species and their habitats. Alternative I will have impacts greater than Alternatives II and IV, but less than Alternative III.

Intense, Stand-replacing Fires

The primary threat to wildlife resources is the possibility of intense, stand-replacing fires over significant portions of the park due to many years of fire suppression and associated fuel buildup. Such fires likely would greatly change the diversity and abundance of wildlife species in the affected area through wide-scale and significant changes in habitat. In a mixed-intensity fire regime, that is natural for most forested habitats in the park, patches of stand-replacing fire are important components, leading to habitat heterogeneity through creation of small gaps and openings in the forest canopy. These openings, intermixed over the landscape with areas affected by different fire intensities and histories, allow high wildlife species diversity and ecosystem resilience. Wildlife species endemic to Whiskeytown have existed for thousands of years under the natural fire regime and have developed behavioral and life-history adaptations that allow different species to take advantage of the different habitats that result from fire in spatial and temporal contexts. Under current conditions of abnormally high fuel loading in many forest vegetation types, however, the abnormally intense fires that are likely would lead to habitat homogeneity, and an unnatural assemblage and succession of wildlife species adapted to the altered environment. Many areas of the park are also now overgrown with dense thickets of young age-class coniferous trees, as a result of logging which occurred over much of the park during the few decades prior to National Park Service land acquisition. While these conditions present the severe threat of catastrophic fire discussed above, they also affect the abundance and diversity of wildlife species directly by creating unfavorable habitat conditions for some species. For example, dense understory growth may adversely affect habitat quality for northern spotted owls by limiting their access to prey species.

Conclusion: Under Alternative I, achieving target conditions for many habitat types would be unlikely, and, therefore, a high threat of catastrophic fire throughout much of the park would continue or increase indefinitely. In addition, fire suppression actions (e.g., fire line construction, helispots, retardant drops, spike camps), and their accompanying impacts are likely to occur frequently under this alternative, because of the higher risk of large fires that are difficult to suppress. Impacts under Alternative I will be major, adverse, and long-term. Under Alternative III, fuel reduction projects are limited to areas in or near fuel breaks and developed areas. The emphasis for this alternative is on suppressing all fires before major impacts occur. However, given the present fuels situation, during unfavorable weather or in remote areas it is likely that some wildland fires will escape initial suppression activities and catastrophic fires will occur. In addition, fire suppression actions and their accompanying impacts will be greatest under this alternative. Impacts under Alternative III will be major, adverse, and long-term. Under Alternatives II and IV, aggressive fuel reduction efforts will occur and, over time, the likelihood of large-scale catastrophic fire will be greatly decreased. Mitigation: No mitigation of this impact is available, except implementation of more aggressive programs to achieve target fuel conditions, as given in the action alternatives.

Prescribed Fire

This technique provides the greatest potential to restore suppression-affected wildlife habitat and reduce the threat of catastrophic fire. Historically, park managers have primarily targeted areas near park boundaries to reduce

the likelihood of wildland fires burning from the park onto adjacent lands. Prescribed fires are planned to occur under conditions that reduce brush and small trees and consume much of the ground fuels, while limiting mortality of overstory trees. These same conditions typically benefit other resources, including wildlife and habitat, and minimize fire-related impacts to sensitive wildlife resources (e.g., raptor nest sites). High levels of fuel loading in some areas may cause prescribed fires to burn at higher than natural intensities, even when fire prescriptions and management are designed to minimize these effects. As a result, forest gaps, and consumption of large woody debris which provides important habitat for many small mammals and salamanders, may be greater than the natural range of variation in some areas of a burn. This may adversely affect species that depend on this habitat component. Such impacts, however, must be weighed against the benefit of reduced risk of catastrophic fire that would cause much greater detrimental change in wildlife habitat.

Hand line construction would result in the removal and disturbance of soil and forest litter, possibly affecting animals such as small mammals, amphibians, invertebrates, and ground-nesting birds. The presence of crews in remote locations could cause direct disturbance of some wildlife species. Impacts can be minimized by on-site avoidance of valuable or sensitive wildlife resources encountered (e.g., raptor nests, and riparian areas). Removal of forest litter and vegetation can lead to soil erosion and increased siltation in adjacent lakes and streams. This could have an adverse effect on aquatic species, such as fish, amphibians and aquatic invertebrates. Snagging, or snag removal along the periphery of a prescribed fire, is completed before ignition to lessen the chances of fires starting across control lines by reducing a source of airborne embers. Snag removal results in a loss of habitat to some wildlife species such as cavity nesters and species that feed on invertebrates typically associated with snags or decaying wood, as well as species that favor snags for dens. This habitat would likely be replaced over time as some new snags will generally be created by the prescribed fire. Mitigation: Careful planning of fire line construction to avoid sensitive wildlife resources and habitats, and avoidance of unnecessary line construction or removal of snags that do not pose a threat to control of the fire.

Mop-up, or the churning of soil and forest litter, to extinguish residual hot spots along the periphery of a fire, would cause some mortality of buried organisms by exposing them to heat and flames. Mop-up activities also may cause some localized increases in erosion due to loosening of the soil layer. Such impacts, however, would be localized and affect few species. Mitigation: Limit mop-up activities to areas that threaten the integrity of the fireline.

Conclusion: Under Alternative I, approximately 1,400 acres per year would be targeted for prescribed burns and benefits would be limited by the relatively small number of acres that would be treated. This is significantly less than the amount believed to have burned naturally each year. Under Alternative I, impacts of prescribed fire on wildlife would be minor, beneficial, and long-term because this action provides focused movement toward habitat improvement in areas most severely altered by fire suppression. Additionally, there will be some reduction in the risk of catastrophic fire, but such benefits are limited by the relatively small amount of area that would be treated annually. Non-dormant season burning is only done on an extremely limited scale under this alternative. Therefore, impacts to nesting birds and vegetative habitat that is vulnerable to in-season fire will be negligible.

Under Alternative II, approximately 3,000 acres per year are planned for prescribed burns. This alternative provides the most long-term benefit for wildlife and also most closely mimics pre-settlement fire acreages within the park. Additionally, short-term adverse impacts associated with site preparation and mop-up will be greatest under Alternative II. Impacts associated with non-dormant season burning will be greatest under this alternative as well, since targeted acreages will likely necessitate significant amounts of in-season prescribed burning. Under Alternative II, short-term impacts will be adverse and minor, while long-term impacts will be beneficial and major.

Under Alternative III, approximately 250 acres per year are targeted for prescribed burns. This alternative provides the least long-term benefits and also has the least short-term impacts. This alternative also does little to diminish the threat of catastrophic wildland fire to wildlife and wildlife habitat. Short-term impacts to wildlife under this alternative will be negligible, while long-term impacts are adverse and major based on the continued threat of large-scale catastrophic wildland fire.

Under Alternative IV, approximately 2,250 acres per year are targeted for prescribed fire. Adverse and beneficial impacts associated with this

alternative fall in between those associated with Alternatives I and II.

Hand thinning of understory vegetation, down fuels, and small-diameter trees near developed areas, along the boundary, and along shaded fuel breaks would have mixed effects on wildlife and habitat. Thinning of the forest and fuels to target conditions provides a more natural habitat in these areas, and helps reduce the threat of catastrophic fire, especially from human-caused ignitions that typically occur in or near developed areas. The resulting forest structure, however, tends to be less complex and more homogeneous. It is likely that some species will benefit from the increase in openness, particularly in areas of dense chaparral, while others will be adversely affected by the reduction of complexity and structure. Construction of shaded fuel breaks and hand thinning operations will potentially adversely impact wildlife in a number of ways. Removal of brush and some small trees will adversely affect wildlife currently using these habitat features, such as insects and nesting birds. Also, human presence and use of tools, such as chainsaws, during thinning operations will disturb wildlife, although such disturbance is temporary. Additionally, fuel breaks may contribute to habitat fragmentation for species that require dense understory habitat for movement or dispersal. Disturbance related impacts would be adverse, short-term and minor, while habitat modification related impacts would be adverse, long-term and minor. In habitats near developed areas, where protection of human-built structures and facilities is a concern, manual thinning and pile burning to reduce fuel loads would potentially result in forest structure that differs significantly from the natural condition. These areas will become more open (less understory vegetation) with less down wood and the localized effect on animal species that depend on these features, such as salamanders, small mammals, and ground-nesting birds will be adverse. Developed areas within the park constitute a relatively small area, and therefore the associated adverse impacts will be minor and long-term.

Piling and burning of vegetation removed during hand thinning may have an adverse effect on some wildlife. Some species, such as small rodents, ground-nesting birds, and reptiles, may take up residence in burn piles between the time they are stacked and the time they are burned; which sometimes can be several months. Most of these animals are likely to flee the flames once the piles are ignited, but some may perish.

Conclusion: Under Alternative I, approximately 275 acres per year would be impacted by Level 1 mechanical fuel treatments. The area of habitat affected would be relatively small and some wildlife species may be adversely affected by the emphasis on fuel reduction, but other species are likely to benefit from achievement of some reduction of the threat of catastrophic fire. Impacts to wildlife would be minor, adverse, and long-term. Under Alternative II, Level 1 mechanical treatment would only be used in developed areas, along boundaries, and to prepare existing fuel breaks for use as prescribed burn unit boundaries. Impacts associated with Level 1 mechanical treatment will be negligible. Under Alternative III, approximately 225 acres per year would be treated by hand-thinning and shaded fuel break construction. Impacts to wildlife would be similar to those occurring under Alternative I. Under Alternative IV, approximately 225 acres per year would be treated by hand-thinning and shaded fuel break construction. Impacts to wildlife would be similar to those occurring under Alternatives I and III.

Chipping vegetation removed during hand thinning will likely have minor, short-term adverse affects to some wildlife species due to the high levels of noise produced by the chipping machine. Vertebrate species will likely move out of the area during chipping activities. Additionally, accumulation of wood chips will likely inhibit herbaceous species, grasses, and other new plant growth that benefit many species of wildlife. As the wood chips deteriorate, however, important nutrients will be added to the soil and plant production will likely increase. Under all Alternatives, chipping will be used only along roads and in developed areas, thus, impacts will be minor, adverse, and short-term.

Alternative I

All impacts to wildlife that will occur under Alternative I will also occur under the other alternatives. The primary difference between Alternative I impacts and those associated with the other alternatives is scale. For example, it is likely that those impacts associated with catastrophic wildland fire will occur on a larger-scale under Alternative I than under Alternatives II or IV, due primarily to the pre-fire treatment of fuel/vegetation. Conversely, the adverse impacts associated with pre-fire fuel treatments will occur on a smaller scale for Alternative I than for Alternatives II or IV. See above for comparison of impacts associated with all alternatives.

Conclusion: Effect of Alternative I on wildlife would be major, adverse, and long-term, based primarily upon the continuation of the direct effects of high-fuel loading on habitat structure and quality in some areas, and the continued threat of catastrophic fire which has the potential to cause wide-scale, long-term, changes in habitats, and result in great changes in wildlife abundance and diversity in those areas affected. Impacts from actions to suppress fires would be occur regularly under this alternative, because of the prolonged period over which undesirable high intensity wildland fires are likely to occur. Large, catastrophic fire would potentially affect large areas of wildlife habitat, which are considered important to the natural integrity of the park.

Alternative II

All impacts to wildlife that will occur under Alternative II will also occur under the other alternatives. The primary difference between Alternative II impacts and those associated with the other alternatives is scale. For example, the impacts associated with prescribed fire will occur on a larger-scale under Alternative II than under the other alternatives, due to the large-scale use of this treatment to control fuels/ vegetation. Conversely, the adverse impacts associated with other fuel treatments will occur on a smaller scale for Alternative II than for the other alternatives. See above for comparison of impacts associated with all alternatives.

Conclusion: The cumulative impacts of Alternative II on wildlife would be major, beneficial, and long-term, based primarily upon the ability to return fire to the majority of the park with a return interval approaching that thought to occur prior to European settlement. Wildlife native to this area has evolved with the regular occurrence of fire and most habitats of the area benefit from low-severity fire. Short-term adverse impacts associated with the preparation and completion of prescribed fire will likely be offset by the benefits.

Alternative III

All impacts to wildlife that will occur under Alternative III, with the exception of Level 2 mechanical fuel treatment, will also occur under the other alternatives. The primary difference between Alternative III impacts and those associated with the other alternatives is scale and the addition of Level 2 mechanical fuel treatment. See above for comparison of impacts associated with all alternatives.

Level 2 mechanical fuel treatment involves the use of brush-reduction machinery to grind and shred brush on a three-year review cycle to determine maintenance needs. Appropriate maintenance requirements would be completed as needed according to this cycle. The purpose is to reduce vegetative density and continuity, and to reduce ladder fuels capable of transporting a surface fire into the forest canopy. This treatment will only occur on slopes less than 30% and primarily would occur during summer and fall when soil moisture content is low. Approximately 225 acres per year are targeted for treatment. Short-term impacts to wildlife associated with level 2 mechanical treatment include disturbance from the machinery, which is very loud. Vertebrate species will likely leave the area during periods of machine activity. Disturbances to some nesting species will also likely occur during summer periods. Short-term impacts will be adverse and minor. Long-term impacts include changes in habitat structure that will favor some species while reducing habitat suitability for others. Habitat fragmentation is also a potential impact as treated areas may impair movement or dispersal among species that require the dense understory that will be decreased by this treatment. Machinery use associated with this treatment will also potentially increase erosion and the resultant siltation due to loosened soils. Aquatic dependent species, such as amphibians, will potentially be negatively impacted by this treatment. Adverse long-term impacts due to habitat modification will likely be minor. Decrease of the potential for large-scale catastrophic wildland fire and resultant wildlife habitat destruction is a moderate long-term beneficial impact. Mitigation: Avoidance of areas where sensitive wildlife, such as raptors, are nesting and avoiding steep slopes or easily erodible soils will help minimize impacts to wildlife associated with level 2 mechanical fuel treatment.

Conclusion: Cumulative effect of Alternative III on wildlife would be major, adverse, and long-term, based primarily upon the continuation of the direct effects of high-fuel loading on habitat structure and quality in some areas, and the continued threat of catastrophic fire which has the potential to cause wide-scale, long-term, changes in habitats, and result in great changes in wildlife abundance and diversity in those areas affected. Impacts from actions to suppress fires would be most intense under this alternative, because of the prolonged period over which undesirable high intensity wildland fires are likely to occur. Large, catastrophic fire would potentially affect large areas of wildlife habitat, which are considered important to the natural integrity of the park.

Alternative IV

Alternative IV utilizes a variety of strategies to reduce fuels to manageable levels. Treatments and impacts unique to Alternative IV include Level 3 Mechanical Fuel Treatment. A discussion of the impacts to wildlife associated with the strategies and activities occurring under all alternatives are analyzed above with comparisons between the four considered alternatives. Impacts will be the similar to those occurring under Alternative III, although approximately 100 additional acres will be targeted per year.

Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small-diameter trees of less than 12 inches diameters at breast height (DBH). The strategy would be used in the construction of fuel breaks and to thin understory and overstocked stands. Thinning would be used to restore a more open forest structure and to promote species composition representative of pre-settlement, pre-suppression forest conditions. Approximately 300 acres per year will be targeted for this treatment under Alternative IV. Impacts to wildlife species would likely be short-term and adverse, primarily due to disturbance from noise associated with the machinery. Some direct mortality would likely occur for species unable to leave the area. Machinery use associated with this treatment will also potentially increase erosion and the resultant siltation due to loosened soils. Aquatic dependent species, such as amphibians, will potentially be negatively impacted by this treatment. Adverse long-term impacts due to habitat modification will likely be minor. Decrease of the potential for large-scale catastrophic wildland fire and resultant wildlife habitat destruction is a moderate long-term beneficial impact.
Mitigation: Avoidance of areas where sensitive wildlife, such as raptors, are nesting and avoiding steep slopes or easily erodible soils will help minimize impacts to wildlife associated with level 3 mechanical fuel treatment.

Conclusion: Cumulative effect of Alternative IV on wildlife would be moderate, beneficial, and long-term, based primarily upon the ability to decrease the risk of catastrophic wildland fire over time combined with the return of fire to much of the park. Short-term adverse impacts associated with mechanical fuel treatments and prescribed fire preparation will somewhat offset the benefits to wildlife and their habitat.

Species of Special Concern – Federal Threatened Species

Bald Eagle (Haliaeetus leucocephalus)

Whiskeytown Lake supports two breeding pair of bald eagles as well as a substantial migratory wintering population. Bald eagle activity such as perching, foraging, nesting, and roosting is generally limited to the lower elevations of the park and occurs mostly within two miles of Whiskeytown Lake. Bald eagles are dependent on large, dominant trees for nesting and perching. The majority of foraging activity occurs on Whiskeytown Lake and prey species include a wide variety of fish as well as numerous ducks, coots, and grebes.

Bald eagle habitat at Whiskeytown occurs in areas where most fires have been successfully suppressed for several decades. Therefore, a substantial portion of the park's bald eagle habitat is at risk from catastrophic fire. Compounding this threat is the fact that most visitor activity and opportunity for human-caused fire starts occur in close proximity to bald eagle habitat. The relatively slow pace at which this risk would be reduced under Alternatives I and III, through prescribed fire and level I mechanical fuel reduction techniques, means that this risk would continue indefinitely, or potentially grow worse as fuels continue to accumulate. Catastrophic fire would destroy large trees and snags that are important components of bald eagle habitat. Effects of catastrophic fire on bald eagles under Alternatives I and III would potentially be major, adverse, and long-term. Effects of catastrophic fire on bald eagles under Alternatives II and IV would be substantially decreased over time and would likely be moderate, adverse, and long-term.

Significant areas of bald eagle habitat occur in both the Frontcountry Fire Management Unit (FMU-1) and the Backcountry Fire Management Unit (FMU-2). Historic and current nest sites also occur within both FMU's. Under Alternatives I, II, and IV, prescribed fire is proposed to be utilized throughout much of the area around Whiskeytown Lake, which is typically utilized for nesting, roosting, foraging, and perching. Prescribed fire, therefore would be the primary tool for fuel reduction and restoration of natural forest structure in a substantial portion of the park's bald eagle habitat. These areas are also typified by having high fuel loads and abundant ladder fuels. Under Alternative I, however, the rate of prescribed fire use would remain relatively low, so the high risk of catastrophic fire would continue indefinitely. The current high levels of fuel accumulation

may, in some areas, result in prescribed fires with enough intensity to cause mortality among some large trees. This adverse effect, however, must be weighed against the reduced threat of catastrophic fire over large areas that would result from prescribed fire use. Helicopter use within ½ mile of bald eagle nest sites will also have the potential impact of disturbance with possible nest abandonment. To mitigate this potential adverse impact, helicopter use will not be allowed within ½ mile of active bald eagle nest sites. Consultation with USFWS, Under Section 7 of the ESA, will be initiated for prescribed fire projects implemented in current or historical bald eagle nesting habitat. Impacts of prescribed fire on bald eagles under Alternatives I, II, and IV would be minor, beneficial, and long-term. Impacts of prescribed fire to bald eagles under Alternative III will be negligible.

Construction of hand lines could have an adverse effect on bald eagles if large trees or snags are cut in areas used by eagles. This would generally not occur, since the management goals include retaining of large and hand lines could avoid these features. Some snags would be lost in fires, but new snags would be created from fire mortality of trees. Chain saw use within ½ mile of active nest sites during fireline construction could have an adverse impact on nesting bald eagles due to disturbance and possible nest abandonment. To mitigate this potential adverse impact, fireline construction for prescribed burns will not occur within ½ mile of bald eagle nest sites during the nesting period. Snagging would have an adverse effect on eagles if important perching or roosting snags were cut. However, snags would only be cut if they presented a threat to life and safety, were a threat to control of a prescribed fire, or represented a hazard to property or park resources. Impacts of site preparation associated with prescribed fire under Alternatives I and IV would be minor, adverse, and short term. Impacts of site preparation associated with Alternative II would be increased but would still be classified as minor, adverse, and short-term. Impacts of site preparation under Alternative III would be negligible.

Mop-up, or the churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would likely have minimal impacts to bald eagles, although some potential exists for disturbance of perched or foraging eagles. Impacts of mop-up under all alternatives would be negligible, adverse, and short-term.

Chain saw use associated with thinning and fuel break construction could potentially cause disturbance of nesting bald eagles if allowed to occur within ½ mile of active nests. To avoid this impact, chainsaw use would not occur within ½ mile of active nest sites. Thinning and shaded fuel break construction would have an indirect benefit to bald eagles by lessening severity and size of wildland fire and therefore, reducing mortality to large trees and fire consumption of snags. Human activity associated with pile burning may adversely impact foraging or perched eagles by causing them to temporarily move out of preferred foraging or perching areas. Impacts to bald eagles of Level 1 Mechanical Fuel Treatments would be minor, beneficial, and long term under Alternatives I, III, and IV. Impacts to bald eagles associated with Level 1 Mechanical Fuel Treatment under Alternative II would not occur.

Activities associated with pile burning could cause disturbance to nesting bald eagles if allowed to occur in the immediate vicinity of active bald eagle nests. To mitigate this potential impact, pile burning would not occur near active bald eagle nests. Human activity associated with pile burning may adversely impact foraging or perching eagles by causing them to temporarily move out of preferred foraging or perching areas. Impacts of pile burning would be minor, adverse, and short term under all alternatives.

High noise levels associated with chipping vegetation would potentially cause disturbance to nesting bald eagles if allowed to occur within ½ mile of active bald eagle nests. To mitigate this potential impact, chipping activities would be limited to areas outside bald eagle nest sites or to periods when nesting activity is not occurring. Human activity associated with pile burning may adversely impact foraging or perching eagles by causing them to temporarily move out of preferred foraging or perching areas. Impacts of chipping would be minor, adverse, and short term under all alternatives.

Construction of hand lines or dozer lines associated with wildland fire suppression activities would have an adverse effect on bald eagles if large trees or snags are cut or pushed over in areas used by eagles. This would generally not occur, since management goals include retaining of large trees and containment lines could avoid these features. Water or retardant drops could have an adverse effect on eagles if nesting birds are disturbed by aircraft. To mitigate this potential adverse

impact, aircraft use will not be allowed within 1/2 mile of active bald eagle nest sites. Helispots would generally be constructed in open areas away from the large trees favored by eagles. Snagging would have an adverse effect on eagles if important perching or roosting snags were cut. However, snags would only be cut if they presented a threat to life and safety, were a threat to control of a wildland fire, or represented a hazard to property or park resources. Emergency consultation with USFWS, under Section 7 of the Endangered Species Act, would be initiated in the event of a wildland fire occurring within ½ mile of nesting habitat or if nesting habitat is under imminent threat of being impacted by fire or suppression activities. Impacts of wildland fire suppression activities to bald eagles would potentially by high initially under all alternatives, but would be lessened over time under Alternatives II and IV which call for more aggressive treatment of hazardous fuels. Impacts due to fire suppression activities are likely to be minor, adverse, and short-term for all alternatives.

Level 2 mechanical fuel treatment involves the use of brush-reduction machinery to grind and shred brush on a three-year review cycle to determine maintenance needs. Appropriate maintenance requirements would be completed as needed according to this cycle. The purpose is to reduce vegetative density and continuity, and to reduce ladder fuels capable of transporting a surface fire into the forest canopy. This treatment will only occur on slopes less than 30% and primarily would occur during summer and fall when soil moisture content is low. This treatment will only be under Alternatives III and IV. Approximately 225 acres/year are targeted for treatment under Alternative III and approximately 320 acres/year under Alternative IV. Potential short-term impacts to bald eagles associated with level 2 mechanical treatment include disturbance from the machinery, which is very loud. Decrease of the potential for large-scale catastrophic wildland fire and resultant mortality of large overstory trees is a moderate, long-term, beneficial impact. Short-term impacts to bald eagles associated with Level 2 Mechanical Fuel Treatment will be minor and adverse for Alternatives III and IV. Long-term impacts to bald eagles associated with Level 2 Mechanical Fuel Treatments will be moderate and beneficial for Alternatives III and IV.

Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small-diameter trees of less than 12 inches DBH. The strategy would be used in the construction of fuel breaks and to thin understory and overstocked stands. Thinning would be used to restore a more open forest structure and to promote species composition representative of pre-settlement, pre-suppression forest conditions. This treatment would only be used under Alternative IV and would treat approximately 300 acres/year. Potential short-term adverse impacts to bald eagles would be primarily due to disturbance from noise associated with the machinery. This impact will likely be minor as machinery will not be used within ½ mile of nesting bald eagles and foraging areas around Whiskeytown Lake are not targeted for this treatment. A potential beneficial impact is that thinning overstocked stands will likely improve growth of remaining trees and potentially provide stands of large conifers used by eagles for nesting. Decrease of the potential for large-scale catastrophic wildland fire and resultant wildlife habitat destruction is a moderate long-term beneficial impact.

Conclusion. Alternatives I and III would have a moderate, adverse, long-term effect on bald eagles, primarily based on the continued threat of catastrophic fire, that would affect the large trees and snags that are important habitat components. Alternatives II and IV will significantly decrease the major threat of catastrophic wildland fire to bald eagle habitat over time through aggressive treatment of fuels. Alternative IV will have more potential to have adverse impacts to bald eagles from disturbance, both from human activity and from machinery noise. These impacts may be minimized by avoidance of areas used for nesting, foraging, or roosting.

Northern Spotted Owl (Strix occidentalis caurina)

The northern spotted owl is found throughout much of northern California in dense old-growth, multi-layered mixed conifer, redwood, and Douglas-fir habitats, from sea level up to approximately 7600 ft. (Zeiner et al. 1990). The western area of the park falls within the reported range of the northern spotted owl and contains some areas of suitable habitat. Forested areas with greater that 70% canopy closure are potential spotted owl nesting and roosting areas, while areas with greater than 40% canopy closure provide foraging areas. Old growth forests provide the best habitat. Most spotted owl habitat owes its structure and species composition to fire (Lujan 1992). Historically, spotted owls occupied a dynamic landscape that often consisted of large areas of burned and unburned forest. Today, however, habitat is greatly reduced and fragmented, and owl populations have become increasingly

vulnerable to loss of habitat due to fire (Lujan 1992). Fires can cause further habitat fragmentation and loss of preferred suitable old growth. One study showed that areas that had been clearcut or burned within the previous 20 years were rarely used by spotted owls for foraging. Additionally, spotted owls usually avoided crossing burned areas by traveling through corridors of unburned timber around the area. Spotted owls are also intolerant of high temperatures and are stressed at temperatures above 80 to 87 degrees Fahrenheit (27-31 deg. C) (Gutierrez 1985). Spotted owls tend to roost in small trees in the forest understory during warm weather and high up in the large trees during cold or wet weather. The layered canopy structure in old forests provide both types of roosts. (Thomas et. al. 1990). There is one known spotted owl site within the park, but more sites may be found as surveys are completed in some of the more remote areas of the park. Much of the higher elevations along the western boundary of the park that historically may have supported spotted owls was heavily altered by timber harvest activities in the 1960's and early 1970's. It is possible that these areas will be repopulated by spotted owls as the forest regenerates, matures and develops the complex structural characteristics commonly found in areas occupied by spotted owls.

Under a natural fire regime, much of the spotted owl habitat in the Klamath Mountains was subject to frequent, low-intensity fires. Under current conditions, most of the area considered suitable spotted owl habitat, has not burned for many decades. These areas are typically characterized by unnaturally high fuel loads with extensive ladder fuels in the form of thick brush stands or white fir regeneration. These conditions make it likely that large, stand-replacing fires will occur, which would destroy spotted owl habitat by reducing the canopy closure and multi-level forest that defines good habitat. In addition, the growth of dense understory vegetation may affect habitat quality by making foraging by spotted owls more difficult. Under Alternatives I and III, the relatively slow rate of treatment of forest habitats to reduce fuel accumulations would likely result in the destruction of spotted owl habitat through catastrophic fires and prolong the degradation of habitat by allowing thick understory vegetation to remain. Impact of catastrophic fire on northern spotted owls under Alternatives I and III would be major, adverse, and long-term. Effects of catastrophic fire on northern spotted owls under Alternatives II and IV would be substantially decreased over time and would likely be moderate, adverse, and long-term.

Prescribed fire provides the greatest potential for targeted treatment of forest habitats, with a focus on protecting spotted owls and improving their habitat. Additional preparation work will be performed on prescribed fires that include known spotted owl nesting territories. This prep work would include scattering of heavy fuel build-up near large conifers and manual removal of ladder fuels near large trees. Prep work and prescribed burns would only be completed outside the Limited Operating Period (LOP), which currently is February 1 – July 10. The additional prep work is designed to reduce the chance of adverse effect on nesting and roosting habitat from high-intensity fire. Additionally, consultation with USFWS, under Section 7 of the Endangered Species Act, will be initiated prior to initiation of prep work or implementation of the burn. Prescribed fire must also take into account other habitat components, such as large, down, woody debris which are known to be important to prey species of spotted owls. Fires of an intensity that would significantly reduce the amount of large, woody debris would, therefore, have an adverse effect on spotted owls. The use of prescribed fire under Alternatives I, II, and IV would have minor, adverse, short-term impacts and minor, beneficial, long-term impacts on northern spotted owls, primarily through reduction of the threat of catastrophic fire. Prescribed fire would not be used within northern spotted owl habitat under Alternative III.

Disturbance associated with chainsaw use during handline construction would potentially adversely affect spotted owls if it occurred near a nest site during the nesting season. To avoid this impact, handline construction would not occur within ¼ mile of a known owl nest site during the LOP. Additionally, removal of overstory trees during handline construction will be avoided. Snags are often used by spotted owls as nest sites. Therefore, snagging operations would only occur to ensure health and human safety and the integrity of fire lines. Site preparation associated with prescribed fire would have negligible, adverse, short-term impacts on the northern spotted owl under Alternatives I, II, and IV.

The churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would likely have minimal impacts to spotted owls, although some potential exists for disturbance of roosting owls. Impacts of mop-up would be negligible, adverse, and short-term under Alternatives I, II, and IV.

Water and retardant drops would have an adverse effect on spotted owls if they occurred over nesting habitat, and affected nests. Such events have a low probability of occurring, but could be mitigated if nest sites and probable nesting habitat could be avoided. Helispots and spike camps would potentially have an adverse effect on spotted owls if they were located close to nesting or roosting areas, and the level of disturbance associated with these areas was high. Hand-line, if constructed through a spotted owl nesting or roosting area would potentially cause adverse effects from disturbance and habitat alteration, especially if trees were felled. Emergency consultation with USFWS, under Section 7 of the Endangered Species Act, would be initiated in the event that a wildland fire or wildland fire suppression activities threatens suitable spotted owl nesting habitat. Impacts to the northern spotted owl from wildland fire suppression would be moderate, adverse, and short-term under all alternatives, although these impacts are expected to occur most frequently under Alternatives III and I.

Level 1 mechanical fuel treatment could occur on a limited basis in suitable northern spotted owl habitat under all alternatives. Chain saw use would not occur within ¼ mile of a known owl nest site during the LOP. Areas containing suitable nesting or roosting habitat will be surveyed using established USFWS protocol prior to implementation of level I mechanical fuel treatments in suitable nesting or roosting habitat. Additionally, consultation with USFWS, under section 7 of the Endangered Species Act, will be initiated prior to implementing mechanical treatments within ¼ mile of a known nesting territory. Level I mechanical fuel treatments will likely have minor short-term adverse impacts on the northern spotted owl due to the potential for disturbance and changes in habitat characteristics that may adversely impact forage species. Moderate beneficial long-term impacts will likely occur due to the reduction of the threat of catastrophic fire and the increase in the ability of owls to forage in areas where a thick understory is thinned. Hand-thinning brush and small over-stocked trees will also likely accelerate the development of the habitat features characteristic of suitable spotted owl habitat in areas impacted by historic logging.

No other mechanical fuel treatment is not proposed to occur in suitable northern spotted owl habitat under any of the alternatives.

Conclusion: Alternatives I and III would potentially have major, adverse, long-term impacts on spotted owls from the prolonged threat of catastrophic fire that would be likely due to the current, relatively slow rate of treatment of accumulated fuels. Alternatives II and IV would effectively decrease the threat of catastrophic fire to spotted owl habitat over time. Short-term impacts under Alternatives II and IV would be minor and adverse, while long-term impacts would be moderate and beneficial.

Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)

Presence of the valley elderberry longhorn beetle (VELB) has not been documented within the park, but may occur along some portions of Clear Creek. The entire life cycle of the VELB is connected to the elderberry plant (Sambucus sp.). A small population of elderberry plants have been documented within the park near Trinity Mountain Road, ½ mile south of French Gulch. The entire park has not been surveyed for elderberry plants and it is possible that other small populations may be discovered. It is unknown if VELB are present on the Elderberry plants known to occur within the park as very dense Himalayan blackberry presently prevents examination of stems for exit holes. The nearest confirmed VELB occurrences were near Turtle Bay in Redding about 15 miles east of the park elderberry location (California Natural Diversity Database). Adverse impacts to elderberry plants could have an adverse effect on VELB. Management activities such as prescribed fire, mechanical fuel treatment, and wildland fire suppression generally have goals of protecting riparian areas and impacts to elderberry bushes that occur in these areas would be nonexistent or negligible. There are no plans to implement fire or fuel management related projects in the immediate vicinity of the known population of elderberry plants. Consultation with USFWS, under Section 7 of the Endangered Species Act, will be initiated prior to implementation of any project activity that may affect elderberry plants.

Conclusion: All alternatives will have a negligible impact on the valley elderberry longhorn beetle.

California red-legged frog (Rana aurora draytonii)

The park falls within the reported range of the California red-legged frog, and some suitable habitat exists (ponds and slow-moving streams with emergent vegetation), but no historic observations of the species are known from the park. The nearest known population of red-legged frogs is in Tehama County, approximately 35 miles south of the park. Surveys of areas containing suitable habitat were completed in 1995 and adults, tadpoles, and egg masses were not located. Additionally, all potential suitable habitat within the park is currently occupied by non-native bullfrogs which generally exclude red-legged frogs. It is unlikely that activities associated with fire or fuel management activities will have any impact on the California red-legged frog. If red-legged frogs are located within the park, consultation with USFWS, under Section 7 of the Endangered Species Act, will be initiated prior to implementation of any project activity that may affect the California red-legged frog.

Conclusion: The California red-legged frog will not be impacted by any of the alternatives.

Species of Special Concern - Federal Species of Concern

Pacific Fisher (Martes pennanti pacifica)

Fishers are among the most habitat-specific mammals in North America, living in landscape mosaics of conifer-dominated forest stands, and avoiding open areas that have no overstory or shrub cover (Buskirk and Powell 1994). Late successional mid to low elevation coniferous or mixed forests provide the most suitable habitat because they provide abundant potential den sites and prey (Allen 1983). The presence of large deciduous trees, such as oaks, also appears to be important. Fishers den in a variety of protected cavities, brush piles, logs, or under an upturned tree. Hollow logs, trees, and snags are especially important habitat components (Zeiner et al. 1988). Forest type is probably not as important to fishers as structural characteristics, such as dense canopies, and large trees, snags, and down logs. Riparian areas are also important (Seglund 1995). Fishers may be extirpated from much of their historical range in Washington, Oregon, and California (Zielinski et al. 1995). Trapping at the end of the 19th century severely reduced fisher populations, but the reasons for the lack of recovery in the species in the absence of trapping are unclear. Factors may include loss of suitable habitat from logging and fire suppression, fragmentation of habitat, and disturbance and mortality from roads. Distribution and populations of fishers are not known at Whiskeytown, but the Wildlife Observation Database, dating from the early 1970's to present, reports numerous fisher observations throughout many areas of the park. It is likely that fishers occur at Whiskeytown where suitable habitat exists.

Catastrophic fire has the potential for severely altering fisher habitat by reducing canopy closure and forest floor features that are important components of suitable fisher habitat. Many areas of the park that contain suitable fisher habitat have not burned for several decades and are characterized by having high levels of down fuel and considerable ladder fuels in the form of brush and conifer seedlings. The potential for catastrophic fire and the resultant adverse impacts to fisher habitat is high in these areas. Under Alternatives I and III, actions to reduce fuel loading would proceed at a relatively slow pace, resulting in the continued threat of catastrophic fires and adverse effects on fishers. Impacts of Alternatives I and III on fishers would, therefore, be major, adverse, and long-term. The potential for catastrophic wildland fire and its effects would be substantially lessened over time under Alternatives II and IV, which will more aggressively treat hazardous fuels.

Because prescribed fires can be targeted on habitats that are at the greatest risk of catastrophic fire, and are the most severely altered by a history of fire suppression, it has the potential for great resource benefit. High fuel loadings in some areas would potentially result in prescribed fires of high enough intensity to consume large woody debris, which is an important component of fisher habitat. Also, large snags, which are of high value to fishers, would potentially be consumed. This impact will be offset somewhat by the likelihood that the prescribed fire will create some new snags. Short-term impacts of prescribed fire will be minor and adverse. Long-term impacts will be minor and beneficial due to the reduction of the risk of catastrophic fire. Burn prescriptions should strive to conserve habitat elements that are important to fishers. The benefit of prescribed fire under Alternative I would be limited by the relatively slow rate of its use. Therefore, impacts to fisher under Alternative I would be minor, beneficial, and long-term, based upon a modest reduction in the threat of catastrophic fire. Under Alternative II, prescribed fire use would approximately double over current levels and the associated impacts, both adverse and beneficial, would also approximately double. Under Alternative III, prescribed fire would only be used on an extremely limited basis and impacts would be negligible. Under Alternative IV, use of prescribed fire would increase slightly over current levels, and impacts would be comparable to Alternative I.

Disturbance associated with chainsaw use during handline construction may potentially adversely affect denning fishers. Additionally, handline construction has the potential to expose dens hidden by dense brush. Removal of overstory trees during handline construction will be avoided. Snags will only be cut to ensure health and human safety and the integrity of fire lines. Under Alternative I, site preparation associated with prescribed fire would have minor, adverse, short-term impacts on the pacific fisher. These impacts would approximately double under Alternative II, but would likely still remain minor, adverse, and short-term. Impacts to fishers resulting from site preparation for prescribed fires under Alternative III would be negligible. Prescribed fire preparation impacts resulting from Alternative IV would be similar to Alternative I.

Mop-up, or the churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would likely have minimal impacts to fishers under all alternatives. Impacts would be short-term, negligible and adverse.

Chain saw use associated with thinning and fuel break construction could potentially cause disturbance of denning fishers. Fishers prefer dense forest stands and thinning and fuel break construction will likely degrade portions of their habitat. These impacts will be minor, adverse and long-term. Thinning and shaded fuel break construction would have an indirect benefit to fishers by lessening severity and size of wildland fire and therefore, reducing mortality to large trees and fire consumption of snags. Human activity associated with pile burning may adversely impact fishers by causing them to temporarily move out of preferred areas. Short – term impacts of Level 1 Mechanical Fuel Treatments would be minor and adverse. Long-term impacts would be minor and beneficial.

Human activity associated with pile burning may adversely impact foraging or denning fishers by causing them to temporarily move out of preferred areas. Fishers have been documented to use brush piles for denning and shelter and it is possible, but not likely, that denning sites would be established in newly created brush piles and then destroyed during pile burning activities. This impact is not likely as most brush piles are burned as soon as conditions allow this to safely occur. Impacts to fishers associated with pile burning under all alternatives would be negligible, adverse, and short term.

High noise levels associated with chipping vegetation would potentially cause disturbance to denning or foraging fishers. Human activity associated with chipping may adversely impact foraging fishers by causing them to temporarily move out of preferred areas. This is unlikely to occur as chipping activities will only occur along roads or near developed areas that are normally avoided by fishers. Impacts to fishers from chipping would be negligible, adverse, and short term under all alternatives.

Handline and dozerline construction could have a localized, adverse effect on fishers through direct disturbance, and alteration of habitat. Such effects, however, would be limited in area and short-term. Water and retardant drops would likely have no effect on fishers. Some short-term disturbance would occur from helicopter or airplane overflights. Helispot and spike camps could have an adverse effect if they were located near a fisher den. This impact could not be avoided due to lack of

information on den sites. Snagging could have an adverse effect on fishers by removing an important habitat component, because snags are often used as den sites. Snags should only be cut when they present a clear threat to human safety or the integrity of a fire line. Prescribed and wildland fire would create new snags through the killing of trees, but it would take time for the dead trees to become suitable snags through decay. Overall, actions taken to suppress wildland fires would likely have a minor, adverse, long-term effect on fishers under all alternatives, primarily due to possible reduction in the number of snags and small-scale habitat alteration.

Level 2 mechanical fuel treatment involves the use of brush-reduction machinery to grind and shred brush on a three-year review cycle to determine maintenance needs. Appropriate maintenance requirements would be completed as needed according to this cycle. The purpose is to reduce vegetative density and continuity, and to reduce ladder fuels capable of transporting a surface fire into the forest canopy. This treatment will only occur on slopes less than 30% and primarily would occur during summer and fall when soil moisture content is low. This treatment will only be used under Alternatives III and IV. Approximately 225 acres/year are targeted for treatment under Alternative III and approximately 320 acres/year under

Alternative IV. Potential short-term impacts to fishers associated with level 2 mechanical treatment include disturbance from the machinery, which is very loud. Decrease of the potential for large-scale catastrophic wildland fire is a moderate, long-term, beneficial impact. Short-term impacts to fishers associated with Level 2 Mechanical Fuel Treatment will be minor and adverse.

Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small-diameter trees of less than 12 inches DBH. The strategy would be used in the construction of fuel breaks and to thin understory and overstocked stands. Thinning would be used to restore a more open forest structure and to promote species composition representative of pre-settlement, pre-suppression forest conditions. This treatment would only be used under Alternative IV and would treat approximately 300 acres/year. Potential short-term adverse impacts to fishers would be primarily due to disturbance from noise associated with the machinery. This impact will likely be minor as the area targeted for treatment is relatively small. Decrease of the potential for large-scale catastrophic wildland fire and resultant habitat destruction is a moderate long-term beneficial impact.

Conclusion: Overall, Alternatives I and III would have a major, adverse, long-term effect on fishers by allowing the threat of catastrophic fire to continue indefinitely. Alternatives II and IV will have short-term, adverse impacts associated with disturbance, while providing long-term, beneficial impacts through the aggressive treatment of fuels and reduction of the likelihood of catastrophic wildland fire and habitat loss.

Foothill yellow-legged frog (Rana boylii)

Foothill yellow-legged frogs are dependent on permanent water and are found in or near rocky streams in a variety of habitats, including mixed chaparral, valley-foothill hardwood, valley-foothill hardwood conifer, ponderosa pine, mixed conifer, and wet meadow types (Zeiner et al. 1988). Unlike most other ranid frogs in California, this species is rarely encountered far from permanent water (Zeiner et al. 1988). Exotic bullfrogs (Rana catesbeiana), which are prevalent at Whiskeytown, have been implicated in the observed reduction of foothill yellow-legged frog populations in the Sierra (Moyle 1973). Foothill yellow-legged frogs are fairly common in the perennial streams that feed Whiskeytown Reservoir.

Catastrophic wildland fire could potentially alter habitats important to foothill yellow-legged frogs. The most likely scenario would be that a catastrophic wildland fire could consume large amounts of riparian habitats, which are important to frogs. A secondary impact would be the increases in sedimentation of streams that is likely to significantly increase following catastrophic fire. Increases in sedimentation will adversely impact egg masses, tadpoles, and adults. Impacts from catastrophic fire on foothill yellow-legged frogs would be moderate, adverse, and long-term, based primarily on the loss of riparian habitats and sedimentation of aquatic habitats. Under Alternatives I and III, actions to reduce fuel loading would proceed at a relatively slow pace, resulting in the continued threat of catastrophic fires and adverse effects on foothill yellow-legged frogs. Impacts of Alternatives I and III on foothill yellow-legged frogs would, therefore, be major, adverse, and long-term. The potential for catastrophic wildland fire and its effects would be substantially lessened over time under Alternatives II and IV, which will more aggressively treat hazardous fuels.

Although prescribed fire would be limited under Alternative I, some benefit to foothill yellow-legged frogs would be derived from reduction in the risk of catastrophic fire. Prescribed fires burn with low intensity and are planned and managed to have little impacts to riparian vegetation. Negligible increases in sedimentation to streams may occur post-fire due to exposed soil along control lines. Portable pumps are often placed in streams during prescribed fires and the risk for fuel spills into the stream is present. Fuel spills into the stream would have a moderate, adverse, short-term impact to foothill yellow-legged frogs. Overall impacts of prescribed fire on foothill yellow-legged frogs under Alternative I would be negligible, beneficial, and long-term due to the reduction of risk of catastrophic wildland fire. Impacts, both adverse and beneficial, to foothill yellow-legged frogs would be greatest under Alternative II, which would approximately double the level of annual prescribed fire acreage. Prescribed burning will only occur at a minimal level under Alternative III and impacts will be negligible. Impacts on foothill yellow-legged frogs associated with prescribed fire under Alternative IV will be similar to Alternative I.

Handline construction will expose soil and may result in post-fire increases in sedimentation to waterways. Snagging is not likely to have impacts to foothill yellow-legged frogs. Impacts associated with prescribed fire site preparation is minor, adverse, and short-term under Alternatives I and IV. Impacts under Alternative III is negligible. Impacts to foothill yellow-legged frogs from prescribed fire site preparation under Alternative II will be greatest and will likely be moderate, adverse, and short-term, based on the increase in targeted acreage and associated line construction and sedimentation.

Mop-up, the churning of soil and forest litter, to extinguish residual hot spots along the periphery of a prescribed fire, would potentially cause increases in erosion and sedimentation of streams. This impact would likely be localized and fairly small in scope as most hot-spots that require active mop-up will occur upslope and away from riparian areas and streams. Impacts associated with mop-up will be minor, adverse, and short-term for Alternatives I, III, and IV. Impacts associated with Alternative II will be negligible.

Thinning and shaded fuel break construction would have an indirect benefit to foothill yellow-legged frogs by lessening severity and size of wildland fire and therefore, reducing impacts to riparian areas and sedimentation of streams. Human activity associated with thinning and shaded fuel break construction may adversely impact frogs by causing increases in erosion and sedimentation of streams. Short –term impacts of Level 1 Mechanical Fuel Treatments from Alternatives I, III and IV would be minor and adverse. Long-term impacts from Alternatives I, III and IV would be minor and beneficial. Impacts resulting from Level 1 Mechanical Fuel Treatment under Alternative II will be negligible.

Pile burning or chipping are not likely impact foothill yellow-legged frogs.

Retardant drops could adversely affect foothill yellow-legged frogs through contamination of their aquatic habitat. Protocols for retardant use at Whiskeytown restrict its use within 300 feet of water, which lessens the chances of the chemicals reaching water. Nevertheless, it is likely that some chemicals from retardant use will flush into streams during rains. Impacts of retardant use on foothill yellow-legged frogs are potentially moderate, adverse, and short-term based primarily on the possibility of accidental retardant contamination of streams. Water drops will not likely have an impact on the foothill yellow-legged frog. These impacts will likely be similar for all alternatives as fire suppression strategies at Whiskeytown rely on aggressive initial attack with airtankers and helicopters during periods of high fire risk, regardless of fire size.Helispots and spike camps would have limited use in yellow-legged frog habitat, and would be sited away from such sensitive habitats. Hand and dozer lines would have potential impacts from the resultant sedimentation of streams that would occur due to the disturbed, exposed topsoil. Hand and dozerlines often travel straight up slopes and provide excellent corridors for water diversion and erosion. These impacts can be minimized by avoiding the use of dozers where possible and rehabilitating firelines after the fire is contained/controlled. Overall impacts of wildland fire suppression actions on yellow-legged frogs under Alternatives II and IV would be minor, adverse, and long-term due to the aggressive treatment of fuels and accompanying decrease in wildland fire severity and likelihood of more rapid containment and control. Impacts resulting from wildland fire suppression under Alternative III will likely be more severe as the probability of large, intense fires requiring multiple retardant drops and dozer lines is higher. Impacts under Alternative I are less than Alternative III and more than Alternatives II and IV.

Level 2 mechanical fuel treatment involves the use of brush-reduction machinery to grind and shred brush on a three-year review cycle to determine maintenance needs. Adverse impacts to foothill yellow-legged frogs from Level 2 Mechanical Fuel Treatment will be negligible as treatments are restricted to areas away from riparian zones or perennial streams. Decrease of the potential for large-scale catastrophic wildland fire is a moderate, long-term, beneficial impact.

Level 3 Mechanical Fuel Treatment involves the use of machinery to remove brush and small-diameter trees of less than 12 inches DBH. Potential short-term adverse impacts to foothill yellow-legged frogs will be erosion and sedimentation resulting from machinery use. This impact will likely be minor as the area targeted for treatment is relatively small and will not occur within riparian zones or near perennial streams. Decrease of the potential for large-scale catastrophic wildland fire and resultant habitat destruction is a moderate, long-term beneficial impact.

Conclusion: Impacts to foothill yellow-legged frogs from Alternatives I and III will be minor, adverse, and long-term based on the continued threat of large-scale, high-intensity wildland fires, the continued need for very aggressive suppression activities, and the associated erosion and sedimentation and potential loss of riparian habitats. Under Alternatives II and IV, the likelihood of high-intensity wildland fire and the need for aggressive suppression actions will be decreased substantially over time due to hazardous fuel reductions. Short-term impacts to foothill-yellow legged frogs, under these alternatives, will be minor and adverse, while long-term impacts will be moderate and beneficial.

Tailed frog (Ascaphus truei)

Tailed frogs occur in permanent streams of low temperatures in conifer dominated habitats including Douglas-fir, Klamath mixed-conifer, and ponderosa pine habitats. It also occurs in montane hardwood-conifer habitats. Tailed frogs occur more frequently in mature or late-successional forests than in younger stands (Bury 1983, Bury and Corn 1988, Jennings and Hayes 1994) and are restricted to perennial streams of low temperature in steep-walled valleys with dense vegetation. Permanent water is critical because the aquatic larvae require 2-3 years to transform (Zeiner et al. 1988). Distribution of the tailed frog is not known at Whiskeytown, although confirmed observations have been reported from Brandy Creek, Crystal Creek, and their tributaries.

Catastrophic wildland fire could likely alter habitat important to tailed frogs. The most likely scenario would be that a catastrophic wildland fire would consume large amounts of overstory conifers and riparian habitats, which would allow streams to receive more sunlight and warm up to temperatures unsuitable to tailed frogs. A secondary impact would be the increases in sedimentation of streams that is likely to significantly increase following catastrophic fire. Increases in sedimentation will adversely impact egg masses, tadpoles, and adults. Impacts from catastrophic fire on tailed frogs would be moderate, adverse, and long-term, based primarily on the increased stream temperatures and sedimentation of aquatic habitats.

Under Alternatives I and III, actions to reduce fuel loading would proceed at a relatively slow pace, resulting in the continued threat of large-scale high intensity fires and adverse effects on foothill tailed frogs. Impacts of Alternatives I and III on tailed frogs would, therefore, be major, adverse, and long-term. The potential for catastrophic wildland fire and its effects would be substantially lessened over time under Alternatives II and IV, which will more aggressively treat hazardous fuels.

Although prescribed fire would be limited under Alternative I, some benefit to tailed frogs would be derived from reduction in the risk of catastrophic fire. Prescribed fires burn with low intensity and are planned and managed to have little impacts to riparian vegetation and overstory conifers which are known to be important habitat components of tailed frogs. Negligible increases in sedimentation to streams may occur post-fire due to exposed soil along control lines. Portable pumps are often placed in streams during prescribed fires and the risk for fuel spills into the stream is present. Fuel spills into the stream would have a moderate, adverse, short-term impact to tailed frogs. Overall impacts of prescribed fire on tailed frogs will be similar to those of foothill yellow-legged frogs (see above).

Impacts from handline construction, snagging, mop-up, levels 1 and 2 mechanical fuel treatments and suppression will likely be the same as foothill yellow-legged frogs (see above).

Pile burning and chipping will not occur in riparian habitats and will not likely impact tailed frogs.

Conclusion: Impacts to tailed frogs from Alternatives I and III will be minor, adverse, and

long-term based on the continued threat of large-scale, high-intensity wildland fires, the continued need for very aggressive suppression activities, and the associated erosion and sedimentation and potential loss of shading from overstory vegetation. Under Alternatives II and IV, the likelihood of high-intensity wildland fire and the need for aggressive suppression actions will be decreased substantially over time due to hazardous fuel reductions. Short-term impacts to tailed frogs, under these alternatives, will be minor and adverse, while long-term impacts will be moderate and beneficial.

Northwestern pond turtle (Clemmys marmorata marmorata)

The northwestern pond turtle is associated with permanent or nearly permanent water in a wide variety of habitat types (Zeiner et al. 1988). Pond turtles require basking sites such as partially submerged logs, rocks, mats of floating vegetation or open mud banks. Hibernation in colder areas is passed underwater in bottom mud. Two distinct habitats may be used for oviposition. Along large slow-moving streams, eggs are deposited in nests constructed in sandy banks. Along foothill streams, females may climb hillsides, sometimes moving considerable distances to find a suitable nest site (Storer 1930). Whiskeytown contains both habitat types and both types of sites are likely used for oviposition.

Catastrophic wildland fire would likely have little impact to pond turtles or their habitat, although nests may be destroyed by prolonged high intensity fires. Fire may actually create more favorable nesting sites by allowing sunlight to reach the forest floor (Bury, B. Pers. Comm.). Impacts to pond turtles under all alternatives will be negligible.

Prescribed fires will not likely adversely impact the northwestern pond turtle or their habitat. More favorable nesting sites may be created by opening dense or closed canopy chaparral or forests.

Site preparation associated with prescribed fire will likely have little impact to the pond turtle or it's habitat. There is a very small possibility that nests could be destroyed by ground disturbing activities associated with handline construction. Impacts from site preparation associated with prescribed fire on pond turtles under all alternatives will likely be negligible.

Mop-up to extinguish residual hot spots along the periphery of a prescribed fire would not likely impact the northwestern pond turtle.

Thinning of brush and creation of shaded fuel breaks will not adversely impact pond turtles and may create more favorable nesting sites by opening dense, closed canopy chaparral. Impacts of Level 1 mechanical fuel treatments, under all alternatives, will likely be minor, short-term, and beneficial. Pile burning would likely destroy nests in the event a pile was created and burned directly above a nest site. The chances of this occurring are small. Impacts associated with pile burning under all alternatives is negligible.

Chipping would not have impacts to the northwestern pond turtle.

Retardant drops could adversely affect northwestern pond turtles through contamination of their aquatic habitat. Protocols for retardant use at Whiskeytown restrict its use within 300 feet of water, which lessens the chances of the chemicals reaching water. Nevertheless, it is likely that some chemicals from retardant use will flush into streams during rains and the possibility exists for accidental drops directly in streams. Impacts of retardant use on pond turtles are potentially moderate, adverse, and short-term, based primarily on the possibility of accidental retardant contamination of streams. Water drops will not likely have an impact on pond turtles. These impacts will likely be similar for all alternatives as fire suppression strategies within the lower elevations of Whiskeytown, which are occupied by the pond turtle, rely on aggressive initial attack with airtankers and helicopters during periods of high fire risk, regardless of fire size. Helispots and spike camps would have limited use in pond turtle habitat, and would be sited away from such sensitive habitats. Hand and dozer lines would likely have negligible impacts to northwestern pond turtles under all alternatives. Overall impacts of wildland fire suppression actions on pond turtles under Alternatives II and IV would be minor, adverse, and short-term due to the potential of contaminating aquatic habitats with retardant. Impacts resulting from wildland fire suppression under Alternative III will likely be more severe as the probability of large, intense fires requiring multiple retardant drops is higher. Impacts under Alternative I are less than Alternative III and more than Alternatives II and IV.

Helispots and spike camps would not impact western pond turtles. Dozer lines, and to a lesser extent, hand lines could potentially destroy underground nests. Overall impacts of wildland fire management actions on pond turtles under all alternatives would be minor, adverse, and short-term.

Conclusion: Impact to western pond turtles under all alternatives would be minor, adverse, and short-term mainly due to the potential for contamination of aquatic habitats with retardant and possibility of nest destruction from line construction or mechanical fuel treatments

Pacific western big-eared bat (Corynorhinus (=Plecotus) townsendii townsendii)

The pacific western big-eared bat is found in all but subalpine and alpine habitats in California and may be found at any season throughout its range. It is most common in mesic habitats and feeds principally on small moths. The species requires caves, mines, tunnels, buildings, or other human-made structures for roosting and roosting sites are thought to be the limiting resource and the species is extremely sensitive to disturbance of roosting sites (Zeiner et al. 1990). Some surveys of potential roosting sites have been completed within the park and individual pacific western big-eared bats have been observed in mines and buildings at several locations.

Catastrophic wildland fire would not likely have direct impacts to pacific western big-eared bats. More likely, the bats would be indirectly negatively impacted by loss of habitat necessary to prey species. Catastrophic wildland fire could consume large amounts of riparian habitats that are necessary to many species of moths, which are their primary prey source. Impacts from catastrophic fire on pacific western big-eared bats under Alternatives I and III would be moderate, adverse, and short-term, primarily due to the potential loss of riparian habitats necessary to prey species. Potential for catastrophic fire will be substantially decreased over time under Alternatives II and IV and will be minor, adverse, and short-term.

Some benefit to pacific western big-eared bats would be derived from reduction in the risk of catastrophic fire. Prescribed fires burn with low intensity and are planned and managed to have little impacts to riparian vegetation. Overall impacts of prescribed fire on pacific western big-eared bats under all alternatives would be minor, beneficial, and long-term due to the reduction of risk of catastrophic wildland fire.

Handline construction, snagging, mop-up, pile burning and chipping will not likely have impacts to the pacific western big-eared bat.

Thinning and shaded fuel break construction would have an indirect benefit to the pacific western big-eared bat by lessening the potential for large-scale high severity wildland fires and therefore, reducing impacts to riparian areas. Impacts under Alternatives I, III, and IV would be minor, long-term, and beneficial. Level 1 Mechanical Fuel Treatment will occur only on a very limited basis under Alternative II and impacts will be negligible.

Wildland fire suppression activities and levels 2 and 3 mechanical fuel treatments will likely have negligible impacts to the pacific western big-eared bat.

Conclusion: Impacts to the pacific western big-eared bat under Alternative I and III would be minor, adverse, and short-term due primarily to the continued threat of large-scale high-intensity wildland fire and the potential for loss of riparian habitats necessary for their primary prey species. Under Alternatives II and IV, the likelihood of large-scale high-intensity wildland fire and the potential for loss of large amounts of riparian areas will be decreased substantially over time due to hazardous fuel reductions. Overall impacts will be long-term, minor, and beneficial.

State-listed Species

Willow flycatcher (Empidonax trailii) – California Endangered

In the past, willow flycatchers nested in California wherever willow thickets in wetlands, meadows, or riparian areas were found (Grinnell and Miller 1944). Dense willow thickets are required for nesting and roosting. The species most often occurs in broad, open river valleys or large mountain meadows with lush growth of shrubby willows (Serena 1982). In recent decades, breeding populations have disappeared from low elevation habitats in the state. Alteration and destruction of riparian and meadow habitats is thought to be the principal cause for this decline (Remson 1978). Other contributing factors may include nest parasitism by brown-headed cowbirds, disturbance from grazing, and disturbance on wintering grounds (Serena 1982). Willow flycatchers arrive in California from Central and South American wintering grounds in May and June. They depart in August with some transients noted through mid-September (Zeiner et al. 1990).Willow flycatchers have not been documented at Whiskeytown, but have been observed within the Clear Creek watershed south of the park boundary. Areas within the park which may contain suitable habitat occur in the Clear Creek drainage between Whiskeytown Dam and the park boundary and along Upper Clear Creek above Carr Powerhouse.

The long-term response of willow flycatchers and their habitat to fire is not known. Most areas containing large stands of willows remains somewhat wet throughout the year, but it is possible that under severe drought or high-wind conditions riparian areas containing a large willow component would burn during a catastrophic wildland fire. Willows are capable of resprouting and reoccupying areas fairly quickly, but at the least, a short-term moderate adverse impact is likely. The risk of catastrophic fire is greatest under Alternative III, due to the minimal amount of fuel treatment that would be accomplished, resulting in a greater potential for catastrophic fires over time. The risk of catastrophic fire is also fairly high under Alternative I due to the relatively slow pace of treatment of accumulated fuels. Impact of catastrophic fire on willow flycatchers under Alternative I and III would be moderate, adverse, and long-term, based upon the continued threat of catastrophic wildland fire. The risk of catastrophic wildland fire that potentially could consume riparian areas will be decreased substantially over time under Alternatives II and IV due to the aggressive treatment of hazardous fuels.

Prescribed fires are not planned to occur in the riparian habitats used by the willow flycatcher. Prescribed fires occurring adjacent to riparian habitats may cause temporary decreases of some insect prey species utilized by the willow flycatcher. Impacts of prescribed fire on willow flycatchers under Alternatives I, II, and IV would be minor, beneficial, and long-term, based upon the modest reduction in the threat of catastrophic fire that would occur. Impacts of prescribed fire on the willow flycatcher under Alternative II will be negligible.

Fire control lines are not constructed in the riparian areas that produce suitable habitat for the willow flycatcher. Additionally, snags are not likely to be felled in or near riparian habitats and are not thought to be an important habitat component. Site preparation associated with prescribed fire will have negligible impacts to the willow flycatcher under all alternatives.

Mop-up activities and pile burning will not likely impact willow flycatchers.

Hand thinning and construction of shaded fuel breaks would have a negligible effect on willow flycatchers, because these operations would not occur in riparian habitats. Chipping would not occur in or near riparian habitats containing suitable willow flycatcher habitat.

Water and retardant drops are very unlikely to affect willow flycatchers because the habitat flycatchers occupy is relatively wet, and does not typically carry fire. Existing procedures for retardant use also restrict its use to areas away from streams. Helispots could affect willow flycatchers if they are located near nesting areas, and the amount of helicopter traffic were enough to cause frequent disturbance. If willow flycatchers are documented within the park, helispots be located away from potential nesting sites. Spike camps are prescribed to be established outside of sensitive habitats, such as riparian areas, and therefore would not have impacts to willow flycatchers. Handlines could have an adverse effect on willow flycatchers if they were constructed through riparian areas and involved the removal of willows. These habitats, however, usually contain enough moisture that they do not carry fire, making fire lines unnecessary. Also, fire line construction guidelines call for the avoidance of sensitive habitats, such as riparian areas when possible. Snag removal would have no effect on willow flycatchers as snags are not an important component of willow flycatcher habitat, and are not commonly found in riparian areas. Mop-up activities are unlikely to impact willow

flycatchers. Overall, actions taken to manage wildland fires would have a negligible impact on willow flycatchers under all alternatives.

Levels 2 and 3 Mechanical Fuel Treatment will likely have negligible impacts to the willow flycatcher.

Conclusion: The risk to willow flycatchers from fire management and fuels reduction activities is negligible to minor under all alternatives. The greatest threat is that of a high-intensity wildland fire that potentially could consume riparian areas. This threat is least under Alternatives II and IV which prescribe aggressive treatments of hazardous fuels.

SOILS AND WATER QUALITY

The methodology for assessing fire management activities to Whiskeytown's soil and water quality is through a combination of the professional knowledge and experience of the Whiskeytown Natural Resource Management staff and literature review. The manner in which environmental impacts are measured for both soil and water quality is listed below.

Type of impact

Adverse: Likely to result in unnatural changes in physical and chemical properties of soil and water.

Beneficial: Likely to protect and /or restore the natural physical and chemical properties of soil and water.

Duration of impact

Short-term: Immediate changes in the physical and chemical properties of soil and water where the impacts last one hydrologic season.

Intermediate-term: Immediate changes in the physical and chemical properties of soil and water where the impacts last two to four hydrologic seasons.

Long-term: Immediate changes in the physical and chemical properties of soil and water where the impacts last more than four hydrologic seasons.

Intensity of impact

Negligible: Imperceptible or undetectable impacts.

Minor: Slightly perceptible, and limited in extent. Without further impacts, adverse impacts would reverse and the resources would recover.

Moderate: Readily apparent, but limited in extent. Without further impacts, adverse impacts would eventually reverse and the resource would recover.

Major: Substantial, highly noticeable, and affecting a large area. Changes would not reverse without active management.

Regulations and policies governing soil and water quality include the Clean Water Act, the Endangered Species Act, the National Park Service Organic Act, National Park Service Management Policies 2001, Whiskeytown's General Management Plan and Resource Management Plan.

Issues and impacts common to all alternatives for soil and water quality

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality. All alternatives have suppression as a strategy. No alternative proposes the impairment of a park's soils or water.

Suppression: There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated less than 200° C for long duration can create hydrophobic layers. Hydrophobic soils reduce infiltration and concentrates flow, increasing erosion. Actions include direct fire suppression. There would be a beneficial or adverse, short-term to long-term, and negligible to major impacts from these actions. Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions include: construction of dozer line, hand line, containment lines, safety zones, heli-spots, drop points, staging areas, and road improvements. There would be adverse or beneficial, short-term to long-term, and negligible to major impacts. There may be some soil erosion from water, retardant, water-foam applications. Actions include water and retardant drops from fixed and rotary wing aircraft, water applications from engine pumping, and hand application. There would be a range of beneficial or adverse, short-term to intermediate-term impacts, and negligible to moderate impacts. There may be some native water depletion from pumping water from streams, lakes, impoundments, and groundwater sources. Dipping buckets, and pumping water from streams and aquifers can increase turbidity or scour fines from channels, diminishing water quality and quantity. There would be adverse, short-term to long-term, and negligible to major impacts.

There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the burn, increased flows from affect slopes would deliver increased nutrients and sediment after or

during the fire. There would be a range of beneficial or adverse, short-term to intermediate-term impacts, and negligible to major impacts. There may be some water quality degradation from increased sedimentation from increased use of roads and trails, construction of dozer line, hand line, containment lines, safety zones, heli-spots, drop points, staging areas, and road improvements. There would be a range of adverse, short-term to long-term, and negligible to major impacts.

There may be some water quality degradation from discharge of fire retardant or foam into the environment. For an action that includes air or ground based applications and incidental spillage of retardant and foam. There would be a range of adverse, short-term to long-term, and negligible to major impacts.

There may be some water quality degradation of Whiskeytown Lake and lower Clear Creek from chronic delivery of sediment, retardant and foam, and nutrients. Several suppression incidents within one fire season could result in adverse, short-term to long-term, and negligible to major impacts.

Prescribed Fire: Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions common to all alternatives include: fire ignition of burn piles, holding, and reconnaissance. There would be a range of beneficial or adverse, short-term to long-term, and negligible to moderate impacts from implementation of these actions. There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Actions common to all alternatives include ignition of burn piles. There would be a range of beneficial or adverse, short-term to long-term, and minor to major impacts from implementation of these actions.

There may be some water quality degradation from increased sedimentation from increased use of roads and trails and fire ignition, and reconnaissance. There would be a range of beneficial or adverse, short-term to long-term, and negligible to moderate impacts. There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the pile burns, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short-term, and negligible to moderate impacts from implementation of these actions.

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Action includes repetitive use of burn pile locations. There would be adverse, short-term to long-term, and minor to major impacts from implementation of this action.

Mechanical Treatment Level 1: Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions include: fuel reduction, pile burning, and area reconnaissance, install and maintain shaded fuel breaks, and rehabilitate pile burn rings and trails. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Actions include pile burning. There would be a beneficial or adverse, short-term to long-term, and negligible to moderate impacts.

There may be some increased erosion from raindrop impact. Actions include vegetation removal and vegetation mulching due to increase of duff layer and decrease in vegetative cover. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts. There may be some water quality degradation from increased sedimentation from increased use of roads and trails to access the fire for suppression. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts. There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils at pile burn sites. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the burn, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated less than 200° C for long duration can create hydrophobic layers. Hydrophobic soils reduce infiltration and concentrates flow, increasing erosion. Actions include use of same burn pile areas, season after season. There would be a beneficial or adverse, short-term to long-term, and negligible to major impacts from these actions.

There may be some reduction of duff and vegetation cover as ground conditions convert to a more natural fire regime. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

Fire cache relocation and rebuilding park headquarter administrative building: There may be some additional soil compaction and erosion from increased heavy equipment, motorized vehicle, and foot traffic in already developed areas. Major ground disturbances such as excavation and grading would take place. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

There may be some water quality degradation from increased sedimentation as a result of increased cleared areas and concentration of flow. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

Alternative I

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative in context of soil and water quality.

Suppression: Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Prescribed fire impacts for Alternative I are described in the previous sections Impacts Common to All Alternatives for Soil and Water Quality, and also include broadcast burns, control line construction and rehabilitation, shaded fuel break maintenance, and construction of water bars.

There may be some soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions for this alternatives that increase compaction and erosion would include: broadcast burns and holding and reconnaissance of those burns, control line construction, shaded fuel break maintenance, construction of water bars, and rehabilitation of control lines. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts from implementation of these actions. There may be some physical and chemical alteration and decomposition of soil from heating. Soils heated over 200° C for short duration or soils heated for long duration can create hydrophobic layers. Actions include ignition of broadcast burns. There would be a range of beneficial or adverse, short-term to long-term, and minor to major impacts from implementation of these actions.

There may be some water quality degradation from increased sedimentation from increased use of roads and trails for broadcast burn ignition, holding, and reconnaissance of fire ignition, control line construction, shaded fuel break maintenance, construction of water bars, and rehabilitation of control lines. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts. There may be some water quality degradation by increased sedimentation and nutrient delivery from erosion of burned and hydrophobic soils. Decreased soil infiltration and removal of cover (duff and vegetation) increase rain drop impact velocity and concentrate flow. As a result of the broadcast burns, increased flows from affect slopes would deliver increased nutrients and sediment after or during the fire. There would be a range of beneficial or adverse, short-term, and negligible to major impacts from implementation of these actions.

There may be some soil and water quality alteration to a natural chemistry and composition as a result of more frequent, low temperature fires. There would be beneficial, long-term, major impact from this condition.

Mechanical Treatment Level 1: Mechanical treatment level 1 impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Alternative II

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality.

Suppression: Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality and Alternative I.

Prescribed Fire: Prescribed fire impacts for Alternative II are described in the previous sections Impacts Common to All Alternatives for Soil and Water Quality and Alternative I, but would not include construction of water bars and construction and rehabilitation of control lines.

Mechanical Treatment Level 1: Mechanical Treatment Level 1 impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Alternative III

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality.

Suppression: Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Prescribed Fire: Prescribed fire impacts for Alternative III are described in the previous sections, Impacts Common to All Alternatives for Soil and Water Quality and Alternative I, and includes construction of shaded fuel breaks, but not construction of water bars or shaded fuel break maintenance.

Soil compaction and erosion from increased motorized vehicle and foot traffic in developed and undeveloped areas. Actions for this alternatives that increase compaction and erosion would include construction of shaded fuel breaks. There would be a range of beneficial or adverse, short-term to long-term, and negligible to moderate impacts from implementation of these actions.

Water quality degradation from increased sedimentation from increased use of roads and trails for construction of shaded fuel breaks. There would be a range of beneficial or adverse, short-term to long-term, and negligible to major impacts.

Mechanical Treatment Level 1: Mechanical Treatment Level 1 impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Mechanical Treatment Level 2: Soil compaction and erosion from increased motorized vehicles in developed and undeveloped areas with a slope less than 30 percent. Actions for this alternatives that increase compaction and erosion would include use of heavy equipment, tracked or wheeled, for brush-reduction. There would be a range of beneficial or adverse, short-term to long-term, and moderate to major impacts from implementation of this action.

There may be some water quality degradation from increased sedimentation from impact of heavy equipment on slopes less than 30 percent. There would be adverse, short-term to long-term, and negligible to major impacts.

There may be some soil and water quality alteration to a more natural chemistry and composition as a result of more frequent, low temperature fires. There would be beneficial, long-term, major impact from this condition.

Alternative IV

These impacts are discussed in terms of context, duration and intensity relative to the fire management actions common to each proposed alternative, and the impacts of those actions in context of soil and water quality and include all actions covered in the previous sections Impacts Common to All Alternatives for Soil and Water Quality and Alternative I.

Suppression: Suppression impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality.

Prescribed Fire: Prescribed fire impacts for Alternative IV are described in the previous sections Impacts Common to All Alternatives for Soil and Water Quality and Alternative I, but would not include water bar construction and control line construction.

Mechanical Treatment Levels 1 and 2: Mechanical treatment level 1 impacts are discussed in preceding section Impacts Common to All Alternatives for Soil and Water Quality. For mechanical treatment level 2, the impacts discussed in the preceding section Alternative III would be the same as for Alternative IV.

Mechanical Treatment Level 3: There may be some soil compaction and erosion from increased motorized vehicles in developed and undeveloped areas. Actions for this alternatives that increase compaction and erosion would include use of equipment for brush and small

tree removal. There would be a range of beneficial or adverse, short-term to long-term, and moderate to major impacts from implementation of this action.

There may be some water quality degradation from increased sedimentation from impact of heavy equipment. There would be adverse, short-term to long-term, and moderate to major impacts.

There may be some soil and water quality alteration to a more natural chemistry and composition as a result of more frequent, low temperature fires. There would be beneficial and adverse, long-term, moderate to major impact from this condition.

Wetlands and Floodplains

Whiskeytown has some scattered mineral springs located at lower elevations in the park and in active floodplain areas along riparian corridors. Impacts associated with these types of landforms and habitats are discussed in the vegetation and water quality sections above (see Riparian Community for floodplains) and in the Areas of Special Designation (for mineral springs).

Air Quality

Impacts and Issues Common to all Alternatives

Smoke is an inevitable by-product of a fire-evolved ecosystem. Smoke would be produced from wildland fires occurring during the drier fire season months and from prescribed burning accomplished during periods with lower potential loss levels. Smoke emissions from unwanted wildland fires would continue to occur at some level every year under all alternatives. Some alternatives allow more control over when and where fires, and hence when smoke events, occur. All individual prescribed fire projects under all alternatives are subject to approval at the time of implementation by the Shasta County Air Pollution Control District. The park must abide by the laws and regulations of California--and no alternatives proposed in this document includes impairment of park air quality. Prescribed burning would be accomplished only when permitted by the responsible local or state level regulatory agency. Generally, the effects of prescribed burning have a short duration of no more than 3 to 5 days. Wildfires similar to those in 1999 could affect the park for several weeks. Smoke behavior, and corresponding impacts, is a complex issue involving a number of dynamic elements:

1. The amount and type of fuel that would burn. Restoration areas have the highest fuel loading. Much of the fuel load in those areas (up to 50%) consists of 100 years of accumulated duff, which burns mostly in the smoldering phase and produces more particulates than an equivalent number of tons burning in the flaming phase. Maintenance areas have less fuel overall and much less duff (less than 25% total fuel load) per acre than restoration burns. A higher percentage of fuels burn in the flaming phase resulting in a significantly lower rate of emissions.

2. The type of fire situation and controllability. Prescribed burn operations are the most controllable and predictable of all fire events. Generally, large unwanted suppression fires are the most uncontrollable and least predictable.

3. The time of year smoke is produced. Fall and early winter generally have climatic conditions least favorable to smoke dispersion, while spring and summer generally have better conditions for dispersing smoke. Even though this is generally the case, some successful prescribed burning has taken place during fall and winter.

4. The exact behavior of the smoke plume, including the direction and elevation that the smoke plume moves, and resulting concentrations at ground level. The behavior of the plume is highly dependent on elevation and dynamic meteorological conditions occurring at the time of the fire event. Generally, the higher the elevation of the burn, the greater the mixing volume of air to dilute it. Higher elevation winds also tend to better dilute and disperse smoke at lower concentrations. High level winds may transport dispersed smoke particles large distances. Complex geography and weather patterns complicate the ability to exactly predict the quantity and destination of smoke particles in the plume.

5. The interaction of smoke from park fires with pollution sources in the Sacramento valley (including other fires in the area). During fire season, there is the potential for significant amounts of smoke from fires on USDA Forest Service, Bureau of Land Management, and state lands, as well as mobile and stationary sources of pollutants, including the Knauf Fiberglass plant and other manufacturing sites and ozone produced during the hot summer days.

6. The ability to effectively model all variables in a dynamic environment. As with most meteorological forecasting, the best and most

accurate information is available close to the time of interest. While long-term climactic models are valuable in advance fire program planning, it is the conditions that exist at the time of the actual fire event that are the best indicators of potential smoke impacts. As individual fire events occur under constantly changing environmental conditions, and many occur randomly through space and time, sophisticated air quality modeling beyond the scope of this environmental impact statement and current technology would be needed in order to determine whether the estimated increases in smoke emissions proposed in these alternatives would cause actual exceedances of annual and 24 hour National Ambient Air Quality Standards within the Sacramento valley air basin at any point in time. In lieu of such modeling, complying with burn/no burn day designations issued by the District, and by using the best available meteorology and forecasting at the time of ignition are techniques that would be used to manage local and regional smoke effects and maintain emissions within the NAAQS under all alternatives. The District provides significant input into park decisions as individual projects are proposed for implementation. Modeling and forecasting meteorological conditions related to smoke dispersion and assessing potential impacts on regional conditions assist the park in determining whether to proceed with ignition.

7. Dense smoke would likely occur in the vicinity closest to fire operations. Unhealthful concentrations of smoke would be most likely to affect fire personnel immediately adjacent to the fire. Most smoke plumes from fire operations would disperse at middle to upper elevations (6,000 to 12,000 feet) into remote, low population areas and, occasionally, into more heavily populated areas of the Sacramento valley.

Criteria Pollutants: The most significant air quality issue that interacts with the proposed actions is the designation of the Sacramento valley air basin as a non-attainment area for two criteria pollutants [ozone and PM10 (particulate matter less than ten microns)] as defined by the Federal Clean Air Act and California Clean Air Acts. Both ozone and PM10 pose public health and safety concerns, though ozone in particular is also a pollutant with significant ecological consequences. Carbon dioxide is also a criteria pollutant that must be considered due to its importance and impact in the global warming issue. Of the air quality related values to be considered in this document, the production and management of PM10 is the most significant. PM10 is the pollutant of primary concern in relation to the actions proposed in this document, although PM2.5 (particulate matter lass then 2.5 microns) is just as important as a pollutant because of the health effects of smaller size particles remaining in a person's lungs and the respiratory illnesses related to this situation. The Shasta County Air Pollution Control District (hereinafter referred to as the District) has written an Attainment Plan to address the health effects of ozone and PM10. The plan primarily addresses measures to reduce ozone levels in order to meet established deadlines set for complying with National and California Ambient Air Quality Standards (N&CAAQS), although the rules on prescribed burning have also been revised. Smoke Management Plans are now required well in advance of a prescribed burn to assist the District in determining who would be allowed to burn on a particular day. The park is encouraged to work with the state and federal agencies that conduct prescribed burning within the air basin. Smoke management requirements are dynamic and require considerable consultation with the District prior to and during implementation.

Since wildland fires may contribute significant levels of PM10, an analysis of each alternative was undertaken to assess the PM10 emissions, as well as other by-products of the forest fire process, generated under each as a way to compare to current program emissions.

Smoke Emissions Estimates: In order to quantify the smoke emissions that are predicted to result from each of the alternatives considered in the fire management plan, a computer software model, the First Order Fire Effects Model 5.0 (FOFEM) was utilized to generate emission factors for PM10, PM2.5, VOC (as CH_4), CO, and CO_2. FOFEM is a computer-based planning tool that is used to provide quantitative predictions for planning prescribed fire, for impact assessment, and for long-range planning and policy development (Reinhardt et al.). FOFEM provides quantitative fire effects information for tree mortality, fuel consumption, mineral soil exposure, and smoke. The smoke module of FOFEM models emissions production, but not dispersion or visibility. The smoke module requires a number of inputs related to the burn characteristics, including fuel category, cover type, fuel loading, moisture content, percent of crown burn, and others. To arrive at the best possible estimates, park-specific fuel load data was utilized where it was available. The resulting emission estimates were used to draw comparisons between alternatives.

The area of each fire management plan cover type in a given prescribed burn unit was determined using Geographic Information Systems (GIS) data. This was accomplished by intersecting two GIS data sets: the prescribed burn unit areas and plant communities. The plant communities were then correlated with the parks' fire effects monitoring types and the Society of American Foresters (SAF) and Society for Range Management (SRM) cover types available in FOFEM. In some cases, direct correlation between cover types was not possible and a surrogate SAF/SRM cover type was selected. For example, Pacific Ponderosa Pine was used to model both the park's Ponderosa Pine and Mixed Conifer forests. The table below provides a cross-reference for cover types. Not all cover types occurred within all burn units. The most prevalent monitoring/ cover types are Mixed Conifer, Mixed Oak Woodland, Knobcone Pine, and Chaparral.

Whiskeytown is in the process of developing a vegetation and fuels map which would provide a much higher level of accuracy and detail with regard to the park's vegetation cover types and fuel models. Until this project is completed, the park must rely on older data and data which has not been ground-truthed for accuracy.

To best represent fuel loads, information used in the model was based on the default values for each vegetative cover type used in FOFEM and data collected from park-wide fire effects monitoring plots. Due to the heavy fuel loadings at Whiskeytown, fuel loading data from standard fuel model descriptors were occasionally used if it more accurately reflected the characteristics of a particular vegetation type.

For a given prescribed burn unit and pollutant, the emissions were quantified by the following equation:

$E = \sum_{c=1}^{n} EF_c * A_c$, where
E = emissions, tons/year
EF_c = emissions factor for coverage c, ton/acre
A_c = area of coverage c, acres

Average emission factors for all prescribed burns were calculated from the FOFEM predictions in order to facilitate comparison of alternatives. Separate FOFEM runs were used to develop emission factors for unwanted wildfire since it can be expected to typically burn under drier conditions and consume more fuel, particularly crown and branch fuels, and therefore, result in higher emissions. In order to develop average wildfire emission factors, representative burn parameters for unwanted wildfire were provided by park staff for the four predominant cover types: mixed conifer, mixed oak woodland, knobcone pine, and chaparral.

The alternatives in this document are structured around several primary fire management strategies (suppression, prescribed fire, and mechanical treatments). Park staff estimated the number of acres to be treated for each strategy under each alternative. The emissions estimates

Vegetation cover types for Whiskeytown National Recreation Area

Monitoring Type	Vegetation Description	SAF/SRM Type	SAF/SRM Description
N/A	Bare Rock	N/A	N/A
N/A	Water	N/A	N/A
QUKE (oak woodland)	Oak Woodland	246	California Black Oak
N/A	Blue Oak Grassland	201 (SRM)	Blue Oak Woodland
PIAT (knobcone pine)	Knobcone Pine	248	Knobcone Pine
N/A	Riparian	422 (SRM)	Riparian
PIPO (ponderosa pine)	Ponderosa Pine	245	Pacific Ponderosa Pine
PIPO	Mixed Coniferous Forest	245	Pacific Ponderosa Pine
N/A	Montane Chaparral	209 (SRM)	Montane Shrub land
ARVI (greenleaf manzanita)	Chaparral	207 (SRM)	Scrub Oak Mixed Chaparral

that follow in this section were generated for an eight-year period, the length of time that prescribed fire and mechanical treatment plans extend out in the fire management plan.

Both the prescribed and wildfire emission factors predicted by FOFEM are considerably higher than similar emission factors in EPA's Compilation of Air Pollution Emission Factors (AP-42) for the same region and the default values in California's Smoke Management Guidelines for Agricultural and Prescribe Burning which are used when applying for a burn permit from the Shasta County Air Pollution Control District. Both the AP-42 and California-derived emission factors are generalized for large regions and "can vary by as much as 50 percent with fuel and fire conditions." In addition, since fuel loadings in many areas of the park may be heavier than normal due to a history of fire suppression, the average emission factors used here can be considered more representative of the park. Finally, the FOFEM model does not provide emission factors for NOX.

According to the EPA AP-42 emission factors, the emission factors for NOX from wildfires and prescribe burning are approximately 35 times less than those for CO emissions. Therefore, the CO emission factors produced by the FOFEM model were scaled down proportionately to estimate NOX emission factors. The table below provides the emission factors used for each fire type. Prescribed fire would be expected to burn at low intensity and less crown consumption than wildfires.

In its present configuration, FOFEM 5.0 does not exactly duplicate the consumption measured in the field by fire effects plots. However, the model does have the benefit of using algorithms that approximate the relationship between fuels that are burned in the flaming and smoldering phases. Modeling consumption using the two phases is important because significantly more smoke is produced in the smoldering phase than in the flaming phase given the same quantity of fuel burned.

Composite Emission Factor Summary (Based on relative acreage)

	Emission Factors (tons / acre)					
Fire Type	PM^{10}	$PM^{2.5}$	VOC	CO	N_{ox}	CO^2
Prescribed	0.29	0.25	0.15	2.83	0.08	28.63
Wildfire	0.34	0.29	0.16	3.47	0.10	35.12

Average emission factors were also developed for each vegetation/monitoring type (based on GIS data) from FOFEM. The number of acres estimated to be burned for each treatment type under each alternative were then multiplied by the emission factor to estimate the tons of emissions produced. Comparison of the alternatives is based on a listing of tentative burn unit projects and associated number of acres to be treated by prescribed burning for the years 2002-2008.

Burn unit locations and schedules for each Alternative were developed by the park and prioritized based on park fire and resource management goals and objectives as well as the Wildland Urban Interface Plan that has been developed. In this way, the park would be able to treat areas of the park that are considered to be most at risk from unwanted fire and associated urban interface protection and achieve ecosystem restoration objectives as well. Large burn units may be burned in sections over the course of several years when unfavorable burning conditions and air quality concerns would prevent the entire unit from being treated in one calendar year or when a portion of the burn unit must be avoided due to other considerations, such as cultural and natural resource values or other management concerns.

Each of the alternatives is compared using the historical average (1971-2001) for wildfire of 142 acres burned per year, including both lightning ignitions and human-caused ignitions, and 671 acres (1993-2001) of prescribed burning (which included pile burning). It should be noted that the predicted future emissions for Alternative I are based on an average of 1400 acres per year, as this is the annual goal in the park's current fire management program. The historical average is less due to the inability to burn as many acres as desired each year. This was due to a variety of reasons, including a National Park Service-imposed moratorium in 2000, extreme wildfire seasons in 1996 and 1999, and unfavorable environmental conditions in other years. In total, approximately 14,000 acres of park land have been specifically targeted for prescribed burning under the fire management plan. The table below summarizes the average annual emissions from various fire types that are estimated to have occurred within the park over the period referenced above.

Air emissions from burn treatments would diminish over time with a return to regular fire return intervals since fuel loading and fuel

consumption would decline as the ecosystem is restored. As the park is returned to a more ecologically natural state and heavy fuel loadings are reduced, it is expected that unwanted wildfires would also occur less frequently and burn less intensely in the long-term. It is unlikely that this would occur in the period for which the revised fire management plan will cover, however.

Emissions estimates were also made for pile burning operations. Although the prescribed burning emissions totals include pile burning emissions, piles would be burned at times of the year when prescribed burns would not be conducted, so the pile burning emissions would be spread out over a longer period of time than prescribed burn emissions would be. The table below summarizes both the emission factors for pile burning and the predicted average annual emissions for each alternative.

Type of Impact

Impacts were considered to be *beneficial* or *adverse* to air quality. *Beneficial* air quality impacts would reduce emissions or lower pollutant concentrations, while *adverse* impacts would increase emissions or raise pollutant concentrations.

Duration

The duration of the impact was considered to be *short-term* or *long-term* in nature. *Short- term* impacts (3-5 days) would be associated with specific fire events, while *long-term* impacts would occur at the time that the park achieves a natural background.

Intensity

The intensity of an impact considers whether the impact is judged to be *negligible, minor, moderate,* or *major* relative to the No Action Alternative I. For this analysis, the impact would be the percent increase or decrease in air emissions between the Alternatives in relation to the No Action alternative.

Negligible: 0 to 5 percent change in air emissions.

Minor: 5 to 20 percent change in air emissions.

Moderate: 21 to 50 percent change in air emissions.

Major: >50 percent change in air emissions.

Alternative I

Smoke from wildfires and prescribed burning is a complex mixture of carbon, tars, liquids, and

Historical Average Annual Fire Emissions for Various Fire Types in Whiskeytown

Fire Type	ACRES	PM_{10}	$PM_{2.5}$	VOC[3]	CO	NOx	CO_2
Prescribed Burns[1]	671	207	178	107	2020	58	20899
Wildfire[2]	142	48	40	23	491	14	4973
Total	813	255	218	131	2511	72	25872

[1]Average for 1993 -2001 (includes pile burning); [2]Average for 1971-2001; [3]As Methane

Emission Factors and Predicted Air Emissions Associated with Pile Burning for Various Alternatives

		PM_{10}	$PM_{2.5}$	CH_4	CO	CO_2
Pile Burning Emission Factors	(lb/acre)	437	370	206	4240	60340
	(tons/acre)	0.22	0.19	0.10	2.12	30.17

Pile Burning - Predicted Average Annual Emissions (tons/yr)

Basis	Acres	PM_{10}	$PM_{2.5}$	CH_4	CO	CO_2
Historical	56	12	10	6	119	1690
Alt 1 Pile	112	24	21	12	237	3379
Alt 2 Pile	300	66	56	31	636	9051
Alt 3 Pile	22	5	4	2	47	664
Alt 4 Pile	320	70	59	33	678	9654

gases. The major pollutants are particulate matter (PM), volatile organic compounds (VOCs), carbon monoxide (CO) and carbon dioxide (CO2). Nitrogen oxides (NOX) also is produced but in a relatively small quantity compared to the other pollutants. The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in an eight-year period 2002 to 2008 based on park burning plans and historical records, respectively.

No significant changes would occur to the current annual fire program. PM10 emissions would not significantly change in the short-term. Occasional large, unwanted fire events would continue to affect local communities and regional air quality several times each decade. Proactive fuels management would decrease smoke events in some areas of the park over time. Over the long-term, fire fuels would accumulate in untreated areas of the park resulting in larger, less predictable unwanted fire events.

Generally, Alternative I would continue the practices of recent years, which would not meet the park's natural resources management objective of returning the park to its natural background. The impacts of catastrophic wildfires consuming areas of high fuel loadings on air quality would be adverse, short-term and major.

Due to the fact that the timing and location of prescribed fire can minimize smoke impacts, the impacts of prescribed fire smoke events would be adverse to beneficial, short-term and negligible.

Mechanical treatment activities that are currently being employed would continue under this Alternative. Most hand-thinning activities involving the use of chain saws would have negligible to minor, short-term and adverse effects upon air quality. Piles of fuels would have the potential to affect air quality, but generally piles are burned in the winter and spring months when there are very few other smoke events occurring simultaneously, thus limiting the amount smoke production. Pile burning would generally be limited to low-intensity, localized impacts, minimizing impacts to visitors and the local communities. Because the piles would be burned under atmospheric conditions specified by the county, the smoke effects would generally be localized. Impacts would be adverse, short-term and negligible.

Chipping would produce minimal levels of emissions. Noise from the chipper would be the greater effect upon visitors. There would be no need to move to another location to avoid the emissions. Effects would be adverse, short-term and negligible.

Under Alternative I, there would be no irreversible and irretrievable commitments to resource.

There are mitigation measures and a management commitment to mitigate the adverse effects of smoke and other emissions on air quality and visibility associated with prescribed burns. Together with overall priority considerations, such as fire fighter and public safety, suppression actions are managed also to mitigate unacceptable air quality and smoke impacts. Various management techniques can be applied to reduce air emissions produced by prescribed and wildland burning. These reductions come almost exclusively by reducing

Predicted Air Emissions (in tons) Associated with Various Fire Types in Whiskeytown National Recreation Area for Alternative I

Fire Type	ACRES	PM_{10}	$PM_{2.5}$	VOC[1]	CO	NO_x	CO_2
Prescribed Burns[1]	1400	431.6	369.5	223.8	4205.4	120.2	43463.3
Wildfire (Best Case)[2]	1	47.7	40.4	23.2	491.1	14.0	4972.7
Wildfire (Worst Case)[3]	2349	791.6	670.3	385.3	8146.7	232.8	82492.6
Total	1401	479.3	409.9	247.0	4696.5	134.2	48436.0

[1] As Methane

[2]Based on smallest number of acres in historical fire database

[3]Based on largest number of acres in historical fire database

the area burned, the fuel loading, or fuel consumption.

Whiskeytown fire management staff coordinates prescribed burning plans with fire management staff from other National Parks, National Forests, BLM Units, and State Agencies. The goal of this group is to assure that planned ignitions on federal and state lands in the Sacramento Valley and its environs do not adversely impact smoke sensitive areas in and around the burn area. Prior to each planned burn, the park must obtain a permit from the appropriate County level Air Quality Management District and must obtain meteorological approval to burn from the California Air Resources Board. It is the responsibility of these air quality regulatory agencies to coordinate the numbers of fires burning in a specific region.

Cumulative Impacts: There are other actions in the immediate area and the Sacramento Valley that could have cumulative impacts when viewed in the context of this document. These include simultaneous wildfire and prescribed fire events, agricultural burning, dirt road traffic, and mobile and stationary sources that could result in adverse, long-term and major impacts.

Alternative II

Air emissions associated with the estimated burning actions for Alternative II for the years 2002-2008 were estimated using the FOFEM model, and the results are summarized and compared to Alternative I in the table below. Due to the fact that so few acres have been treated historically and most everything likely to be burned would be treated for the first time (two units are scheduled to be re-burned in this plan), it would take longer for the park to achieve the lighter fuel loadings needed to attain its natural background state. It would take a longer period for the park to attain its resource management objectives related to desired stand structure and density and for the park to attain a natural background state.

The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in the eight-year period 2002 to 2008 based on park burning plans and historical records, respectively, for Alternative II compared with Alternative I.

Under this alternative, there would be short-term, unavoidable adverse impacts to air quality due to the increased use of prescribed burning. As the park attains its natural background state over time, however, fuel loadings would be reduced. Because this alternative's prescribed burn schedule is focused primarily on the western, northern, and eastern portions of the park, it is unlikely that this alternative would meet the park's natural resources management objective of returning the park to its natural background. Much of the park would still be susceptible to unwanted wildland fire events. The impacts of catastrophic wildfires consuming areas of high fuel loadings on air quality would be adverse, short-term and major. Due to the exclusive use of prescribed fire in this alternative and the subsequent ability to select the timing and location of most fire events, the impacts of prescribed fire smoke events could be minimized. PM10 emissions would not significantly change in the short-term, as the primary difference between this alternative and No Action is the increased number of acres treated with prescribed fire. Occasional large, unwanted fire events would continue to affect local communities and regional air quality several times each decade. The duration and intensity of smoke from large unwanted fire events would decrease over time as heavy fuel concentrations were systematically reduced across the parks.

The increase in prescribed burning would result in additional short-term impacts from smoke generated by more burning. Due to the fact that the timing and location of prescribed fires, and that they would be ignited only under certain atmospheric conditions, would be controlled, the impacts of prescribed fire smoke events would be minimized and be adverse to beneficial, short-term and major.

The impacts from chain saw use and chipping would decrease under this alternative as a result of narrower fire lines and fuel breaks. Boundaries for prescribed burn units would be installed both as fire lines and fuel breaks, so there would be a combination of both narrow and wide clearings on the ridges and roads serving as burn unit boundaries.

The impacts from mechanical treatment activities are the same as those discussed in Alternative I.

Under Alternative II, there would be no irreversible and irretrievable commitments to resources.

There are mitigation measures and a management commitment to mitigate the adverse effects of smoke and other air emissions on air quality and visibility associated with

prescribed burns. Together with overall priority considerations, such as fire fighter and public safety, suppression actions are managed also to mitigate unacceptable air quality and smoke impacts. Various management techniques can be applied to reduce air emissions produced by prescribed and wildland burning. These reductions come almost exclusively by reducing the area burned, the fuel loading, or fuel consumption. Historically, suppressing wildfires often only delays the generation of emissions rather than reducing or eliminating them.

Methods to reduce emissions by reducing the area burned include mechanical treatments and concentration burning. Mechanical treatment may include removal of standing or downed trees and onsite chipping or pile burning. However, it is labor intensive and chipping requires road access that is frequently not available in remote areas. In addition, it may interfere with land management objectives if such treatment causes undue soil disturbance, stimulates alien vegetation invasion, impairs water quality, or removes material needed for nutrient cycling or small animal habitat. Concentration burning involves burning a subset of a larger area to be treated. Although this decreases the total area burned, the subset area burned would represent a high fuel loading with associated higher emissions.

Techniques to reduce fuel loading includes mechanical fuel removal, burning more frequently, and scheduling burns prior to the appearance of new fuels. Mechanical fuel removal is the same as that described above, but a prescribed burn follows it. Frequent, low-intensity fires can prevent unwanted vegetation from becoming established on the forest floor. This technique has positive land management effects since it may result in fire regimes that more closely mimic natural fire frequencies. Burning before new fuels appear may also reduce fuel loading. Examples include burning before vegetation drops its leaves in the fall and burning before brushy or herbaceous fuel greens up.

Emission reductions also can be achieved when significant amounts of fuel are at or above the moisture of extinction and therefore unavailable for combustion. Long-term emission reductions, rather than the postponement of emissions generation, are achieved only if the fuels that are left behind can be expected to decompose or otherwise be sequestered at the time of subsequent burning in the area. Increasing combustion efficiency or shifting the majority of combustion away from the smoldering phase and into the more efficient flaming phase can reduce emissions. Methods to accomplish this include pile or windrow burning, rapid mop-up, appropriate ignition techniques and shortened fire duration. Pile or windrow burning generates more heat and burns more efficiently. It is effective for forest fuel types rather than brush type fuels. However, it can have adverse effects on soils and water quality since high temperature extremes can cause soil sterilization.

The mitigation measures discussed above are intended to be fire prescription elements to minimize or avoid impacts on sensitive receptors that are identified in the discussion of the Affected Environment. Additional measures that are adopted include the avoidance of conducting burns during heavy visitor use periods and the coordination with other regional agencies that also conduct burns and regulatory authorities.

Agency coordination concerns and impacts for Alternative II is the same as Alternative I.

Cumulative impacts for Alternative II are the same as those discussed in Alternative I.

Alternative III

Average annual air emissions associated with the predicted burning actions for Alternative III for the years 2002-2008 were estimated using the FOFEM model, and the results are summarized and compared to Alternative I in the table below. With minimal prescribed burning included in this alternative, it would take longer for the park to attain its natural resource management objectives related to desired stand structure and density and for the park to attain a natural background state. The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in the eight-year period 2002-2008 based on park burning plans and historical records, respectively, compared with the No Action alternative.

Under this alternative, there would be short-term, beneficial impacts to air quality due to the increase in shaded fuel breaks and the accompanying pile burning and the continued threat of catastrophic wildfire. As the park attains its natural background state over time, fire loadings would be reduced and the need to conduct prescribed fires also would be decreased. Adverse impacts on air quality would decrease as well.

Mechanical treatment impacts would be the same as Alternatives I and II except for the use

of brush clearing machinery, which would be used in areas with vehicle access. Air quality impacts from this type of machinery would be negligible to minor, short-term and beneficial. Under this alternative, no appreciable irreversible or irretrievable commitments of resources would be associated with air quality. Mitigation measures for Alternative III are the same as those for Alternative II.

Agency coordination concerns and impacts for Alternative III is the same as Alternative I.

Cumulative impacts for Alternative III are the same as those for Alternative I.

Alternative IV

Average annual air emissions associated with the predicted burning actions for Alternative IV were estimated using the FOFEM model, and the results are summarized and compared to Alternative I. With this alternative containing increased prescribed burning (compared to No Action) and mechanical treatment Level III, this alternative would allow the park to accelerate the rate at which it would be able to meet its resource management objectives related to desired stand structure and density and for the park to attain a natural background state.

The table below summarizes the predicted annual tons of emissions from prescribed burning and wildfires that are estimated would occur in Alternative IV in the eight-year period 2002-2008 based on park burning plans and historical records, respectively, compared with the No Action Alternative.

Under this alternative, there would be short-term, unavoidable adverse impacts to air quality due to the increased use of prescribed burning. As the park attains its natural background state over time, fuel loadings would be reduced and the need to conduct prescribed fires also would be decreased. Adverse impacts on air quality would decrease as well. The use of natural fire in this alternative would reduce the ability to manage smoke impacts in comparison to Alternative II, but with the proactive management of prescribed fire, better control is effected over Alternatives I and III. Some large, unwanted fire events would occur each decade, with declining duration and intensity of associated smoke events over time as fuels are managed in a proactive manner and fuel loads are reduced across the park, although this would not occur during the life of this plan.

Under this alternative, no appreciable irreversible or irretrievable commitments of resources would be associated with air quality.

Mitigation measures for Alternative IV are the same as those for Alternative II.

Agency coordination concerns and impacts for Alternative IV is the same as Alternative I.

Cumulative impacts for Alternative IV are the same as those for Alternative I.

Conclusion: None of the alternatives would create impairment of the Class 2 airshed values. When properly managed, most of the alternatives would not result in exceedances of the NAAQS for criteria pollutants. In considering the impacts of the PM10 produced by the various alternatives, both the gross amount of emissions along with the ability to manage the emissions under each alternative are important considerations. Alternatives that allow high levels of control over timing and placement of ignitions (e.g., Alternatives I, II, and III) have less impact on air quality than alternatives that produce particulates on a random basis with less opportunity for management control (Alternative IV). Pile burning related to fuel break construction and prescribed burn unit boundaries would increase over the historical acreage in all alternatives but Alternative III. Long-term effectiveness of the alternatives must also be considered. Assuming that best available control measures are applied to all alternatives, and that they can be successfully managed to keep emissions within the NAAQS levels to protect public health, the alternatives that are likely to show decreasing fuel loads and trends of emission production over time should be favored over those that are likely to indicate an increasing rate of emissions due to a slower rate of fuel reduction.

Each alternative shows some long-term effectiveness in decreasing emissions over time, though it would be expected that Alternative III, with only modest accomplishments, would begin to rise again over a longer time span than assessed in this plan. Alternatives I and II, with their emphasis on prescribed fire and suppression and mechanical treatment Level 1, would most likely continue to show high levels of emissions for the short-term due to the inability to treat as many acres as are needed to return the park to its natural background state.

Alternative IV shows moderate increases in PM-10 emissions over the other alternatives, but also exercises a great amount of control over the timing and placement of fire events, with most restoration burning occurring under controlled prescribed fire events.

Areas of Special Consideration

Fire management activities and their associated environmental impacts are more limited in areas of special consideration due to both the rare or unique qualities and features of these sites, and the overlap of fire management activities in the areas. For example, rare plants sites are more frequently found in these areas as a result of either limited land use activities or remote access concerns. Also, mineral springs are thought to be less impacted by fire management activities due to their hydrologic nature. More data is needed for a complete understanding of the impacts for each of these areas.

Rare plant sites

Rare plant sites occur throughout the park and in every vegetation community. In addition to the impacts discussed above in the vegetation communities section, rare plants sites may be seen as ecological indicators of ecosystem health and response to fire management activities. More data is needed to understand the connection between rare plant sites and fire management activities.

Mineral Springs

No fire management activities would occur in mineral spring areas. For the most part, these springs occur in lower elevation areas and are strong magnets for wildlife. Also, many rare plants occur in these areas, including Puccinellia howellii, or Howell's alkali grass—the plant species in Northern California closest to extinction according to the US Fish and Wildlife Service (Smith 2002).

Old Growth Forests

Impacts to old growth forests are discussed in the vegetation communities section (see mixed conifer and ponderosa pine communities). As a general overview, under Alternative I, the park would consider conducting limited prescribed fires in some old growth stands. Under Alternative II lower intensity impacts to old growth would be more limited, however, fire frequency and intensity is expected to increase, posing a greater risk over time. Alternative III's emphasis on increased prescribed fire would have a beneficial impact on old growth, with the caveat that a vegetation community's response to management ignited fire is thought to be different than that of naturally ignited fire. Though Alternative IV does include increased levels of mechanical treatment, the park's old growth stands would not be considered appropriate locations for levels 2 and 3 mechanical treatment of fuels , primarily due to soil compaction and erosion problems of heavy equipment on decomposed granitic soils. Some sensitive wildlife species are found in old growth areas, including: northern spotted owl, tailed frogs, and pacific fishers. Although research indicated that pacific fishers favor old growth forests, at Whiskeytown they are more frequently observed where people are, generally in lower elevations along the lake and creeks. There have been no formal studies measure abundance and distribution of pacific fishers in Whiskeytown.

The Top of Shasta Bally

For a review of the impacts to the top of Shasta Bally, please review the impacts to the chaparral community discussed earlier in this chapter. In this area of exposed rock and montane chaparral there are numerous rare plants, and very little hazardous fuels. This area, along with other chaparral communities, is a fire adapted community. Wildland fire is expected to be most prominent in this area, due to the high incidences of lighting strikes and the expected elevation creep of fires started below the summit. As a generalized statement, fire in this area is expected to stimulate biodiversity. Despite these benefits, suppression activities would be considered an appropriate response, especially around the antennae farm leased area. Fox sparrows are common in this part of the park.

Riparian Habitats

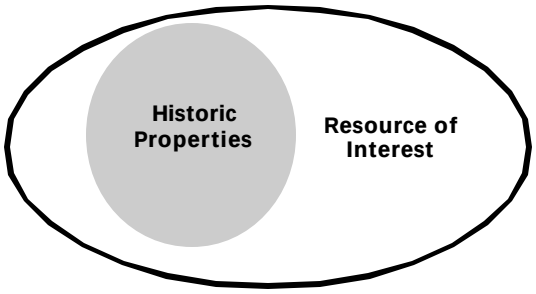
For a review of the impacts to the park's riparian habitats, please review the impacts to the riparian vegetation community discussed earlier in this chapter. Some wildlife of concern that occur in riparian habitats include the western pond turtle, the foothill yellow legged frog, and the tailed frog. Impacts to these resources are also discussed earlier in this chapter under Wildlife.

CULTURAL ENVIRONMENT AND SPECIAL DESIGNATIONS

Fire management actions such as prescribed fire, suppression, and mechanical treatments have the potential to impact cultural resources such as archeological sites, structures, ethnographic resources, and cultural landscapes. Museum objects can also be threatened by such actions, both the physical well being of the objects themselves, and the ability to properly catalog and process those objects.

Section 106 of the National Historic Preservation Act requires Federal agencies to consider the impacts of its actions on properties listed in, or eligible for inclusion in, the National Register of Historic Places (i.e., Historic Properties), and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment. Proper management of museum objects is dictated by 36 CFR 79. Presently the agencies comprising the U.S. Department of the Interior, including the National Park Service, and the U.S. Department of Agriculture are developing a nationwide Programmatic Agreement with each states' respective Historic Preservation Office, the National Council of State Historic Preservation Offices, and Advisory Council on Historic Preservation. This document would follow procedures outlined in 36 CFR 800.14(b) of Section 106 of the National Historic Preservation Act. Among the core elements of the Programmatic Agreement include professional qualifications, standard protocols for cultural resources compliance for fire management actions, Indian Tribe and public participation, agency review procedures, and inadvertent impacts. The benefit of Programmatic Agreement would be greatly expedited Section 106 compliance review for fire management actions, as well as the establishment of standard protocols for most effectively identifying, evaluating and protecting cultural resources during planned and unplanned fire management actions.

Relationship between Historic Properties and Resources of Interest



Terms found in Section 106 of the National Historic Preservation Act are used to describe cultural resource significance and impacts in this section. However, it is important to distinguish Historic Properties (as defined above) from resources of interest, which are those classes of resources that have some potential to be important, and have the potential to be impaired by the fire management action. While Historic Properties are de facto resources of interest, these might also include sites, features, structures or other phenomenon that do not meet National Register of Historic Places criteria of significance, the minimum age requirement, and/or possesses sufficient integrity, but contribute somehow to our understanding of prehistory, history, or traditional lifeways, and could be compromised (Figure 1. Relationship between Historic Properties and Resources of Interest.). Each resource of interest is comprised of a set of attributes, called significant characteristics, which lend importance to that resource. An example of a resource of interest at Whiskeytown are small, sparse flaked stone lithic scatters. Such resources typically have low data potential and diminished integrity due to historic land-use practices, and would generally not qualify as Historic Properties. However, when one considers that much of the Native American archeological resources found at Whiskeytown were heavily impacted during the construction of the reservoir, small, sparse flaked stone lithic scatters command greater importance as sources of information understanding Native American lifeways in the middle reaches of the Clear Creek watershed. As such, these sites deserve consideration when threatened by impacts from fire management actions.

Methodology

NEPA recognizes three types of impacts—direct, indirect, and cumulative. Direct impacts are those that are caused at the same time and place as the action, indirect impacts occur later in time and at a distance, while cumulative impacts are additive. In regard to cultural resources, direct, operational and indirect effect categories are utilized. Direct impacts are those where the fire itself is the cause of the impacts, operational impacts occur as a result of associated operations like line construction or staging, while indirect impacts are ones where fire and/or associated operations result in changes to local context such that cultural resources would be effected. As such, direct and operational impacts for cultural resources are the equivalent of direct impacts under NEPA, while indirect

impacts on cultural resources correspond to indirect and cumulative impacts.

One major impediment to cultural resources compliance related to fire management actions is a poor understanding of the nature of direct, operational and indirect impacts. In an effort to remedy this situation, Federal agencies sponsored the preparation of a volume of fire impacts on cultural resources to be published through the U.S. Forest Service "Rainbow Series" on fire impacts. This document has yet to appear, so a review of existing fire impacts knowledge is broadly summarized--with an emphasis on known direct fire impacts on those components that comprise the cultural resources of Whiskeytown (e.g., stone, bone, glass, metal, wood, vegetation), and operational and indirect impacts that could potentially occur as a result of the proposed fire management actions.

NEPA also dictates that potential impacts be considered in regard to type (adverse, beneficial) duration (short-term, long-term, permanent) and intensity. The Section 106 process considers only the adverse impacts upon cultural resources, not potentially beneficial ones. An ordinal scale of impact intensity (negligible, minor, moderate, major) is also foreign to the Section 106 process—impacts are either adverse (when the integrity of the historic property is diminished due to the undertaking) or they are not. Duration is not typically factored when assessing impacts during the Section 106 process. These issues are considered in greater detail below in relation to direct, operational and indirect impacts.

The following measures are employed to assess impacts of fire management actions on cultural resources. Further rationale for each measure is provided in discussions of direct, operational, and indirect impacts that follow.

Type of Impact

Adverse: Changes to the significant characteristics of a resource of interest. These changes may be perceptible and measurable, or, in the case of certain archeological and ethnographic resources, imperceptible and psychological.

Beneficial: Changes on or in the vicinity of a resource of interest such that the significant characteristics of the resource are protected against adverse impacts of fire management actions and/or restored to some desired condition.

Duration

Impact duration measurements change by the type of resource being analyzed.

Archeological Resources

Short-term-Adverse: Changes that result in permanent or temporary loss of data potential in the significant characteristics of a resource of interest, but do not manifest for a period of 10 or fewer years following the fire management action.

Short-term-Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 years.

Long-term-Adverse: Changes that result in a permanent or temporary loss of data potential in the significant characteristics of a resource of interest, and manifest in more than 10 years following the fire management action.

Long-term-Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 to 20 years.

Permanent-Adverse: Changes that result in permanent loss of data potential in the significant characteristics of a resource of interest, and manifest immediately following the fire management action.

Permanent-Beneficial: Changes that result in permanent protection to the significant characteristics of a resource of interest from fire management actions.

Structures

Short-term-Adverse: Changes that result in a permanent or temporary loss of data potential in a resource of interest, but do not manifest for a period of 10 or fewer years following the fire management action.

Short-term-Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 years.

Long-term-Adverse: Changes that result in a permanent or temporary loss of data potential in a resource of interest, and are manifest in more than 10 years following the fire management action.

Long-term-Beneficial: Changes that afford protection to the significant characteristics of a resource of interest from fire management actions for a period of no more than 10 to 20 years.

Permanent-Adverse: Changes that result in permanent loss of data potential in a resource of interest, and that are manifest immediately following the fire management action.

Permanent-Beneficial: Changes that result in permanent protection to the significant characteristics of a resource of interest from fire management actions.

Ethnographic Resources

Short-term-Adverse: Temporary changes in the significant characteristics of a resource of interest that do not disrupt the cultural traditions associated with that resource for a noticeable period. This period would vary by resource type and traditional practitioners.

Short-term-Beneficial: Temporary changes in the significant characteristics of a resource of interest that enhance or maintain cultural traditions for a period of no more than one year. For example, burning leaf litter in an oak grove to facilitate acorn collection.

Long-term-Adverse: Temporary changes in the significant characteristics of a resource of interest for a noticeable period. This period would vary by resource type and traditional practitioners.

Long-term-Beneficial: Temporary changes in the significant characteristics of a resource of interest that enhance or maintain cultural traditions for a period of one to 10 years. For example, clearing fuel from a spiritual site to prevent intense fire behavior.

Permanent-Adverse: Permanent changes in the significant characteristics of a resource of interest that result in a loss of cultural traditions associated with that resource.

Permanent-Beneficial: Permanent changes in the significant characteristics of a resource of interest that have the potential to enhance or maintain cultural traditions in perpetuity.

Cultural Landscapes

Short-term-Adverse: Temporary alteration of the significant characteristics of a resource of interest for a period lasting no more than 10 years. Short-term alterations would almost always involve living vegetation.

Short-term-Beneficial: Temporary protection, restoration, or maintenance of the significant characteristics of a resource of interest for a period lasting no more than 10 years.

Long-term-Adverse: Temporary alteration of the significant characteristics of a resource of interest for a period lasting more than 10 years. Short-term alterations would almost always involve living vegetation.

Long-term-Beneficial: Temporary protection, restoration, or maintenance of the significant characteristics of a resource of interest for a period lasting more than 10 years.

Permanent-Adverse: Permanent alteration of the significant characteristics of a resource of interest. Permanent alterations would often encompass both living vegetation and other landscape features.

Permanent-Beneficial: Permanent protection, restoration, or maintenance of the significant characteristics of a resource of interest.

Museum Objects

Short-term-Adverse: Backlogs in the processing of archival and spatial data that do not exceed one year.

Long-term-Adverse: Backlogs in the processing of archival and spatial data that range from one to five years.

Permanent: Backlogs in the processing of archival and spatial data that exceeds five years.

Intensity

In this analysis, intensity of impact is measured relative only to adverse resource impacts.

Archeological Resources

Negligible: No or barely perceptible and changes to the significant characteristics of a resource of interest.

Minor: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a minor percentage of the significant characteristics would be affected. Resources prone to impacts in this category might include archeological resources

containing a high percentage of resources of interest with low vulnerability to the impacts of fire management actions and/or possessing subsurface components.

Moderate: Perceptible and measurable changes to the significant characteristics of a resource of interest, but those changes do not inhibit interpretive potential and/or a moderate percentage of the significant characteristics would be affected. Resources prone to impacts in this category might include archeological sites containing a moderate percentage of resources of interest with low vulnerability to the impacts of fire management actions and/or possessing subsurface components.

Major: Perceptible changes to the significant characteristics of a resource of interest, and those changes inhibit interpretive potential of a major percentage of the significant characteristics. Resources prone to impacts in this category might include archeological sites containing a large percentage of resources of interest with high vulnerability to the impacts of fire management actions.

Structures

Negligible: Barely perceptible and not measurable changes confined to a single resource of interest or contributing element of a larger National Register district. Changes do not adversely effect significant characteristics.

Minor: Perceptible and measurable changes to a single resource of interest or contributing element of a larger National Register district. Changes do not adversely effect significant characteristics.

Moderate: Perceptible and measurable changes in the significant characteristics of a single resource of interest or small group of contributing elements in a larger National Register district.

Major: Perceptible and measurable changes of substantial magnitude in significant characteristics of a single resource of interest or large group of contributing elements in a National Register district.

Ethnographic Resources

Negligible: Barely perceptible and not measurable changes to a resource of interest.

Minor: Perceptible and measurable changes to a resource of interest. For example, an important oak grove burns during a wildland fire, but not at a time or intensity that impairs acorn production or collection.

Moderate: Perceptible and measurable changes in the significant characteristics of a resource of interest. For example, an important oak grove burns during the fall, consuming a high percentage of acorns and killing a couple of productive trees.

Major: Perceptible and measurable changes of substantial magnitude in significant characteristics of a resource of interest. For example, an important oak grove burns during a severe wildland fire, killing the vast majority of productive trees.

Cultural Landscapes

Negligible: Barely perceptible and not measurable changes to a resource of interest.

Minor: Perceptible and measurable minor changes to a resource of interest. For example, a severe wildland fire kills a highly visible concentration of noncontributing oak trees located on the boundary of a rural historic cultural landscape.

Moderate: Perceptible and measurable moderate changes in the significant characteristics of a resource of interest. For example, a fire crew cuts down several contributing fruit trees in a rural historic cultural landscape in preparation for a prescribed burn.

Major: Perceptible and measurable changes of substantial magnitude in significant characteristics of a resource of interest. For example, extreme fire behavior and aggressive suppression action destroys a large number of contributing elements within a rural historic cultural landscape.

Museum Objects: *Not applicable*

A summary of direct, operational and indirect impacts is presented below, followed by an explanation of the measures chosen for the types, duration and intensity of impacts listed above.

Direct, Operational and Indirect Impacts

Direct Impacts Cultural resources vary in terms of their susceptibility to direct fire impacts. For example, obsidian hydration rinds are generally impacted at temperatures in excess of 100 to 150° C, dimensional lumber ignites at 350° C,

glass melts at around 500° C, and cast iron at 1400° C. Duration of heating is less well understood, but in general, the longer a resource is exposed to heat, the greater the likelihood of damage. Fire can result in the complete elimination of an artifact or feature (e.g., through consumption) or can alter attributes of an artifact or feature such that important research (e.g., obsidian hydration rinds, residues on pottery, bone burning), traditional (e.g., Native American spiritual sites) or other values are impacted. Fires tend to burn in a complex manner depending on fuels, weather and terrain (Ryan and Noste 1985). Fire intensity is generally greater under conditions of heavier fuel (e.g., dead and down timber, brush fields), low fuel moisture, high air temperatures, high winds, low humidity and/or rugged terrain. It is the behavior of a fire (ground, surface, and crown) and proximity to a cultural resource that would determine the amount and type of damage that could occur. While running surface fires and crown fires reach extreme temperatures (500 to 1500° C) and have high energy release rates, relatively little of that heat is directed towards the surface of the ground, and ground fires can result in long duration heating (400 to 700° C) within the upper 15 cm of the soil profile. Only under rare conditions (e.g., burning tree roots) would elevated temperatures penetrate more deeply beneath the ground surface. Ground and creeping and active surface fires are usually associated with prescribed burns, whereas running surface and crown fires occur primarily during wildland fires. Very generally, cultural resources located above the ground surface (e.g., rock imagery panels, historical structures) are most vulnerable to direct fire impacts during crown and active surface fires, while ground and creeping surface fires threaten those found at or just below the ground surface (e.g., archeological sites).

Operational Impacts: Operational impacts to cultural resources are most likely to occur as a result of fire management actions association with prescribed burns, wildland fires and mechanical thinning. The operational impacts on cultural resources have been quantified in relatively few cases. However, several generalizations can be made: impacts resulting from the operation of heavy equipment on and in close proximity to cultural resources would correlate directly with the nature and extent of the disturbance, nature of local sediments, and nature and extent of cultural resources.

With the exception of those that result in more intense fire behavior (e.g., slash piles, firing techniques), impacts resulting from operational impacts would generally be restricted to the displacement, breakage and/or destruction and looting of cultural resources. In this sense, operational impacts tend to be less encompassing than direct impacts. For example, an obsidian projectile point displaced by construction of a fire line would probably retain its hydration rind, morphology, and other attributes.

Except in rare situations, operational impacts are likely to be most pronounced on cultural resources found on and near the ground surface.

Operational impacts would be most likely to occur, and at the greatest intensity, during wildland fires. This is due primarily to the fact that such actions are often carried out with little or no pre-planning and without consultation or supervision by a cultural resource specialist.

Indirect Impacts: Indirect impacts are perhaps the most elusive of all, since the impacts may be delayed and incremental. The potential for indirect impacts would relate strongly to the context in which a cultural resource is found, the nature of that resource, and the type and extent of the disturbance activity. In most cases, intense fire behavior and major suppression efforts associated with wildland fires would render cultural resources vulnerable to indirect impacts soon after the event. Indirect impacts may not be as pronounced following managed actions such as prescribed burns or mechanical thinning, but can, given enough time, have equally adverse consequences.

Type of Impacts

In general, direct impacts of fire management actions on cultural resources would be adverse. This is particularly true of archeological resources, structures, and museum objects. While direct fire impacts can also adversely impact ethnographic resources and cultural landscapes, fire can also be used to restore, enhance and maintain them. For example, in regard to ethnographic resources, some plants important for basket making benefit from the proper application of fire (Anderson 1999). In cultural landscapes with a vegetation component, fire can be applied to replicate and maintain historic scenes. Adverse direct impacts are more likely to occur during extreme fire behavior such as wildland fires, although cultural resources with high vulnerability to fire are susceptible to low intensity burns often associated with prescribed fire.

Operational impacts of fire management actions on cultural resources would, in most cases, be adverse. However, the degree of impact depends greatly on the nature of the operation and the cultural resource or resources in question. Adverse operational impacts are of particular concern during and after wildland fire events. With proper planning, operations can also be used for beneficial purposes. For example, mechanical thinning can effectively remove hazardous fuels from and in the vicinity of cultural resources, as well as restore, enhance or maintain ethnographic resources and cultural landscapes, in cases where the risk of direct impacts is too high. Finally, the indirect impacts of fire management actions generally adversely affect cultural resources, especially those that follow high intensity wildland fires.

Duration of Impacts

With respect to archeological resources, structures and cultural landscapes, short and long-term impacts related to fire management actions are distinguished based on the number of years (10 and 20, respectively) before impacts manifested following the action. These numbers were selected based on the assumption that some form of fire management action (prescribed fire, mechanical thinning) would be carried out within the same area within 10 years of the previous action (presuming about 3500 acres are treated each year, as estimated under the preferred alternative). As such, previously recorded resources would be revisited and pertinent attributes documented and/or preservation measures taken. Previously undocumented cultural resources might be recorded prior to the subsequent undertaking, and appropriate management actions implemented. Impacts of short and long-term duration differ from those of permanent duration, where significant characteristics of a resource of interest are irrevocably compromised during the action. Intervals utilized for ethnographic resources and museum objects are configured somewhat differently given variations in the use and nature of these resources.

The duration of direct, operational and indirect impacts on fire management actions is influenced strongly by the nature of the action and fire intensity. For example, a high intensity wildland fire would tend to result in more adverse permanent impacts than a low intensity prescribed burn. Likewise, a suppression effort using heavy equipment has a higher likelihood of more adverse operational and indirect impacts than one with hand lines. Adverse impacts resulting from fire management actions vary in regard to timing. For example, some archeological resources would be totally consumed by the burn, while others would be modified such that deterioration would occur more rapidly following the burn. Ethnographic resources and cultural landscape features may recover slowly following fire management actions. However, fire can also be used to protect certain cultural resources by reducing adjacent fuel loads, or, in the case of ethnographic resources or cultural landscapes, restore, maintain, and/or enhance them. Short-term, long-term, and permanent impacts on museum objects was determined based on the fact that fire management actions would require a substantial amount of fieldwork, compilation of a tremendous amount of data, and that Whiskeytown lacks curator staff skills.

Intensity of Impacts

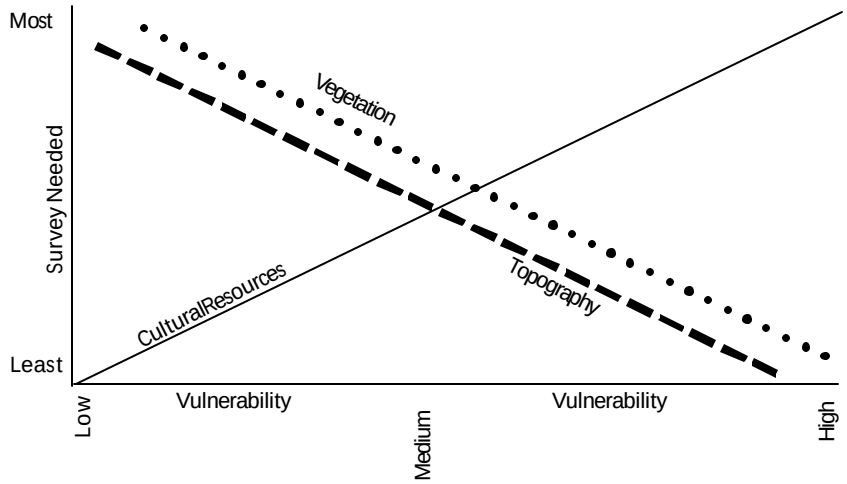
The intensity of direct fire impacts is difficult to quantify. This is due in part to the poor understanding of these impacts, as well as the apparent differential vulnerability of the various cultural resource classes. Because of this, it is probably better to consider potential direct impacts to individual components of a particular resource class (e.g., flaked stone, ground stone, bone, shell in a Native American village) rather than the resource class as a whole (e.g., lithic scatters, villages, trash scatters, mines for archeological resources). As noted, however, even within individual components, direct fire impacts differentially impact various attributes of a particular artifact or feature type. For example, potential direct fire impacts on an obsidian artifact include alteration of the obsidian hydration rind, inability to chemically source, breakage, melting, discoloration, and elimination of organic residues, each of which can occur at different temperatures and/or duration of exposure. Ideally, an assessment of the intensity of potential direct impacts on cultural resources at Whiskeytown would be conducted in conjunction with fire temperature data for each fuel model/vegetation community, detailed fire history studies, and accurate inventory of the types and distribution of cultural resources found in the unit. Unfortunately, this is not the case. While computer models predicting the intensity and severity of fire behavior based on a number of variables are available, predicting direct fire impacts on cultural resources from the outputs is not well developed. For example, most experiments measuring the impacts of fire on cultural resources utilized temperature as the agent of change, while computer models provide estimates of fire line intensity in non-comparable British Thermal Units (BTUs).

As noted in the Affected Environment Chapter, accurate fire history data are available only for the past 30 years, less than 10% of the unit has been inventoried for cultural resources, few archeological excavations have been conducted, and the thick vegetation cover that blankets much of the unit has certainly influenced survey results.

Still, some generalizations can be put forth with regard to evaluating potential direct fire impacts. In most cases, the greater the fuel load, the more intensely a fire is likely to burn (DeBano et al. 1996). Thirteen fuel models have been defined in North America (Anderson 1981), 11 of which are found at Whiskeytown. These models, which can be divided into grass and grass-dominated, chaparral and shrub field, timber litter and slash categories, vary in regard to average fuel load and fire line intensity (see the table below). Unfortunately, the distribution of these fuel models is not well established at Whiskeytown, nor are on-the-ground determinations of actual fuel loads. Still, various estimates, combined with outputs generated by fire behavior computer models, provide a means of ranking the various fuel models in terms of fire intensity, and therefore, likelihood of impacting cultural resources. These can be expressed as ranges, varying from benign fire behavior that might be expected in association with prescribed burns, to extreme conditions that occur during wildland fires. Those fuel models that are most widespread (e.g., chaparral and timber litter) at Whiskeytown can exhibit intense fire behavior, and contain the greatest percentage of the recorded cultural resources (see the table below). While temperature thresholds above which various classes or attributes of cultural resources can be adversely affected are not readily identifiable, it can be assumed that highly vulnerable data like wooden structures and features and obsidian hydration rinds have the potential to be impaired at even the lowest fire intensities in most fuel models.

Past fire activity is relevant in assessing potential direct impacts in that fuel loads can be influenced by the frequency of fire. For example, long-term research in mixed conifer forests of the Sierra Nevada demonstrated a significant reduction in fuel loads for up to 10 years following prescribed burns (Keifer 1998). At least 61 of the recorded cultural resources at Whiskeytown lie within areas that have burned once or more in wildland or prescribed fires since the 1940s. Inferences about past fire frequency can also be drawn from topographic variables such as aspect and slope. For example, fire frequency is usually greater on steep, south facing slopes than other orientations.

The accuracy of previous cultural resources surveys at Whiskeytown has probably been influenced by a combination of thick vegetation and rugged topography. Ironically, those areas that are most easily traversed (low gradient topography, sparse vegetation) would usually support less intense fire behavior than steep and/or heavily vegetated locations (Figure 2).



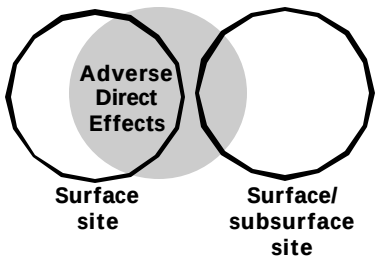
Vulnerability to Fire Effects	*increasing in vulnerability*
Nature of Topography	*increasing in topographic variability*
Nature of Vegetation	*increasing in vegetation density and brush cover*

Relationship between survey coverage, vulnerability of cultural resources to fire impacts, topography, and vegetation

While areas with low topographic gradient were probably the most attractive for settlement, some activities (e.g., mining) were carried out without regard to such considerations. The implication is that it would often be difficult to locate and adequately document cultural resources in areas of thick vegetation and/or steep topography, and that such resources would be highly vulnerable to direct fire impacts.

The volume or extent of a cultural resource vulnerable to direct fire impacts also merits consideration. As noted, except under special circumstances, direct fire impacts would generally be restricted to those cultural resources found above, on, and slightly below the ground surface. As such, all else being equal, the classes and attributes of cultural resources found exclusively on or near the ground surface are prone to have a greater percentage of their number adversely impacted by direct fire impacts than those resources with a combination of surface and subsurface material. This is significant because cultural resources generally considered to have high data potential, such as Native American villages with subsurface components, may actually have a far lower percentage of artifact classes or attributes exposed to direct fire impacts than a lithic scatter, often considered to have low data potential, that is restricted to the ground surface (Figure 3). While it is the village that would probably receive the greatest amount of attention in regard to a planned or unplanned fire management action, it is the lithic scatter that has the potential to undergo the greatest intensity of impact.

Open circles reflect the full range of artifact classes/attributes represented at each site type, and the amount of overlap with the shaded circle represents the amount or percentage of artifact classes/attributes vulnerable to adverse impacts.



Susceptibility of cultural materials in surface and surface/ subsurface contexts to direct fire impacts

Open circles reflect the full range of artifact classes/attributes represented at each site type, and the amount of overlap with the shaded circle represents the percentage of artifact classes/attributes vulnerable to adverse impacts.

Determining if and/or to what extent a cultural resource has subsurface components is best accomplished through invasive (e.g., excavation, auguring) or non-invasive (e.g., remote sensing, cut bank inspection) means. As discussed in Chapter 3, relatively few of these studies have been carried out at Whiskeytown. While people do intentionally and unintentionally bury cultural materials (e.g., trash dumps, burials), it is geomorphologic processes that dictate whether a given cultural resource is likely to have a subsurface component. In general, toe slopes, foot slopes, and terraces would have greater accumulations of colluviums and alluvium than summits and side slopes, from which these sediments are eroding. Owing to the highly erosive geology, these processes are particularly pronounced in the Whiskeytown area. In the absence of invasive or non-invasive investigations, inferences about the presence and extent of subsurface components can be drawn based on the geomorphological context in which a resource is found.

Mitigation of Impacts

NEPA dictates that all mitigation measures in response to proposed actions be identified, their effectiveness measured, and impacts assessed if the proposed actions were to proceed without mitigation. This analysis differs from Section 106 in that it does not suggest that the level of effect is similarly reduced. Although adverse impacts under Section 106 may be mitigated, the impacts remain adverse.

Standardized, detailed mitigation measures for fire management actions at Whiskeytown would be presented in the Cultural Resource Component of the Fire Management Plan. The contents of the Cultural Resource Component of the Fire Management Plan are dictated by the forthcoming programmatic agreement for fire management actions discussed early. The programmatic agreement would be accompanied by a companion set of guidelines, in which appropriate mitigation measures are identified for the various types of fire management actions. Each respective Historic Preservation Office, the National Council of State Historic Preservation Offices, and Advisory Council on Historic Preservation would ratify these mitigation measures as acceptable, when used appropriately, for mitigating the impacts of fire management actions on cultural resources.

Mitigation of impacts to cultural resources against the impacts of fire management actions involves a combination of knowledge of the potential direct, operational and indirect impacts of known or suspected resources, appropriate

resource inventory methods, and protection and treatment measures. A somewhat standardized approach to this has been developed, through consultation with the California Office of Historic Preservation, and implemented at Whiskeytown.

The Cultural Resource Component of the Whiskeytown Fire Management Plan would probably mirror certain aspects of that document. Appropriate mitigation measures can be conveniently divided into pre-action, during-action, and post-action categories. Those that would be employed at Whiskeytown include:

Pre-Action Standards: Cultural resources would be considered during all fire management planning efforts. Fire management personnel and other staff would receive annual training on cultural resources and fire management actions. All cultural resources would be evaluated with respect to hazardous fuel loads. As needed, fuel loads would be reduced using methods commensurate with avoiding or minimizing adverse impacts. Maintaining light fuel loads on and in close proximity to cultural resources would be emphasized. All areas slated for ground disturbing activities would be subjected to pre-action field surveys. This includes areas likely to be disturbed during future wildland fires. Pre-burn survey would be conducted prior to all prescribed burns as dictated by resource distribution and vulnerability, vegetation and topography, and expected fire behavior. Consultation with local Native American communities would continue to occur in the context of fire management actions. Spiritual sites and important plant communities would be identified and appropriately managed for preservation, maintenance, and/or enhancement. Computer and other databases containing cultural resources data would be created and maintained, and made available to fire management personnel in the event of emergencies. Cultural resources specialists from adjacent land management agencies would be consulted in order to coordinate mitigation efforts prior to planned and unplanned fire management actions. Appropriate cultural resources monitoring protocols would be established and implemented. Potential research opportunities to study the impacts of fire management actions on cultural resources would be identified.

During Action Standards: A cultural resource specialist or resource advisor would be present during all fire management actions where recorded and unrecorded resources of interest are considered at risk. Additional survey would be conducted on an as-needed basis. Observations of fire behavior and other variables would be made with respect to recorded cultural resources and/or areas with high probability of containing unrecorded cultural resources. Cultural resources data would be shared with fire management personnel as needed to avoid or minimize adverse impacts. A cultural resource specialist or resource advisor would educate fire management personnel about cultural resources and the potential impacts of fire management actions.

Post Action Standards: The post-action condition of all recorded cultural resources would be assessed. Resources requiring stabilization or other treatment would be mitigated. As appropriate, post-action survey would be conducted in previously surveyed and unsurveyed areas. Previously unrecorded cultural resources would be assessed for condition, and stabilization and other protection needs. Monitoring and research data would be compiled, evaluated, and used to help refine cultural resource compliance for fire management actions.

Issues and Impacts Common to All Alternatives

No alternative proposed in this document includes a goal of impairment to park cultural resources.

Prescribed Fire: Prescribed burns offer the cultural resource specialist the opportunity to attempt to locate, evaluate and mitigate cultural resources prior to the undertaking. Potential mitigation measures are described above. In cases where excessive fuel loads, topography or other restrictions place constraints on the amount and/or adequacy of pre-burn survey, it is highly likely that adverse direct impacts could occur. The ability to conduct pre-burn inventories allows the cultural resources specialist to quantitatively and spatially document fuel conditions and other variables that can be used to direct post-burn survey and more meaningfully assess damage to cultural resources that could not be documented and/or mitigated prior to the burn. While prescribed burns as large as 1,000 acres can be implemented, wildland fires have the potential to grow much larger and encompass many more cultural resources.

Prescribed burns are implemented under specific conditions with the intent of achieving specific objectives such as ecosystem restoration, resource protection, and hazard fuel

reduction. As such, it is possible, through varied timing or operational procedures (e.g., heading or backing fire) to achieve lower or higher fire intensities to accomplish those objectives. In the context of cultural resources management, a low intensity fire might be utilized on or immediately adjacent to a particular cultural resource, while a high intensity fire could significantly reduce hazardous fuels surrounding the resource.

Prescribed burns are implemented at times when the likelihood of escape is low, thereby minimizing potential impacts to those cultural resources in close proximity to a burn unit. Because prescribed burns are implemented under controlled conditions, the cultural resource specialist would often have the opportunity to monitor fire behavior and the effectiveness of mitigation measures during the burn.

Most operational activities, such as line construction, associated with prescribed burns are conducted in advance of the actual burn. This affords the cultural resources specialist the opportunity to survey those locations prior to any disturbances, and make necessary adjustments in order to avoid or minimize operational impacts. The cultural resource specialist can also brief fire personnel on the proper protocol in and around cultural resources.

Because prescribed fires are unlikely to escape the boundaries of the burn units there is little chance of suppression-related operational impacts. In the event of an escape, however, the presence of a cultural resource specialist, along with pre-burn contingency planning, would allow for a greater chance to mitigate or minimize potential adverse operational impacts. Ground disturbances associated with mop-up and rehabilitation are usually few or none following prescribed burns. As discussed below, this contrasts sharply with suppression during wildland fires.

The benefit of pre-burning planning allows the cultural resources specialist to account for potential indirect impacts. For example, if high tree mortality is a concern following the burn, efforts can be taken to reduce the number of trees in proximity to a cultural resource. Some indirect impacts like erosion are exacerbated by intense fire behavior, the type that is unlikely to occur over large areas during prescribed burns.

Wildland fire and Suppression: Due to often extreme fire behavior, the direct impacts of wildland fires on cultural resources can be substantial, including adverse, permanent damage. Wildland fires range from extremely small (<0.1 acre) to thousands of acres, and those that grow to substantial size are often driven by a combination extreme weather conditions and heavy fuels. Extremely high fire temperatures can be expected, with the implication that even the most durable cultural resources are vulnerable to major, permanent damage. Large fires would often encompass a high number of cultural resources. As they are unplanned events, cultural resource specialists rarely have the luxury of benefits conveyed by pre-planning efforts during wildland fires. For example, because a relatively small percentage of Whiskeytown has been inventoried for cultural resources, it is highly likely that wildland fires would occur in areas that lack or have few recorded cultural resources. Information regarding direct impacts would in most cases be obtained during the post-burn phase, and involve evaluating those impacts on resources for which no pre-burn condition data were available. At present, the principle post-wildland fire funding source (Burned Area Emergency Rehabilitation) prohibits the use of those funds to perform post-burn inventory beyond areas impacted by suppression actions. The need for substantial post-wildland fire inventory can impact the ability to complete compliance for planned fire management and other projects.

Operational impacts associated with wildland fire suppression can often be extreme. The act of constructing fire lines, heli-spots, staging areas, mopping-up and other ground disturbing processes can have tremendous impacts on cultural resources. Even with MIST techniques described in Chapter 2, the placement of fire lines and related phenomenon can be quite unsystematic when compared to planned fire management actions. Although the use of heavy equipment for fire suppression is prohibited unless authorized by the Whiskeytown superintendent, it is a standard tool for agencies charged with fire management on adjacent lands, and would almost certainly be employed in cases where life or property was at risk. Large numbers of personnel, from varied backgrounds, are present at any substantial fire. Crews are often spread across a vast area, and their activities difficult to monitor by one or very few resource advisors. Cultural resource looting and vandalism can potentially occur during wildland fire events.

Due to high intensity fire and extensive disturbances related to suppression, indirect impacts related to wildland fires could be

adverse. For example, impacts from erosion are typically pronounced in situations where most or all of the fuel has burned, and when soil permeability is reduced. Tree mortality can be very high following wildland fires, creating potential long-term cultural resource management concerns. With improved ground visibility, cultural resources may be at greater risk from looting. As noted above, these problems become even more acute when one considers that sources of funding for post-burn inventory are not readily available.

Mechanical Treatment and Shaded Fuel break System: Although fire itself is not technically a component of mechanical treatments, prescribed burning of vegetation piles would be utilized. Fuel loads in these piles would be substantial, would tend to burn at very high intensities, and any cultural resources found in proximity would almost certainly suffer direct impacts. With the ability to pre-plan, the cultural resource specialist can ensure that piles are not created on or near cultural resources. Wildland fires started by machinery might lead to severe fire behavior and major, permanent adverse resource impacts.

Operational impacts present the greatest concern in regard to the potential impacts of mechanical treatment. Ground disturbance, particularly that associated with mechanical level 2 and 3 treatments, could result in substantial impacts to cultural resources. However, mechanical treatments offer the benefit of pre-planning in that the location(s) of ground disturbance can be specifically delineated, and known cultural resources avoided. In the event that an area cannot be subjected to adequate pre-burn survey due to thick vegetation, a cultural specialist could monitor the mechanical treatment for cultural resources that become exposed. Likewise, less intensive mechanical treatments can be employed in highly sensitive areas. While looting by fuels crews is also a concern, these impacts could be minimized through a combination of education and avoiding known resources.

A variety of indirect impacts could arise as a result of mechanical treatments. Again, these are probably of greatest concern with mechanical level 2 and 3 treatments. The use of heavy equipment could result in soil compaction, and potential soil erosion on and near cultural resources. The act of thinning vegetation on or near cultural resources might leave them vulnerable to looting. Again, however, the ability to perform pretreatment survey means that equipment can be excluded from or near cultural resources and vegetation can be strategically left in place to discourage looting. Mechanical treatments also offer the potential benefit of reducing fuel loads in proximity to cultural resources and restoring and/or maintaining historical scenes associated with structures and cultural landscapes, especially in situations where it is not desirable or possible to accomplish these tasks with the direct application of fire.

Fire Information and Education: Impacts associated with fire information and education would largely be beneficial, although highly dependent on the nature of the fire management action. Pre-planned events such as prescribed fires and mechanical treatment provide the opportunity to demonstrate the effectiveness of cultural resources compliance to local Native American communities and the interested public.

During unplanned events, such as wildland fires, time for effective communication is often more limited and can be more controversial since resources are often damaged. As noted in Chapter 3, the Wintu community has expressed interest in working more closely with Whiskeytown fire management staff, and this relationship would be cultivated more quickly and effectively in association with well-planned actions.

Fire cache relocation and park headquarters administration building construction: The construction of a new fire cache at Oak Bottom would have no direct impacts on cultural resources. However, relocating fire management personnel to a more centralized location would allow for faster response time to cultural resources in the event of wildland fires. The new cache would be significantly closer to two of the most significant cultural resources—Tower House historical and archeological districts—at Whiskeytown. Rebuilding a new administrative building at park headquarters would not have any measurable impacts on cultural resources, the entire compound area was bulldozed and leveled in the late 1950s by the Bureau of Reclamation to provide for a vehicle yard. Any cultural resources that may have been at this site have been disturbed and provenience has been lost.

Operational impacts associated with the construction of the new fire cache are unlikely to occur. The Oak Bottom and park headquarters compound are developed areas and have been surveyed in their entirety — no cultural resources have been documented at or in the

vicinity of the proposed locations.

No adverse or beneficial indirect impacts are anticipated with the construction of the new fire cache. Long term beneficial impacts can be anticipated through the construction of a new park administrative building in the park headquarters compound. The current museum collection is located in a temporary structure with no foundation. It is anticipated that the museum collection would be incorporated into the new park administration building.

Summary by Alternatives

Alternative I: Actions included in Alternative I include up six prescribed burn projects encompassing up to 1400 acres/year, 15 mechanical level 1 projects covering up to 275 acres/year, 1150 acres of shaded fuel breaks and a suppression program. The fire cache would be relocated to Oak Bottom, however, no new construction of an administration building at park headquarters would occur. Among the beneficial impacts of this alternative are the ability to pre-plan for prescribed burns, mechanical treatments and shaded fuel break construction and maintenance. On the other hand, at the proposed treatment level, reduction of hazardous fuels would take several decades, increasing the possibility that high severity wildland fires could occur and result in major and permanent adverse impacts to cultural resources.

Alternative II: Actions associated with Alternative II include up to 10 prescribed burn projects encompassing up to 3000 acres/year, six mechanical level 1 projects covering up to 80 acres/year, and a suppression program. A new fire cache would be constructed at Oak Bottom and a new park administrative building would be built within the current park headquarters compound. Beneficial impacts of this alternative include the ability to pre-plan for prescribed burns and mechanical treatments. On the other hand, heavy reliance on prescribed burning means that those cultural resources vulnerable to direct fire impacts could be adversely impacted in situations where adequate pre-burn survey and/or mitigation could not be employed. The rate of treatment in Alternative II improves upon that proposed for Alternative I.

Alternative III: Actions associated with Alternative III include up to seven prescribed burn projects encompassing up to 250 acres/year, 12 mechanical level 1 and 2 projects covering up to 450 acres/year, 1400 acres of shaded fuel breaks, and a suppression program. A new fire cache would be constructed at Oak Bottom and a new park administrative building would be built within the current park headquarters compound. As it does little to reduce overall fuel loads over time, this alternative has the potential to result in major and permanent damage to cultural resources. Focusing on suppression merely delays the inevitable fact that flammable vegetation would eventually burn, likely with high intensity, and a multitude of adverse operational and indirect impacts could potentially arise.

Alternative IV: Actions associated with Alternative IV include up to 10 prescribed burn projects encompassing up to 2200 acres/year, 20 mechanical level 1, 2, and 3 projects covering up to 640 acres/year, 1150 acres of shaded fuel breaks, and a suppression program. A new fire cache would be constructed at Oak Bottom and a new park administrative building would be built within the current park headquarters compound. Under this alternative, a substantial number of projects would be subjected to pre-planning for cultural resources compliance, and a mix of prescribed fire and mechanical treatments would be employed. As the most aggressive alternative at combating hazardous fuel loads, Alternative IV would more quickly reduce the chances of adverse impacts associated with wildland fires and wildland fire suppression.

Compatibility with Land Use Plans

Methodology

This section examines local agreements, and the fire plans of adjacent landowners and responsible fire management agencies, and assesses the potential impacts of each of our alternatives on the plans. All the lands adjacent to Whiskeytown are protected by California Department of Forestry and Fire Protection (CDF), known as State Responsibility Area (SRA). CDF has developed a strategic wildland fire defense plan for the Middle Creek Watershed 1994, which covers lands adjacent to our east boundary. The Western Shasta Resource Conservation District (WSRCD) has developed a Strategic Fuels Reduction Plan for the Lower Clear Creek Watershed (1999), which covers adjacent lands to the park's southeast. WSRCD is also developing a plan for Upper Clear Creek Watershed, which covers lands to the park's north. The Bureau of Land Management, Redding Area, developed a Fire Management Planning document (1997), which describes fire management goals for adjacent lands in areas all around Whiskeytown.

The three direct protection entities of Shasta and Trinity Counties, Whiskeytown National

Recreation Area, Shasta-Trinity National Forest (USFS), and Shasta-Trinity Unit (CDF) have an interagency Operating Plan for Fire Suppression. CDF also has developed a California Fire Plan (1999), which establishes state goals and objectives for fire management. The land use plans above emphasize: interagency cooperation, fuels treatments (mechanical and prescribed fire), forest health, and establishment and maintenance of shaded fuel break systems. The land use plans also emphasize swift and efficient initial attack on wildland fires. Whiskeytown fire personnel provided input during the planning process of each document.

Regulations and Policy

The federal wildland management policy of 1995 stresses the importance of developing and maintaining local interagency coordination and cooperation. The National Fire Plan of 2000 reemphasizes local coordination and cooperation in preparedness and fuels management in order to reduce the fire risk to western rural communities.

Issues and Impacts Common to All Alternatives

All alternatives would complement and enhance the land use plans of Whiskeytown's neighbors by providing additional area initial attack and suppression forces and reducing hazard fuels through the management strategies of prescribed fire and mechanical treatments.

Alternative I

Alternative I is compatible with BLM, CDF, and WSRCD plans. The shaded fuel break system currently being implemented by the park is a component of these plans. The emphasis on pre-fire treatments, such as fuels management, is consistent with all land use plans.

Alternative II

Alternative II has a conflict with adjacent land use plans because of the elimination of the shaded fuel break system. The West Redding shaded fuel break system, which has been developed by the local cooperating agencies, includes the lands in Whiskeytown—they are strategic areas that are essential to the effectiveness of the program. The emphasis on reducing hazard fuels is compatible with adjacent land plans. Long-term impacts would be potentially beneficial, with improved forest health and reduced wildland fire risk, but increased risk from prescribed fire escape and increase smoke. Long-term suppression would be mixed—reduced fuels but reduced access for fire fighters (due to lack of shaded fuel break system) during holding actions.

Alternative III

Alternative III is generally compatible with adjacent land use plans. Its emphasis on preparedness, suppression, and hazard fuel reduction is especially compliments the CDF state plan, and area plans. The expanded use of mechanical treatment is compatible with land use plans. Its lack of emphasis on forest health is slightly at odds with the BLM plan. Long-term impacts would be good for suppression actions, with an expanded shaded fuel break system, but a fuels buildup in the interior portions of the Recreation Area would make suppression difficult, raising fire risk. Wildland fires could grow rapidly and test the shaded fuel break system, and adjacent areas burned. Mechanical treatment areas would be tested also.

Alternative IV

Alternative IV is generally compatible with adjacent land use plans. The increased emphasis on the shaded fuel break system, and mechanical treatments for fuels is emphasized in land use plans. The additional emphasis on mechanical treatments, including the use of mechanized equipment to reduce brush and thin trees, is compatible with adjacent land use plans, which currently call for mechanized equipment to reduce hazard fuels and restore landscapes.

Conclusion: The proposed alternatives are generally compatible with adjacent land use plans. The emphasis on more effective suppression and more active fuels management is consistent would land use planning by fire agencies in the Shasta-Trinity county area. Alternative II has a potential for conflict because it does not provide for a shaded fuel break system, and increases the risk of prescribed fire escape. In the Draft Environmental Impact Statement, Alternative IV had a potential for conflict with surrounding landowners because of the proposed wildland fire use strategy. This strategy has been removed for consideration under this plan—making Alternative IV very compatible with adjacent land use plans. Alternative III does not provide for extensive fuels management of the interior of the park, and has a potential long-term conflict because of the lack of meaningful hazard fuel reduction in the interior, and forest health by restoring fire to the natural system. None of the alternatives would impair park resources.

Health and Safety

Impacts and Issues Common to All Alternatives

Due to the abundance of flammable landscapes, plentiful natural and human ignition sources, and hot, dry summers, no alternative eliminates the health risk of smoke for fire fighters, visitors, or communities. Unwanted wildland fires would occur and produce smoke under all alternatives. Alternatives that allow more control over the timing, placement, and conditions under which fires burn would be more successful at minimizing smoke impacts over the long-term.

All individual prescribed fire projects would be managed under the same conditions and constraints under all alternatives. Each project would be implemented only with the concurrence of the Shasta County Air Pollution Control District, and managed to maintain smoke emissions in communities below the legal thresholds as defined by the State of California and the Environmental Protection Agency. To accomplish this, smoke impacts would be managed and mitigated according to requirements contained in the Fire Management Plan.

While the park intends to manage all prescribed fire projects so that established health limits are not exceeded, it is recognized that some individuals exposed to smoke may be sensitive or susceptible to smoke impacts at levels below the legal limits. Under all alternatives, the parks would manage this potential impact through a system of identification of sensitive individuals in the affected communities, advance notification to help affected parties mitigate or avoid potential impacts, and any other actions deemed reasonable and as directed by the Air District.

Fire fighters are exposed to the highest health risk from smoke on or near the fire lines. The risks are well studied and include carbon monoxide, hydrocarbons, and particulates. Standard fire fighting practices are employed to minimize fire fighter exposure. These practices include: planning the location of fire lines to minimize exposure, rotating fire fighters out of smoky segments of the fire line at frequent intervals, and providing rest and sleep areas away from areas of significant smoke on long duration events.

Most by-products of wildland fire combustion of health concern are concentrated at the fire line, and decrease to negligible levels in very short distances. Fine particulates however, may travel much greater distances from fire lines. While they also become diluted with distance, their ability to be transported away from the fire line makes this by-product the one of most concern in relation to public health.

Since the health effect of smoke may occur some distance from actual fire events, the park focuses most attention on the impacts of the alternatives on park visitors, employees, and local communities that experience indirect smoke impacts, especially concentrations of fine particulates. Generally, the greater distance from the fire, the larger the volume of air available to dilute smoke below levels considered harmful to humans. Higher elevation fires typically loft smoke into mixing air masses, diluting the smoke further. Local weather patterns affect smoke mixing and movement, especially at night. Wildland fires similar to those in 1999, when numerous wildland fires were burning simultaneously throughout northern California could affect the park and, thus, the health and safety of visitors and park employees for several weeks.

Smoke impacts are not directly related to increasing wildland fire acreage. For example, grassland fires produce much less smoke per acre than do forest fuels. Even areas of similar vegetation types in forested areas may have significantly different amounts of emissions due to lower fuel load and smoke production in restored areas compared to areas that have missed several cycles of wildland fire and contain unnaturally heavy fuel loadings.

Methodology, regulations and policy

Fire management activities and the potential for injury, illness, and other direct and indirect impacts are evaluated for their potential to affect public and fire personnel during fire management activities at Whiskeytown National Recreation Area. The analysis includes the impacts of prescribed fire, suppression and mechanical treatment on the health and safety of the public and fire personnel.

Type of Impacts

Direct – Impacts that result to public or fire line personnel from participation or exposure to fire management activities.

Indirect – Impacts that result to public or fire line personnel from exposure to smoke or particulates at a distance from the fire line.

Duration

Short-term – Would be temporary in nature, during the period when a fire management activity would take place.

Long-term – Would have a permanent or extended effect on the public or fire line personnel.

Intensity

Negligible – Imperceptible or undetectable effect upon public or fire personnel.

Minor – Minor impacts would be slightly detectable or localized, upon public or fire personnel within a portion of the body.

Moderate – Moderate impacts would be those that are readily apparent but that would not result in limits on activities.

Major – Major impacts would be substantial, highly noticeable impacts and/or impacts that would result in limits on activities.

The health and safety of fire fighters and the public is the highest priority in every action undertaken as it relates to fire fighting strategy and tactics. National Park Service Director's Order #18 states "*…fire fighter and public safety must be the first priority in all fire management activities.*" National Park Service Management Policies states "all wildland fires would be effectively managed, considering resource values to be protected and fire fighter and public safety…" All actions taken involving wildland fire have as their overriding goal providing for fire fighter and public safety. On an event level, mitigation measures are implemented to limit the public's direct exposure to fire. Mitigation includes temporary trail closures, trail cautionary signing, strict road visibility standards, and the temporary closures of facilities. These measures are all to be included in the park's Fire Management Plan.

Alternative I

Public Safety: There is no expected increase in fire-caused injuries to visitors, employees, and the public. Under Alternative I, fire operations would remain at current levels with intermittent visitor, employee, and general public exposure to ground level smoke, particularly during late night and morning periods when smoke plumes collapse, descend and concentrate in low lying areas or canyon bottoms. The infrequent but likely occurrence of high intensity fires burning in accumulated fuels resulting from fire suppression would pose a high threat to the safety of both fire fighters and the public.

Fire Personnel Safety: Since fire operations would remain at current levels, there would not be an immediate increase in the rate of exposure of fire personnel to hazardous conditions—both fire and smoke. Over time, as fuels continue to accumulate in untreated areas of the parks and the risk of high severity fire grows, fire personnel would be exposed to increasingly hazardous conditions. Efforts at direct attack or suppression of intense fires would also pose a threat to fire fighter safety due to the nature of such activity. Hazards of the work include fire line construction, tree falling, helicopter transport, direct flame exposure, and respiratory problems due to smoke inhalation. In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Alternative II

Public Safety: There is no expected increase in fire-caused injuries to visitors, employees, and the public. A significant increase in prescribed fire operations would occur which has the potential to increase the exposure of visitors, employees, and the public to ground level smoke particularly during late night and morning periods when smoke plumes collapse, descend and concentrate in low-lying areas or canyon bottoms. Public exposure to hazards, and risks of ire damages, should be progressively reduced over time.

Fire Personnel Safety: There would be a significant increase in the number and extent of prescribed fire operations which would cause an increase in the rate of exposure of fire personnel to hazardous conditions—both fire and smoke. An increase in injuries may occur but it is not possible to predict with any certainty the increased rate of injury. The planned nature of prescribed fire events should allow for a lower rate of injuries than Alternative III, given the unplanned nature of suppression events. The use of prescribed burns allows fire line construction, tree falling, and firing operations to be conducted in a more orderly and safer manner than during emergency fire suppression. Fires are generally of lower intensity. Hazardous exposures from extended patrol, moisture-laden smoke, and handling petroleum products are greater then Alternative I. Tactics to control prescribed burns are as in Alternative I with more exposure to employees to hazards.

In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the

public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Alternative III

Public Safety: The infrequent but likely occurrence of high intensity fires burning accumulated fuels resulting from fire suppression would pose an increased threat to the safety of both fire fighters, employees, and the public. An increase in unplanned suppression fires has the potential to increase the exposure of visitors, employees, and communities to ground level smoke, particularly during late night and morning periods when smoke plumes collapse, descend and concentrate in low-lying areas or canyon bottoms.

Fire Personnel Safety: An increase in the number and extent of suppression fires would cause an increase in the rate of exposure of fire personnel to hazardous conditions—both fire and smoke. This exposure would be unplanned with the potential for a higher rate of injury than Alternative II. Efforts at direct attack or suppression of intense fire would also pose a threat to fire fighter safety due to the nature of such activities. Hazards of the work include fire line construction, tree falling, helicopter transport, direct flame exposure, and respiratory problems due to smoke inhalation.

In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Alternative IV

Public Safety: There is no expected increase in fire-caused injuries to visitors, employees, and the public. A significant increase in prescribed fire operations would occur, which has the potential to increase the exposure of visitors, employees, and the general public to ground level smoke, particularly during late night and morning periods when smoke plumes collapse, descend, and concentrate in low-lying areas or canyon bottoms. Hazards and risks to the public shall be reduced as in Alternative II. Hazards inherent to fire suppression shall be as described for Alternatives I and II.

Fire Personnel Safety: There would be a significant increase in the number and extent of prescribed fire and mechanical treatment operations which would cause an increase in the rate of exposure of fire personnel to hazardous conditions—both fire, smoke, and personal injury. There would be increased employee exposure from more prescribed burn activity. Direct exposure to flame by employees to hazards in wildland fire is lessened and there is the option to stay away from smoke. There are less tools, equipment, and materials-handling exposures. These benefits are offset by the larger, and sudden, employee exposures required by conversion of a natural fire that has exceeded its prescription to an emergency suppression action. Public safety is often a factor in such decisions. The magnitudes and complexities of such actions, although less frequent than numerous small fire suppression or prescribed burn actions, could result in higher exposures to hazards. Because of a subtle human tendency to regard “prescribed” burns, or natural fires, as less hazardous than other forest fires, there is employee susceptibility to perils by acceptance of exposure to lower perceived hazards.

In aggregate, the actions of this alternative would have adverse, short-term and minor to major impacts upon the health and safety of both the public and fire fighters, except during large, high severity fire events, when the proximity of people to smoke and flame would result in major, short-term, and unavoidable adverse impacts. There would be no impairment from the impacts of this alternative.

Conclusions: No alternative eliminates all health and safety concerns, though the alternatives vary in their ability to manage and mitigate impacts. All actions under all alternatives would be managed to fully comply with legal requirements for protection of public health and safety, including smoke impacts. Public and fire fighter safety is the highest priority for all actions. Alternative II provides optimum management control over the timing, and placement of fire events, and hence provides the greatest control over the amount of smoke produced and minimizes the number of riskier emergency responses. Using a combination of prescribed fire and unplanned ignitions, Alternative IV allows somewhat less management control over the timing, placement, and size of fire events than Alternative II, but is much better in this regard than Alternative III. Since Alternative III relies heavily on random ignition events, the opportunity for management control over the

timing and placement of fires is minimal and results in an increasing probability of unwanted smoke events. Alternative I minimizes smoke impacts in the short-term, but does not significantly address the continued accumulation of fuels. Alternative I would be expected to produce more and larger unwanted smoke events as resistance to control and fuels increase with time.

Community Economics

Impacts and issues common to all alternatives

The fire management program may have both direct and indirect impacts on the local economy. Direct impacts include the park's transactions with local businesses that supply goods and services for fire management activities. Additional direct impacts come from employees on the fire program payroll who procure personal housing, food, goods, and services from local businesses. Indirect impacts include the impact of fire management activities on tourism. While there are some differences in payroll and support costs between the alternatives, it should be noted that the core program size and cost is primarily driven by the organization needed to effectively prevent and suppress unwanted fires. Those costs remain relatively constant across all alternatives. Most of the differences in cost across the alternatives reflect those necessary to both maintain an adequate suppression force as well as a proactive fuels management program. The costs for proactive fuels management programs are not completely additive to suppression costs since some resources are shared between the two functions. Economies of scale are also achieved when combining suppression and proactive management actions.

For all alternatives, the economic impacts of mechanical fuel reduction would be significant since the park is required to spend its Wildland Urban Interface (WUI) funds in the local communities.

Year 2000 visitor statistics for the park during the primary visitor season (May through September) totaled 750,000. This figure is used as a basis for comparing the magnitude of potential impacts on tourism across the alternatives. Each of the alternatives has risks and a degree of uncertainty associated with it. The threat of loss from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels treatment in enough places to influence wildland fire in the intended ways. The analysis of program costs in this Section considers the full range of fire management activities, including the cost of infrequent large unwanted fire events such as the 1990 Kanaka fire, which eventually burned over 3,000 acres of park land. The analysis in this section primarily evaluates the costs associated with the core fire program envisioned under each alternative, which as a matter of course includes preparedness and initial attack suppression capabilities.

Factors used to assess consequences

Fire Management Payroll: The size of the fire management program payroll varies by alternative. Since most of the money paid to fire staff is spent in the local communities in the form of housing, food, and services, increases in total payroll would be expected to have a net beneficial effect on local community economics. Similarly, alternatives with smaller payrolls would have a less beneficial effect.

Program Support: In addition to payroll inputs to the community through its employee base, the fire management program also inputs dollars directly into the economy to support program operations. Purchases are made directly from local businesses for goods and services including food, supplies, and other items. For this analysis, the assumption is made that the same proportion of payroll and support dollars would be spent in the local communities from each alternative. Therefore differences in program budgets between the alternatives are used as a direct indicator of the effect of that alternative's potential economic impact on the local economy.

Tourism Impacts: Park visitation data from 1990 through 2000 shows the summer period (May through September) as typically the busiest tourist months. Those months coincide with the primary fire season. Since it is difficult to directly tie tourism spending to the fire management alternatives, this assessment addresses the relative expected impacts of alternatives on visitation. The level and extent of the effect on tourism due to fire operations is difficult to accurately quantify and convert directly into dollar figures. However, some assumptions may still be made regarding the relative impact of different fire management

alternatives. Direct impacts on tourism from fire operations may come from road or facility closures due to fire operations. Over the past decade such road closures have occurred approximately five times for short periods of time on the primary thoroughfare through the park, State Highway. 299. All of the closures were a result of fire suppression operations resulting from the need to fight unwanted wildland fires. However, since these closures were to vehicles passing through the park, it is highly likely that there was negligible financial impact on businesses in communities adjacent to the park or the local community. Offsetting potential tourism business lost in communities affected by closures is the financial impact of fire fighting efforts that are usually associated with such closures. In all cases over the past 10 years where this has occurred, numerous commercial lodgings, restaurants, and other local business benefited providing for the needs of the fire fighters involved in the suppression effort. Indirect impacts on tourism may come from the impacts of smoke or loss of visibility in local communities, causing shortening or cancellation of visits. Over the past decade there have been several smoke events from both managed fires and wildland fire events that affected local communities. These included the 1997 Shasta Divide and 1998 Mill prescribed fires, the 1999 High Complex and Big Bar wildland fires, and the 1991 Kanaka wildland fire. How and to what extent these events affected a mobile tourist population is unknown. Assumptions may be made that more, or more severe, smoke events may result in a reduction in length-of-stay negatively impacting local business, though several of the events, such as the 1997 Shasta Divide prescribed fire, occurred during October outside the primary visitor season.

Recent experience suggests that indirect impacts of prescribed fire on recreational visits is slight, as most prescribed burns are conducted in the fall when visitation to the park is minimal, while the visual impacts of large high severity fire events may cause significant decreases in recreational use. Therefore, in this assessment, it is assumed that alternatives that decrease potential for high severity events would have a more beneficial effect on recreational visits.

Methodology

Under this topic, the alternatives are evaluated as to their socioeconomic impacts on local communities. Socioeconomic impacts include direct potential direct impacts of property loss, and potential indirect impacts in economic terms, in the event of park closures.

Impact Type

Adverse – would degrade or otherwise negatively alter the characteristics of the existing environment, as it relates to local communities, visitor population, regional economies, and concessionaires and contractors.

Beneficial – would improve upon characteristics of the existing social and economic environment, as it relates to local communities, visitor population, regional economies, and concessionaires and contractors.

Duration

Short-term – temporary in duration and typically transitional impacts associated with implementation of an action.

Long-term – permanent impacts on the social and economic environments.

Intensity

Negligible – Not detectable and expected to have no discernible effect on the social and economic environment.

Minor – Slightly detectable and not expected to have an overall effect on the character of the social and economic environment.

Moderate – Detectable, without question, and could have the potential to initiate an increasing influence on the social and economic environment (particularly if other factors have a contributing effect).

Major – Substantial, highly noticeable influence on the social and economic environments, and could be expected to alter those environments permanently.

Alternative I

Alternative I, as well as the other alternatives considered, has risks and a degree of uncertainty associated with it. The threat of loss from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels treatment in enough places to influence wildland fire in the intended ways. Alternative I proposes localized strategies to reduce hazardous fuel conditions in the park.

The greatest potential for high severity fires would be in Fire Management Unit (FMU) 1 and along the margins of FMU 1, the suppression area of the park. All of the park developed areas as well as the Shasta Divide area on the eastern boundary are all within or along FMU 1, and forest conditions around each of these communities are among the most changed in the park, due largely to past and successful fire suppression activities.

Forest conditions have changed in and around Wildland Urban Interface areas. In this alternative, high severity fire would continue to have the potential to effect these communities through both direct impact, (i.e., property loss and damage as a result of fire in the Wildland Urban Interface), and indirect impacts of closures and other actions, (i.e., loss of business and its economic impacts).

Under this alternative, the potential for large, high intensity high severity wildland fires would remain high in and around Oak Bottom, Brandy Creek, Whiskey Creek, Park Headquarters and the adjacent community of Old Shasta. There would be approximately 100 acres of fuels treated mechanically per year, and 1,400 acres of prescribed burning. At this level of accomplishment, it would not be possible to accomplish restoration objectives, meaning the risk of large, high intensity, high severity fire would remain high.

In the event of high severity fire in these communities, the impact would be great. This impact would be adverse, long-term and major. Similar impacts would be expected in any of the other communities bordering the park in the event of large, extreme fire behavior fires. Potential direct impacts from high severity fire in Wildland Urban Interface would include adverse, long-term and major impacts.

Potential indirect impacts would include loss of revenue in both local and regional communities. Because of closures associated with high severity wildland fires. This would include loss of business activity in the Redding area (i.e., loss of business at lodging, restaurants, gift shops and various services). Because of the potential for high severity fire in FMU 1, the likelihood of having fire-related closures during the life of the plan would be high. Major impacts would likely include short-term job loss (or reductions in hours worked), and reductions in personal income, with the significance of this effect (by person) highly variable, but overall a closure of this duration would have adverse, short-term and moderate impacts.

Costs of this alternative would continue to increase as the shaded fuel break system is expanded and WUI-funded projects continue to inject money into the local economy. Some of this money would be used to reduce risks in WUI areas, but much of the work would be to accomplish restoration objectives. With the amount of WUI burning that would be done annually, risk reduction objectives would not be accomplished during the life of the plan.

Because mechanical thinning would not be a part of this alternative (100 acres or less of thinning, mostly by hand, would occur), it is doubtful that prescribed fire would effectively reduce risks in some areas. This is because prescribed fire in some of the densest areas (where logging historically occurred), when applied under controlled conditions and not in combination with mechanical treatments, would be unlikely to be effective at restoring forest community structure around WUI areas in Whiskeytown today.

The likelihood of being effective at suppressing all fires in WUI areas would decrease further over time as forest conditions continue to change. Considering the potential for high severity fire in WUI areas, the impacts of prescribed fire would be locally beneficial, but overall, the risk would remain high. The impacts of prescribed fire would be beneficial, long-term and minor to moderate.

Prescribed fire use in WUI areas would impact residents through smoke and site closures. During prescribed fire activities, residents and visitors would be effected through localized safety closures and equipment noise. People would likely be able to partake in their chosen activities in another, nearby location, with limited or no restrictions, but smoke would effect all downwind locations in the area.

Some residents would have concerns about the smoke, while others would want the work to move forward, to provide the fire protection and ecosystem restoration benefits. This latter group would be supportive. Overall, these impacts upon local communities would be adverse, short-term and minor. There are risks and uncertainty associated with implementing a successful fire management strategy that includes prescribed fire.

One intent of the program is to do enough fuels treatment in enough places to influence wildland fire in the intended ways. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires.

This alternative utilizes mechanical treatment level 1 only, so there would be no biomass removal operations. Hand-thinning and chipping would result in approximately 100 acres of thinning in Wildland Urban Interface areas. Though locally effective, the small number of acres treated would limit the overall effectiveness of the alternative in reducing the risk of high severity fire. It would not be possible to bring Wildland Urban Interface areas back to within target conditions during the life of the plan, except on a limited, local basis. Large-fire potential would continue to increase. Impacts would be beneficial, long-term and minor.

Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Thus, the impacts of infrequent closures under Alternative I would remain adverse, short-term and moderate. Fire management-related projects would include the continued expansion of the shaded fuel break system, utility right-of-way maintenance piling and burning, fire management planning for Bureau of Land Management areas, and others.

These actions would result in impacts similar to fire management activities in the national park, with the same types of risks. These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long-term, beneficial and moderate to major impacts of these actions, the minor impacts of the treatments in Whiskeytown Wildland Urban Interface under Alternative I would potentially become beneficial, short-term and moderate.

Payroll costs for employees in the parks' fire management program under this alternative would be approximately $800 thousand annually. Total additional dollars for program support and proactive fuels management would be $720 thousand annually.

Offsetting the local economic benefits from fire payroll and support spending are expected periodic adverse impacts for the tourism industry as fire projects are implemented and fire suppression occurs resulting in road or facility closure. Impacts resulting from unplanned fires requiring suppression are expected to increase as suppression acres increase.

Under Alternative I, there are no irreversible and irretrievable commitments to resources.

Conclusion: There are not a lot of fire management projects in the Shasta County area that would significantly impact the local community. Although the population of Shasta County continues to increase, there are not a lot of lodging and service projects or utility and infrastructure projects that could have an effect upon visitation within the local community. There are a few projects of the type described in the proposed action, e.g., projects dealing with fire, fuels, and vegetation management matters.

While there may be some projects that would potentially bring about increases in visitation and spending growth, closures during periods of high severity fire would bring about short-term decreases in both visitation and spending. Considered in combination with the long-term, minor and beneficial economic impacts of new development in the community, the impacts of infrequent closures under Alternative I would remain adverse, short-term and moderate. There are very few fire management-related projects occurring on lands adjacent to the park. Thus, any actions taken on these lands would result in impacts similar to fire management activities in the national park, with the same types of risks. Actions taken to reduce the risk of high severity fire would potentially restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long-term, beneficial and minor impacts of these actions, the moderate impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative I would potentially become beneficial, short-term and moderate.

Alternative II

Alternative II, as well as the other alternatives considered, has risks and a degree of uncertainty associated with it. The threat of loss from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels

treatment in enough places to influence wildland fire in the intended ways. Alternative II proposes landscape strategies to reduce hazardous fuel conditions in the park.

Because of the aggressive nature of carrying out prescribed fire and Wildland Urban Interface programs in this alternative, the risk of high severity fires that would spread into Wildland Urban Interface areas would be much lower than under the No Action alternative. The greatest potential for high severity fires would be in Fire Management Unit (FMU)1 and along the margins of FMU 1, the suppression area of the park. Risk near Oak Bottom, Brandy Creek, Whiskey Creek, and adjacent local communities would be greatly reduced by actions intended to bring plant communities along and within Wildland Urban Interface areas back to within restoration target conditions.

In this alternative, high severity fire would continue to be a risk, but fire in treated areas would typically have acceptable fire behavior, making it easier to protect WUI areas. Potential impacts during high severity events would be less in terms of both direct impacts, i.e., property loss and damage as a result of fire in the Wildland Urban Interface, and the indirect impacts of closures and other actions, i.e., loss of business and its economic effect. Under this alternative, the risk of high severity fire would remain, but fire behavior would be less severe, because of the amount of prescribed fire and Wildland Urban Interface treatment that would occur on an annual basis. There would be up to 3,000 acres treated per year with prescribed fire and another 600 acres of WUI treatment. At this level of accomplishment, it would be possible to accomplish restoration objectives and to reduce the risks of large, high intensity, high severity fire, meaning the size and effect of these fires when they occur. Fuel hazard reduction around developments would reduce the potential of direct economic loss within the planning area. Any direct impacts in Wildland

Urban Interface that would occur because of high severity fire would still likely be adverse, long-term and major, but the potential of these impacts occurring would be greatly reduced under this alternative.

The potential for large, high severity fires would not be gone under this alternative, but the potential for indirect impacts, in the form of revenue loss due to park closures, would be lower. It would be difficult to estimate the duration of any possible closures under this alternative, but closures would be fewer and, when they occurred, shorter, because fire behavior in treatment areas would generally be more acceptable and manageable. Economic impacts on a per visitor basis would most likely be the same as in Alternative I, but closures would likely be of shorter term, as fires would reach treatment areas. A fire like the Kanaka, had it encountered scattered fuel treatment areas, would possibly have been less difficult to manage, and it would have been possible to do so in a shorter period of time. Thus, the potential economic impacts of a closure would have been adverse, short-term and minor, less than under a scenario similar to the Kanaka fire under Alternative I.

It should be noted that total park closures have been very rare in the history of Whiskeytown. Also, actual fire conditions (i.e., when and where a fire would occur) would dictate the values at risk, the measures needed to assure public safety, the extent of closure needed to assure public safety, and thus any resulting economic impacts. The indirect threats for economic losses from fires within the planning area could be increased by prescribed burning in hazard fuels near boundaries of the planning area. The element of risk is primarily the chance of escape of a fire from the planning area on to economic use lands, or loss of structures. However, the precautions in place in conducting this program would minimize this risk. Actual fire events are very difficult to foresee, but closures under this alternative would likely have adverse, short-term and minor impacts, compared to Alternative I.

Expected adverse impacts for the tourism industry would be greater initially than for Alternative I, but decrease over time as fuels treatment leads to a reduction in fuels across the park. Adverse impacts could be partially mitigated through proper planning for prescribed fire events, reducing their randomness and subsequent impact upon the community.

Prescribed fire would be the primary tool used to reduce risks associated with fire in and near Wildland Urban Interface (Oak Bottom, Brandy Creek, Whiskey Creek, Park Headquarters, and others). Under this alternative, up to 3,000 acres would be burned per year, and much of this would be in combination with an average of 600 acres of Wildland Urban Interface work (thinning and fuel reduction) per year. This work would be done to accomplish objectives for restoring plant community structure and

reducing risks around WUI areas. With the amount of WUI treatment that would be done annually, it is likely that risks would be greatly reduced during the life of the plan. The potential for high severity fire in WUI areas would be greatly reduced as a result. Prescribed fire under this alternative would have beneficial, long-term and major impacts.

Prescribed fire use in WUI areas would impact residents through smoke and site closures. During prescribed fire activities, residents and visitors would be effected through localized safety closures and equipment noise. People would likely be able to partake in their chosen activities in another, nearby location, with limited or no restrictions, but smoke would effect all 'downwind' and 'in-basin' locations in the area. Some residents would have concerns about the smoke, while others would want the work to move forward, to provide the fire protection and ecosystem restoration benefits. This latter group would be supportive. Overall, these impacts upon local communities would be adverse, short-term and minor.

There is risk and uncertainty associated with implementing a successful fire management strategy that includes prescribed fire. One of the goals of the program is to do enough fuels treatment in enough places to influence wildland fire in the intended ways. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Less than 100 acres of thinning would occur in Wildland Urban Interface areas to reduce risks. However, because of the increase in the amount of biomass removal through mechanical means under this alternative, overall risk in communities would be less. As a result, hand-thinning would contribute to an overall reduction in risk, but its contribution would be similar to that of Alternative I, beneficial, long-term and minor.

Alternative II would utilize Mechanical Treatment Level 2 to remove biomass in designated prescribed fire units and on shaded fuel breaks, where appropriate. This would be used in combination with hand-thinning and chipping, as in Alternative I. There is a major increase in fuels reduction work compared to no action, and would greatly reduce risks of high severity fire and loss of property in the developed areas in the park and communities adjacent to the park. The effect would be beneficial, long-term and moderate to major. Equipment use would occur along and within WUI areas. During periods when equipment is in use, visitors would be effected through localized safety closures and equipment noise. People would likely be able to partake in their chosen activities in another, nearby location, with limited or no restrictions, but noise levels could be a concern to some. Some visitors would have concerns about equipment use in the national park, while others would want the work to move forward, to provide the fire protection and ecosystem restoration benefits. This latter group would be supportive. These impacts upon local communities would be adverse, short-term and minor.

Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Thus, the impacts of infrequent closures under Alternative II would remain adverse, short-term and moderate. Fire management-related projects would include the continued expansion of the shaded fuel break system, utility right-of-way maintenance piling and burning, fire management planning for BLM areas, and others. These actions would result in impacts similar to fire management activities in the national park, with the same types of risks. These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long-term, beneficial and moderate impacts of these actions, the moderate impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative II would potentially become beneficial, short-term and moderate.

Payroll size would increase through the addition of additional operations crews and resources. Payroll would increase to approximately $900 thousand annually. Total additional dollars for program support and proactive fuels management would increase to about $800 thousand annually. The park fire management organization would be required to expand. Because the risks associated with large, high severity fires would be greatly reduced in this alternative, direct impacts (loss of property during fires) and indirect impacts (loss of business during fire-related closures) would be greatly reduced compared to No Action. This is because prescribed fire and mechanical thinning would restore plant community conditions in WUI areas to within the range of target conditions, reducing the risk

of high severity loss. The potential for fire-related closures and other impacts would also be lower. As a result, the overall affect of this alternative on local communities would be beneficial, long-term and moderate to major.

Under Alternative II, there are no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative II are the same as those discussed in Alternative I.

Alternative III

Costs of this traditional strategy are being increasingly borne by higher public expenditures. In the short-term, suppression is the most economic fire management alternative. There would be a reduction of economic loss from suppression of potentially damaging fires. However, this program would be costly. Over the long-term, however, the costs of this program steadily increase in a relationship with fuel accumulation, and its corollary: resistance to fire control. The increase in potential for high severity fires could cause economic disruption from loss of exploitable natural resources outside the park boundary and deterioration of visitor experience within the park. There are local economic impacts from employment of fire suppression personnel and support services. The increasing potential of high severity fire poses direct and indirect threats to capital improvements, economically significant natural resources, and human safety due to the difficulty of the suppression effort.

This alternative would have the least amount of Prescribed Fire, per year, among the action alternatives, although this alternative would also have the most shaded fuel break acres treated. The treatment acreage would be significantly less than under No Action, resulting in adverse impacts upon and risk levels for local communities that would be greater than under Alternative I, No Action. But the level of risk from the impacts of high severity fire would remain high and would be the greatest among the action alternatives. The amount of annual accomplishment for WUI work would meet objectives for protecting these areas within approximately 10 years, but the ecosystem restoration work would probably never be achieved, meaning the potential for large, high intensity high severity fire would remain high for much of the implementation period. Even with the WUI work completed, large fires could potentially run through the area and put WUI areas at risk, despite efforts to hold the fires and protect communities. The impacts of high severity fire would be similar to Alternative I, except that risks for local communities would be abated by the schedule for WUI treatment, which would put protective areas around the communities within ten years. A slightly higher level of adverse impacts on tourism would be expected due to the random nature of the ignitions. Unplanned ignitions managed for suppression during the fire season without prior restoration of natural fuel loads could lead to more smoke production during the tourist season. Mitigation strategies would be more limited than with prescribed fire treatment (Alternative II) or combined strategies (Alternatives I and IV). Prescribed fire operations typically occur within a defined project area. Approximately 250 acres would be treated in an average year, compared to 1,400 acres pre year under No Action, increasing the risks associated with high severity fire, compared to No Action. Even with this amount of annual work, however, it would still be very unlikely that the park could accomplish ecosystem restoration objectives, meaning that the risks associated with high severity fire would remain high through much of this period. Impacts of prescribed burning on local communities would be beneficial and long-term, but moderate.

This alternative utilizes Level 2 mechanical treatment to reduce biomass and fuel loading. There would be approximately 450 acres of mechanical treatment work and 1100 acres of shaded fuel break work completed in WUI areas per year. This would accomplish WUI objectives for protection of park resources and local communities in approximately 10 years, reducing risks near communities compared to No Action. Although high severity fire potential would remain great, the opportunity to protect these communities would be improved compared to No Action. The impacts of biomass removal would be beneficial, long-term and moderate to major.

Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Thus, the impacts of infrequent closures under Alternative III, would remain adverse, short-term and moderate. Fire management-related projects would include the continued expansion of the shaded fuel break system, utility right-of-way maintenance piling and burning, fire management planning for BLM areas, and others. These actions would result in impacts similar to fire management activities in the national park, with the same types of risks.

These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long-term, beneficial and moderate impacts of these actions, the moderate impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative III would potentially become beneficial, short-term and moderate.

Under Alternative III, there are no irreversible and irretrievable commitments to resources.

Cumulative impacts for Alternative III are the same as those discussed in Alternative I.

The park fire management organization would remain at about the same staffing level.

Total payroll and total support dollars available would be the same as Alternative II.

Alternative IV

This alternative would have an intermediate amount of Prescribed Fire and WUI Treatment per year. The treatment acreage would be greater than under No Action, reducing the impacts upon and risk levels for local communities. The amount of acres treated annually would meet objectives for protecting WUI areas within 6 to 8 years, greatly improving the opportunity to protect communities in and near the park from fire. Initially, the impacts of this alternative would resemble Alternative II. There would be the expenses associated with programs and fire suppression operations. The park fire management operations would expand. Theoretically, at some future time (an undefined condition of reduced risks of wildland fire escape from lighter fuel loads and broken continuities of natural fuels), costs of such programs would decrease. Potential for economic losses resulting from damages to economic values would be reduced, as would disruptions to visitor uses. The impacts of high severity fire would be similar to those under Alternative II. There would be approximately 2,200 acres treated with prescribed fire in an average year, compared to 1,400 acres per year under No Action, reducing the risks of high severity fire compared to No Action. Impacts of prescribed burning on local communities would be beneficial and long-term, and major.

Alternative IV is the only alternative to include Mechanical Treatment Level 3. There would be approximately 640 acres per year of mechanical treatment work completed in WUI areas and 955 acres per year of shaded fuel break work. This would accomplish WUI objectives for protection and ecosystem restoration in 6 to

8 years, reducing risks near communities compared to No Action. Although potential for large fires would remain, the opportunity to protect these communities would be improved compared to No Action. The impacts of biomass removal would be beneficial, long-term and major. Although the Redding area is growing rapidly, it is unlikely that any major development would occur in the communities adjacent to Whiskeytown which would have an effect upon visitation. Anticipated adverse impacts on tourism would parallel Alternative I. There would be a potential for an initial increase in impacts as treatment activity increased, but long-term impacts from individual events would be reduced over time as fuels were restored to more natural levels. Thus, as in No Action, the impacts of infrequent closures under Alternative IV would remain adverse, short-term and moderate. Fire management-related projects would include the continued expansion of the shaded fuel break system, utility right-of-way maintenance piling and burning, fire management planning for BLM areas, and others. These actions would result in impacts similar to fire management activities in the park, with the same types of risks. These actions would potentially reduce risks of high severity fire and restore resources on and near the boundaries of Whiskeytown. Considered in combination with the long-term, beneficial and moderate impacts of these actions, the moderate to major impacts of the treatments in the Whiskeytown Wildland Urban Interface under Alternative I would potentially become beneficial, short-term and moderate to major. Payroll size would increase by roughly one-fifth with the addition of operations crews and support staff. Total payroll would increase to approximately $1 million annually while. Total additional dollars for program support and proactive fuels management would be approximately $1.2 million annually. The budget for this program would be the highest of all alternatives, resulting in more economic benefit to local economies from that source.

Under Alternative IV, there are no irreversible and irretrievable commitments to resources. Cumulative impacts for Alternative IV are the same as those discussed in Alternative I.

Cost Analysis

Annual program costs and costs per acre vary by alternative. To respond to emergencies and

unwanted fires, under all alternatives, a core suppression program is assumed. That core suppression capability remains constant across the alternatives, with changes in strategies and accomplishments to achieve additional resource management and ecosystem objectives accounting for most of the variation in overall costs between alternatives. These figures are estimates that take into account the funds needed to control and suppress infrequent, but expensive, large wildland fires events. Such unwanted events are expected to occur several times each decade under all alternatives. Research conducted by Colorado State University show those alternatives that restore more park acres over time, and those that use fire more deliberately and less randomly, eventually result in a reduction in the rate of fires requiring aggressive suppression and a consequent increase in overall economic return (Omi et al, 1999).

In order to estimate the cost of each alternative, average operational cost estimates for each strategy were derived from budgets based on the existing fire management program in the park. The following tables examine the costs for each alternative by treatment strategy. They are based on current and projected payroll costs as well as the cost for conducting fire operations as described in the fire management plan. The table depicts the anticipated relative effect of different alternatives on local business based on program expenditures, including the relative effect of each alternative on tourism. In a comparison of the relative impacts of the four alternatives on tourism, both Alternatives I and III would have a moderately adverse impact. Alternatives II and IV, on the other hand, would have a slightly adverse to negligible beneficial impact.

Based on data from 1995-2001, the average costs per acre for each strategy are as follows: the per-acre figures in the tables above were multiplied by the estimated acreage for each strategy under each alternative (see explanation in Chapter 2) and rounded to the nearest hundred dollars. Fixed program costs necessary to maintain core suppression capabilities and manage the program were then added to come up with a total program cost estimate for each alternative. Fixed program costs from the year 2001 were used for the first three alternatives. For Alternative IV, an estimated budget for the proposed program was derived from estimates by the national fire office, approximating the most efficient staffing level.

Conclusion: Alternative I demonstrates the lowest overall program cost while Alternative II shows the lowest cost per acre of all alternatives. Alternative I fails to achieve significant natural resource objectives while Alternative II, through optimizing the use of prescribed fire, provides a cost-effective alternative while achieving most objectives,

Economic benefit to local communities would be proportional to program expenditures

	Alternative I	Alternative II	Alternative III	Alternative IV
Direct Payroll	$800,000	$900,000	$900,000	$1,000,000
Support Costs	$120,000	$135,000	$135,000	$180,000
Contracts	$600,000	$800.000	$900,000	$1,200,000
Total Program Expenditures	$1,520,000	$1,835,000	$1,935,000	$2,380,000

Average cost per acre by treatment for each alternative

Strategy	Cost per acre	% of Acres -- 1990's	
Mechanical Treatment	Level 1: $1,600/acre Level 2: $1,000/acre Level 3: $800-1,000/acre	N/A	N/A
Small Fire Suppression	$6,000/acre for fires < 10 acres	96%	2%
Large Fire Suppression	$6,000/acre for fires > 10 acres	4%	98%
Prescribed Fire	$225/acre	N/A	N/A

having the second lowest overall program cost. Alternative III has the highest cost per acre with less certain outcomes for achieving program objectives due to the lack of proactive fuels management. Alternative IV has the highest overall program cost and third lowest cost per acre and fully achieves all program objectives.

The potential for high severity fire remains high in all of the alternatives for the life of this plan, as many areas of the park are being treated for the first time. The risk for direct impacts (loss of property during fires) and indirect impacts (loss of business during fire-related closures) is high in Alternatives I, II, and III, although it would probably be highest in Alternative I. The risk in Alternative III for direct impacts (loss of property during fires) and indirect impacts (loss of business during fire-related closures) would be reduced compared to No Action, but would remain the highest among the action alternatives. This is because of a lesser amount of annual prescribed fire and mechanical thinning accomplishment to restore plant communities in WUI areas and elsewhere in Fire Management Unit 1. The potential for fire-related closures and other impacts would also be only slightly lower than under No Action. Overall, the effect of Alternatives I, II, and III on local communities would be beneficial, long-term and moderate.

The risks associated with large, high severity fires would be reduced in Alternative IV, compared to No Action. The risk in Alternative IV for direct impacts (loss of property during fires) and indirect impacts (loss of business during fire-related closures) would be greatly reduced compared to No Action, and would be intermediate among the action alternatives. This is because of the amount of annual prescribed fire and mechanical thinning accomplishment. The potential for fire-related closures and other impacts would also be lower than under No Action. As a result, the overall effect of this alternative on local communities would be beneficial, long-term and moderate to major.

It is unlikely that the combination of prescribed burning, shaded fuel break construction, and mechanical treatment would reduce the risk of unwanted fire to significantly decrease the potential economic loss to the community. As a result, the overall effect is beneficial, long-term and minor. There would be no impairment under this issue.

Recreation

Impacts and Issues Common to all Alternatives

All alternatives require some level of fire management operations which generally include fire detection, suppression, monitoring, igniting, and holding. Depending on location and time of year, these operations may cause temporary impacts to individual recreational experiences. Impacts include; noise from aircraft and other power equipment such as chain saws and portable pumps, and temporary closures of roads, trails, or facilities to protect visitors from direct exposure to fire events. Smoke from fires may restrict visibility and impact view sheds, or become heavy enough to become a nuisance. The health impacts to visitors from smoke are addressed in Health and Safety (above).

However, given the relatively short duration of the average visit and the ability to be both mobile and flexible enough in itinerary to avoid smoke, exposure during the typical visit is minimal.

Under all of the proposed alternatives, large, high severity fires are probable throughout the park until the majority of the park is restored to its natural function. Because fires have been, and would continue to be, suppressed, fuels build up and the plant community structure changes. It is unlikely that this situation would change during the period of this Fire Management Plan. If there were to be a large, high severity fire, visitors may be excluded from the park until the fire were controlled, impacting visitors during this period of time. Although it is possible that closures could be implemented on a limited-area basis, many would most likely be park-wide in nature, and affect all visitors as a consequence. During these closure periods, the impacts would be adverse, short-term and major, affecting all visitors. These events would likely occur during peak visitation periods, and over a limited time frame. Fire, when functioning to restore or maintain natural processes and conditions, helps to shape and renew the vegetation and wildlife habitats that are integral parts of many recreational pursuits in the park. Fire events may also create unique opportunities for visitor experiences and educational opportunities. The impacts of some fires, such as facilitating the germination of various tree species, and stimulating wildflower displays, may provide beneficial experiences. No alternative proposed in this document includes a goal of impairing park recreational resources.

The placement of the fire cache in Oak Bottom and the construction of a new park administration building in the current park

headquarters compound would have similar impacts on recreation and park visitor experiences. In both cases there would be some moderately adverse, though short term, impacts caused by the construction noise and construction site management. Mitigation of these impacts could be accommodated through the timing of construction so that it does not interfere with heavy visitor seasons. In the long term, however, both facilities would have a major beneficial impact from significantly improved ability of the National Park Service to provide services to visitors. Oak Bottom campers and day use visitors would be easily reached by the public outreach and fire education programs. Park headquarters visitors would be more easily accommodated—meeting space within a new facility would mean a more central public meeting site; additionally, employees dispersed through the compound would be centralized in one location.

Methodology, regulations and policy

Fire management activities and the potential for closures, restrictions, and direct impacts are evaluated for their potential to affect visitation and an aggregate of recreational activities in Whiskeytown National Recreation Area. The analysis includes the impacts of prescribed fire, suppression and mechanical treatment on recreational experiences.

Type of Impact

Adverse – Impacts that reduce visitor participation, quality of visitor experience, and/or service level.

Beneficial – Impacts that enhance visitor participation, quality of visitor experience and/or service level.

Impact Duration

Short-term – Would be temporary in nature, during the period when a fire management activity would take place.

Long-term – Would have a permanent affect on the visitor experience.

Impact Intensity

Negligible – Imperceptible or undetectable affect upon visitor experiences.

Minor – Minor impacts would be slightly detectable or localized, upon visitor experiences within a relatively small area.

Moderate – Moderate impacts would be those that are readily apparent but that would not result in limits on activities.

Major – Major impacts would be substantial, highly noticeable impacts and/or impacts that would result in limits on activities.

The enabling legislation for Whiskeytown states that the park is to "provide...for the public outdoor use and enjoyment…by present and future generations, and for the conservation of scenic, scientific, historic, and other values contributing to public enjoyment of such lands and water." The National Park Service Act of 1916, which outlines the fundamental purpose of the National Park System, directs the National Park Service to allow for public use and enjoyment of national parks, provided that the resources therein remain unimpaired for future generations.

Alternative I

The impacts from fire management activities under this alternative would be similar to those described in "common to all," as there are no new programs or activities expected to alter visitors recreational experiences. The shaded fuel breaks that are currently being installed are on ridge tops far from areas of normal recreational use. Prescribed fires would continue to be scheduled and managed in ways that limit their impacts upon visitors. The amount of prescribed fire activity in the No Action alternative would be second least among the alternatives (approximately 1,400 acres treated per year). Impacts upon recreational activities, including hiking, biking, and touring, would generally be limited to small, local-scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire project boundary. Very few people would be unable to partake in their chosen activity, although some would have to relocate. Smoke would affect more visitors than closures and restrictions. However, because prescribed fires would be ignited only under certain atmospheric conditions, the greatest smoke impacts would generally be localized. Impacts would be adverse, short-term, and minor.

Mechanical treatment activities that are currently being employed would continue under this Alternative. Most hand-thinning activities involving the use of chain saws would have negligible to minor, short-term and adverse impacts upon recreation. Piles of fuels would have the potential to affect scenic quality, but generally piles would be located to limit visibility and other impacts. Pile burning would generally be limited to small, local- scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire boundary. Very few people would be unable to

partake in their chosen activity, although some would have to relocate. Smoke would affect more visitors than closures, but because the piles would be burned under atmospheric conditions specified by the county, the smoke impacts would generally be localized. Impacts would be adverse, short-term and minor. Chipping would affect visitors through small, localized, safety closures that would not limit visitors in their activities. Noise from the chipper would be the greater affect upon visitors. Some would move to another location to avoid the noise. Impacts would be adverse, short-term and moderate to major.

Under Alternative I, there would be no irreversible and irretrievable commitments to resources.

Cumulative Impacts: There have been very few actions taken inside or outside the park in the past to affect recreational opportunities. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long-term and minor.

Alternative II

In the short-term, this alternative may result in slightly increased adverse impacts to recreational use compared to Alternative I due to more aggressive implementation of a prescribed fire program. Impacts would take the form of occasional closures of roads or back country areas to implement fire operations. This alternative would have fewer adverse impacts on recreational use than Alternative III due to the fact that only Level 1 mechanical treatment would be employed to reduce fuel loadings and less than Alternative IV due to more rigid control over timing and placement of ignitions. Over the long-term, random and aggressive suppression actions would be reduced as more of the park was restored to natural fuel loads and forest density, reducing the duration and number of closures and smoke events.

Under Alternative II, prescribed fires would continue to be scheduled and managed in ways that limit their impacts upon visitors. The amount of prescribed fire activity in this alternative would be the greatest among the alternatives (approximately 3000 acres treated per year), more than twice the amount under Alternative I. Impacts upon recreational activities, including hiking, biking, and scenic touring, would generally be limited to small, local-scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire project boundary. Very few people would be unable to partake in their chosen activity, although some would have to relocate.

With the number of acres being treated annually, the potential for these impacts would increase compared to No Action. The increase in prescribed burning would result in additional short-term impacts from smoke generated by more burning. Smoke would still affect more visitors than closures and restrictions. However, because prescribed fires would be ignited only under certain atmospheric conditions, the greatest smoke impacts would generally be localized. Impacts would be adverse, short-term, and minor.

The impacts from chain saw use and chipping would decrease under this alternative as a result of narrower fire lines and shaded fuel breaks. Fire lines would be installed exclusively as prescribed burn unit boundaries, so they would be narrower and require less mechanical work to be installed. Level 1 mechanical treatment activities would be implemented under this alternative, as in Alternative I. Most hand-thinning activities involving the use of chain saws would have negligible to minor, short-term and adverse impacts upon recreation.

Chipping would affect visitors through small, localized, safety closures that would not limit visitors in their activities. Noise from the chipper would be the greater affect upon visitors. Some would move to another location to avoid the noise. Impacts would be adverse, short-term and moderate to major. Piles of fuels would have the potential to affect scenic quality, but generally piles would be located to limit visibility and other impacts. Although more acres would be treated in this alternative than in No Action, hand-thinning activities would still have only negligible to minor, short-term and adverse impacts on recreation, as in No Action. Pile burning would generally be limited to small, local- scale closures and site restrictions, with most visitors being able to recreate elsewhere, outside of the prescribed fire boundary. Very few people would be unable to partake in their chosen activity, although some would have to relocate. Smoke would affect more visitors than closures, but because the piles would be burned under atmospheric conditions specified by the county, the smoke impacts

would generally be localized. Impacts would be adverse, short-term and minor.

Under Alternative II, there would be no irreversible and irretrievable commitments to resources. Cumulative impacts for this alternative II are the same as those discussed in Alternative I.

Alternative III

This alternative would have the least amount of prescribed fire and be in the mid-range in terms of mechanical treatment acreage treated among the action alternatives. The impacts upon recreation would be similar to that of Alternative IV in that the shaded fuel break system would be greatly expanded under both alternatives. This alternative is similar to Alternative IV in that both mechanical treatment levels 1 and 2 would be employed to remove biomass and reduce fuel loadings.

Prescribed fires would be used only to ensure fire fighter safety by installing new shaded fuel breaks in the park utilizing pile burning and small prescribed burns, resulting in the least impact to visitors to Whiskeytown. Mechanical treatment impacts would be the same as Alternatives I and II except for the use of brush clearing machinery, which would affect visitors through localized safety closures and equipment noise. Visitors would, however, be able to partake in their activity, including hiking, nature study and scenic touring, in another, nearby location, with limited or no restrictions. Some visitors would have concerns about equipment use in the national park, while others would understand the rationale for its use and would be supportive. Overall, the impacts upon recreation would be adverse, short-term and minor.

Under Alternative III, there would be no irreversible and irretrievable commitments to resources. Cumulative impacts for this alternative III are the same as those discussed in Alternative I

Alternative IV

This alternative would be slightly higher than mid-range in terms of the amount of prescribed fire and would result in the greatest amount of mechanical treatment among the action alternatives. The treatment acreages for both would be greater than under No Action. The impacts of prescribed fires upon recreation would be the same as Alternatives I and II. This alternative would result in the most adverse impacts to recreational use of all the alternatives due to the removal of whole trees by mechanical means. More closures could be necessary due to the random nature of natural ignitions. This would be offset by the increase in proactive fuels management to reduce fuel loadings through mechanical and prescribed fire treatments.

This alternative includes the use of Level 3 mechanical treatment (small-scale logging), which could have impacts upon recreation. This form of biomass removal would affect visitors through localized safety closures and equipment noise in Fire Management Unit 1 (Front country) and selected areas in FMU 2. Visitors would, however, be able to partake in their activity, including hiking, biking, and scenic touring, in another, nearby location, with limited or no restrictions. Some visitors would have concerns about equipment use in the national park, while others would understand the rationale for its use and would be supportive. Overall, the impacts upon recreation would be adverse, short-term and minor.

Under Alternative IV, there would be no irreversible and irretrievable commitments to resources. Cumulative impacts for Alternative IV are the same as those discussed in Alternative I

Conclusion: None of the Alternatives would cause impairment of recreational opportunities. All alternatives have potential to cause short-term localized adverse impacts to recreational use, but these impacts would be transient. Alternatives that restore and maintain more of the park ecosystems in a naturally functioning state would provide the best quality environment for visitors, as well as optimize opportunities for educational and scientific pursuits.

Visual Resources

Impacts and issues common to all alternatives

Each of the alternatives includes fire management activities which may cause both short-term and long-term impacts depending on location and time of year. These impacts may have both direct and indirect impacts on the visitor. Direct impacts include the visual impacts of hand lines, shaded fuel breaks, and mechanical treatment work as well as the post-fire impacts such as mortality of trees and scorching of foliage and charring of bark, especially along roadways and in developed areas. Indirect impacts include the impacts on park visitation and the memories of park visitors

impacted by the sight of large, high severity wildland fires.

Under all alternatives, large, high-intensity, high severity fires are likely to occur throughout the park until the majority of the park is restored to its natural function. Because fires have been, and would continue to be, suppressed fuels build up and the plant community structure changes. It is unlikely that this situation would change during the life of this revised Fire Management Plan. If the result of these conditions resulted in a large, high severity fire, there may be a major impact on scenic quality. In this case, the impact on scenic quality would be adverse, long-term and major under all alternatives.

Impacts of prescribed fires may be viewed differently by the visiting public. Both the direct and indirect impacts of charred vegetation are the same under all alternatives. Under normal burning conditions, prescribed burns normally result in a mosaic burning pattern where the vegetation grows back shortly after the burn. Chipping would result in local area impacts that would be limited to evidence of activity, through the concentrations of wood chips left behind. Chipping would not be a major feature on a landscape/scenic view scale. These impacts would be adverse, short-term and negligible. The majority of fuels generated from shaded fuel break and prescribed fire site preparation are piled on site and burned at a later time. This activity has two potential impacts on scenic resources. First, piles of stacked fuels would be visible, and potentially within major scenic views. Second, burned piles would leave a pattern of burned area that would not appear natural. Both impacts would be adverse, short-term and minor.

Relocation of the fire cache and construction of a new administrative building in the present park headquarters compound will not have any adverse impacts to viewsheds, per se—though the construction of a new administrative building could mean improved aesthetics from the removal of several buildings that lack significant architectural style or continuity with the landscape. The construction of a new building would be completed with a site design that incorporates an appreciation of the green space in the headquarters area. The relocation of the fire cache would be completed in an area currently occupied by a storage building and fire engine bay. There is not expected to be any adverse impacts to viewsheds, though a similar argument for the improvement of aesthetic values could be made by improved site designs that integrate green space and native vegetation. No alternative in this document includes a goal of impairment to park visual resources.

Methodology

Fire management activities and operations, high severity fire and smoke from fire sources are evaluated for their potential to affect scenic quality in major scenic views, such as Whiskeytown Lake, along road corridors, and in undeveloped areas of the park. Under this topic, the alternatives are evaluated on what may be considered a more subjective basis, as the impacts are not quantifiable as they are in other areas.

Impact Type

Adverse – Impacts would be considered adverse if the visual quality would be degraded.

Beneficial – Impacts would be considered beneficial if the visual quality would be improved.

Duration

Short-term – Short-term impacts would be short-lived or temporary, occurring primarily during fire management treatment activities (prescribed fire, biomass removal, etc.), or just shortly thereafter.

Long-term – Long-term impacts would be permanent or continual - in other words, the impacts would continue well after the activity period for the treatment.

Intensity

Negligible – Imperceptible or undetectable.

Minor – Minor impacts would be slightly detectable or localized within a relatively small area.

Moderate – Moderate impacts would be those that are readily apparent.

Major – In areas of scenic value, major impacts would be substantial, have highly noticeable impacts and/or result in changing the character of the landscape.

Alternative I

This alternative continues the current fire management program. There would continue to be visual impacts from already-planned shaded fuel break construction projects, prescribed burns, wildland fires, and post-burn fire impacts.

As in other areas of impact analysis, the potential impacts from wildland fires is the most important consideration, even though we cannot predict when and where wildland fires would occur. The risk associated with implementing prescribed fire and fuel treatment activity is still lower than the threat of wildland fire, even when one considers potential smoke emissions and escaped prescribed fires. Most of the uncertainty in implementing a successful fire management strategy is associated with doing enough fuels treatment in enough places to influence wildland fire in the intended ways. Alternative I proposes localized strategies to reduce hazardous fuel conditions in Whiskeytown National Recreation Area.

The greatest potential for high severity fires would be in Fire Management Unit (FMU)1 and along the margins of FMU 1, the suppression area of the park. All of the park developed areas as well as the Shasta Divide area on the eastern boundary are all within or along FMU 1, and forest conditions around each of these areas are among the most changed in the park, due largely to past and successful fire suppression activities. The impacts of high severity fire on scenic quality in these areas would be adverse, long-term and major. Under this alternative, the potential for more fires of significant size and intensity would remain high. If fires occurred along major road corridors, or near scenic vistas, the impacts would be adverse, major, and potentially long-term. Prescribed fire can be used as a tool to maintain or minimize impacts to the sensitive scenic resources, such as in the developed areas and highly visible areas around Whiskeytown Lake. It can also have impacts that would be considered potentially adverse to the front country visitor that is an infrequent visitor to parks and natural areas. Fire would be infrequently prescribed as a tool for maintaining open scenic views, and this would generally be incidental to accomplishing vegetation management objectives. This acreage would only be a small portion of the 1,400 acres treated per year on average, and most would be in either Brandy Creek, Oak Bottom, or Whiskey Creek. Prescribed burning could also be used to reduce fuel loadings and mitigate severe wildland fire impacts to the visual resource. Some would see the local impacts of burning as adverse, but public acceptance of the prescribed fire program has increased to the point that local impacts would not be seen as adverse by most. Impacts of prescribed burning on scenic resources would be generally beneficial and long-term, but minor, because of the limited number of acres treated.

This alternative only includes mechanical treatment level 1, so there would not be any whole tree removal or brush mastication by mechanical means. Actions associated with shaded fuel break and prescribed fire unit boundary construction, and mechanical treatment would be visible to visitors within the immediate area of work, but would not typically be seen within scenic views, when viewed on a landscape scale. Impacts would be adverse, short-term, and minor. Hand-thinning is not currently used as a tool to restore and maintain open vistas in Whiskeytown, but chipping could be used to dispose of cut vegetation. Chipping would result in local area impacts that would be limited to evidence of activity, through the concentrations of wood chips left behind. Chipping would not be a major feature on a landscape/scenic view scale. These impacts would be adverse, short-term and negligible.

Cumulative Impacts: There have been very few actions taken inside or outside the park in the past to affect scenic resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long-term and minor.

Considered in combination with these impacts, the impact of Alternative I, No Action on scenic resources would remain beneficial, long-term and minor.

Alternative II

The impacts of this alternative on scenic resources would be similar to that of Alternative I, except that under this alternative, prescribed fire would be significantly increased and could be used as a tool for restoring and maintaining scenic resources. Although Whiskeytown does not have any specific plans in place to address scenic vistas, there are areas in which prescribed fire could be employed to improve aesthetics and vistas. This acreage would only be a small portion of the 3,000 acres per year treated on average, but the actions would clear scenic views of forests that have become overstocked and degraded over the past century. Prescribed fire would also cause impacts that would be considered adverse to some front country visitors, so education efforts

would be needed to explain objectives and the role of fire in natural systems. However, public acceptance of the prescribed fire program has increased to the point that local impacts would not be seen as adverse by most visitors. Impacts of prescribed burning on scenic resources would be generally beneficial and long-term, but moderate to major. Through the use of prescribed fires, areas with sensitive visual resources can be protected from fire and certain fire suppression activities. Fires could also be managed to produce a lower intensity fire, resulting in minimal change to the scenery. Fire lines around prescribed fire unit boundaries would be cut but not maintained as the shaded fuel breaks would be. These actions would be visible to visitors within the immediate area, but would not typically be seen within scenic views, when viewed on a landscape scale. Impacts would be greater than under No Action, due to the greater number of treated acres under this alternative. On the ground, visual impacts would be adverse, short-term and minor, but would contribute to beneficial, long-term and major impacts through the restoration of open scenic views.

As in No Action, this alternative only includes mechanical treatment level 1, so there would not be any whole tree removal or brush mastication by mechanical means. Actions associated with shaded fuel break and prescribed fire unit boundary construction, and mechanical treatment would be visible to visitors within the immediate area of work, but would not typically be seen within scenic views, when viewed on a landscape scale. Impacts would be adverse, short-term, and minor. Hand-thinning is not currently used as a tool to restore and maintain open vistas in Whiskeytown, but chipping could be used to dispose of cut vegetation. These impacts would be adverse, short-term, and minor.

Pile burning would occur on cut fire lines as the primary method of brush disposal but on a much smaller scale than in No Action. The piles of stacked fuels would be visible in the immediate area of work, and potentially within some scenic views. When burned, the piles would leave a pattern of burned area that would not appear natural. As in No Action, both impacts would be adverse, short-term and minor, but the amount and distribution of work would decrease substantially under this alternative due to the fact that there would be no additional shaded fuel break construction as in the other alternatives.

Cumulative Impacts: There have been very few actions taken inside or outside the park in the past to affect scenic resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long-term and minor. Considered in combination with these impacts, the impact of Alternative II on scenic resources would remain beneficial, long-term and moderate.

Alternative III

The impacts of this alternative on scenic resources would be similar to that of Alternative I, except that this alternative eliminates the adverse short-term visual impacts (scorching of foliage and charring of bark) resulting from numerous smaller and frequent prescribed fires. Infrequent, high intensity fires which would occur over the long-term would result in drastic changes in the visual appearance of the affected area. Some unsightly and potentially long-lasting scars from fire suppression activity (i.e. fire lines, stumps, pink colored retardant, etc.) may also result, even under the most carefully conducted fire suppression operations.

Under this alternative, prescribed fire would be significantly decreased and shaded fuel break construction would be significantly increased. Only a very small percentage of the 250 acres of prescribed fire per year planned under this alternative would likely target scenic vistas, compared to the 1,400 acres per year treated per year under No Action. Impacts of prescribed burning on scenic resources would be generally beneficial and long-term, but moderate to major. This alternative would increase the number of acres targeted for shaded fuel break construction to 1,100 acres per year and result in wider shaded fuel breaks than under Alternative I. Although vegetation would be left on site during the construction of the shaded fuel breaks, they could be more visible to others besides those in the immediate area of work, but generally would not be visible from scenic vistas within the park. Impacts would be adverse, short-term and minor. Mechanical treatment level 2 would be utilized in this alternative to reduce fuels with brush reduction machinery. In an average year, 450 acres would be treated. The activity would have at least two potential

impacts. First, the act of shredding vegetation and leaving it in place would result in on-the-ground impacts, such as fuel piles, vehicle tracks and soil disturbance that would have adverse impacts. Some evidence of activity, such as stump cuts, would be potentially long-term. However, with mitigation such as cleanup activities at the end of the project (raking out vehicle tracks and soil disturbance), most of these impacts would be short-term, minor and adverse. Second, biomass removal would restore forest stands to a target condition (when applied in combination with prescribed fire) that would be within the natural range of variability for the system. This would have the beneficial affect of opening up views and improving scenic quality on a landscape basis. This effect would be beneficial, long-term and potentially major, yielding benefits that would not occur under Alternative I. Pile burning would occur on cut fire lines and shaded fuel breaks as the primary method of brush disposal but on a much larger scale than in No Action. The piles of stacked fuels would be visible in the immediate area of work, and potentially within some scenic views. When burned, the piles would leave a pattern of burned area that would not appear natural. As in No Action, both impacts would be adverse, short-term and minor, but the amount and distribution of work would increase substantially under this alternative due to the fact that there would be additional shaded fuel breaks constructed.

Cumulative Impacts: There have been very few actions taken inside or outside the park in the past to affect scenic resources. Fire management and fuels treatment activities likely to occur in the future under this alternative would result in impacts similar to those in the park that result from fire management actions, including burned areas, cut stumps, evidence of holding lines, burned area rehabilitation work, and others. Some of these impacts would be potentially visible from highways entering the park, if passersby knew where to look for them. The impacts would be adverse to beneficial, long-term and minor. Considered in combination with these impacts, the impact of Alternative III on scenic resources would remain beneficial, long-term and moderate.

Alternative IV

The impacts of this alternative on scenic resources would be similar to Alternatives II and III, with their emphasis on prescribed burning and shaded fuel break construction and mechanical treatment, respectively. In developed areas and along boundaries, prescribed fire would be used to minimize the impacts to the sensitive visual resources. The use of prescribed burning to reduce fuel loadings would mitigate severe wildland fire impacts to the visual resource. Impacts from tactics to control wildland fires and prescribed fires would be similar to Alternative I. This alternative is the only alternative that utilizes mechanical treatment level 3, which includes the use of tracked and tired logging equipment. In an average year, 640 acres would be treated. The activity would have at least two potential impacts. First, the act of cutting vegetation and removing it would result in on-the-ground impacts, such as stump cuts, fuel piles, vehicle tracks and soil disturbance that would have adverse impacts. Some evidence of activity, such as stump cuts, would be potentially long-term, unless additional actions (tub grinders, for example) are used. However, with mitigation such as cleanup activities at the end of the project (raking out vehicle tracks and soil disturbance), most of these impacts would be short-term, minor and adverse. Second, biomass removal would restore forest stands to a target condition (when applied in combination with prescribed fire) that would be within the natural range of variability for the system. This would have the beneficial effect of opening up views and improving scenic quality on a landscape basis. This effect would be beneficial, long-term and potentially major, yielding benefits that would not occur under Alternative I. Cumulative impacts for Alternative IV are the same as those discussed in Alternative I.

Considered in combination with these impacts, the impact of Alternative IV on scenic resources would remain beneficial, long-term and moderate.

Cumulative Impacts: Fire management activities would affect scenic resources in generally beneficial ways, through actions that would contribute to restoring and maintaining open vistas and natural forest structure conditions. Alternative I would continue to have a high potential for major, adverse and long-term impacts. If high severity fire were to cause major impacts to areas surrounding the lake and high-visibility areas, the impact would be considered impairment. The intent of Alternatives II and III is to reduce the risk of high severity fire, thus there would be no impairment from the impacts

Chapter 5 Consultation and Coordination

The National Park Service has followed a public process to identify the issues and concerns related to fire management at Whiskeytown. From those initial scoping sessions with members of the public and other agencies, a series of alternatives were developed, analyzed and presented to the public. Public comments and responses have provided a further refinement of the decision to be made. This chapter identifies some of the formal steps that the National Park Service took and who we worked with to make sure the Fire Management Plan will meet all applicable laws, policies, and regulations.

Scoping

Notice of Intent Filed in the Federal Register

The formal scoping process was initiated on August 8, 2001 when the National Park Service published notice in the Federal Register (Volume 66, Number 153) its intent to prepare an environmental impact statement (EIS) for a revised Fire Management Plan for Whiskeytown National Recreation Area.

Public Meeting

A public scoping meeting was held on August 23, 2001 in the town of Old Shasta, in the Shasta Elementary School Multipurpose room. The meeting was advertised in the local media and letters were sent to agencies, organizations and members of the public inviting them to participate in the scoping process. Twenty members of the public attended. The National Park Service presented information about Whiskeytown's current fire management program and outlined four draft alternatives developed to increase fuel reduction efforts in the park. The meeting included a question and answer period and time for public comments.

Consultation with Federal Agencies and Sovereign Nations

Consultation with American Indians

The Redding Rancheria is the federally recognized tribe with an interest in the land and resources now managed by the National Park Service at Whiskeytown National Recreation Area. A letter was sent to Barbara Murphy, tribal representative for the Redding Rancheria. A meeting was held on August 27, 2001 with Wintu representatives Linda Malone and Carol Sinclair to discuss the current fire management program and proposed changes at Whiskeytown National Recreation Area. The protection of cultural resources is a primary concern for the tribe. Concern was also raised regarding the timing of prescribed burns to protect trees, and the associated impacts to air quality. Vandalism or damage to archeological sites during prescribed burns or other fuel reduction activities is also a concern. It was suggested that monitors from the tribe be present during these activities to prevent damage and promote mutual learning opportunities. Consultation with the Wintu Tribe, not a federally recognized group, also occured. Comments from both groups are included in the *Ethnographic Overview of Whiskeytown*.

U.S. Fish and Wildlife Service

The USFWS participated in the interdisciplinary team that developed the draft EIS and provided consultation related to wildlife issues and federally listed threatened and endangered species.

Red Bluff U.S. Fish & Wildlife Service Office
10950 Tyler Road
Red Bluff, California 96080
Phone 530-527-3043

USDA Forest Service

The National Park Service consulted with the Forest Service during meetings of the Northwest Sacramento Province Advisory Committee. Whiskeytown National Recreation Area presented information regarding the park's current fire management program and proposed changes to the fire management plan.

Shasta-Trinity National Forest
2400 Washington Ave.
Redding, CA 96001

Bureau of Land Management

The National Park Service consulted with the Bureau of Land Management (BLM) during meetings of the Northwest Sacramento Province Advisory Committee. Whiskeytown National Recreation Area presented information regarding the park's current fire management program and proposed changes to the fire management plan.

Redding Field Office
355 Hemsted Drive
Redding, CA 96002

Consultation with State Agencies

California Department of Forestry and Fire Prevention (CDF)
Shasta-Trinity Unit Headquarters
875 Cypress Avenue
Redding, CA

California Department of Parks and Recreation, Office of Historic Preservation
P.O. Box 942896
Sacramento, CA 94296-0001

Coordination with Local and Regional Agencies

Redding City Council
777 Cypress Avenue
Redding, CA 96001

Shasta County Air Quality Management District (Northeast Plateau & Sacramento Valley Air Basin)
1855 Placer Street, Suite 101
Redding, CA 96001

Shasta County Board of Supervisors
1815 Yuba Street, Suite 1
Redding, CA 96001

Trinity County Board of Supervisors
P.O. Box 1613
101 Court Street
Weaverville, CA 96093

Western Shasta Resource Conservation District
6270 Parallel Road
Anderson, CA 96007

Local Non-Governmental Organizations

Presentations on the need and purpose behind preparation of a Fire Management Plan were held for the following organizations: Redding Lions Club, Redding Rotary, Shasta-Tehama Bioregional Council and Sierra Club-Shasta Group.

Summary of Major Issues Raised During Consultation and Coordination

Issues are the concerns raised by park staff, other government agencies, and the public that were used to develop and evaluate the alternatives in this document. Concerns ranged from the impacts of wildland fire to the impacts associated with management actions taken to manage fire and reduce fuels. Planning issues discussed in this draft document include impacts to the biological environment (vegetation, wildlife), the physical environment (soils, geologic resources, water quality, wetlands/floodplains, and air quality), the cultural environment (cultural resources, sacred sites), and the social environment (health and safety, community economics, recreation, and visual resources). Impacts resulting from fire and fire management activities were analyzed for the following issues:

Threats to human health, safety and property

Alteration of historic fire regimes

The unnatural accumulation of forest fuels resulting from fire suppression

Smoke management/ impacts to air quality

Accelerated erosion

Soil compaction resulting from heavy foot traffic or equipment

Impacts to water quality

Changes in nutrient cycling

Increased exotic species resulting from vegetation and ground disturbance

Degradation of pre-historic and historic cultural resources

Role of fire in managing resource procurement sites for Native Americans

Impacts to old growth forest

Impacts to sensitive, and federally listed threatened and endangered species

Impacts to wildlife

Impacts to vegetation

Distribution List of Agencies and Organizations for the Environmental Impact Statement

The following entities received copies of the DEIS for this plan for review and comment. A mailing list of interested individual is retained at park headquarters and copies of the DEIS were also sent to those individuals. Copies of this document will also be sent to these individuals and organizations.

Federal Agencies

Advisory Council on Historic Preservation

Department of Agriculture
- Forest Service, Shasta Trinity National Forest

Department of Commerce
- National Marine Fisheries Service

Department of the Interior
- Bureau of Indian Affairs
- Bureau of Land Management
- Bureau of Reclamation
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

Environmental Protection Agency

State Agencies

California Department of Fish and Game
California Department of Forestry
California Department of Parks and Recreation and Office of Historic Preservation
California Department of Water Resources
California Department of Transportation

Local Agencies

City of Redding
Shasta County
Trinity County

American Indian Tribes

The Wintu Tribe
Redding Rancheria

Local Non-Governmental Organizations

Audubon Society
California Native Plant Society
Redding Lions Club
Redding Rotary
Sierra Club, Shasta Group
Shasta Tehama Bioregional Council

Public Comments on the Draft Environmental Impact Statement

A draft version of this document was distributed to the public for review and comment over a 60 day period ending on June 25, 2003. During that 60 day period, two public meetings were held (one in Redding on May 28 and one in Shasta on June 12) and two public tours of areas within the park that have been or need to be under fire management actions (on June 11th and 14th).

Public comments included concerns about the possible consequences of wildland fire use originally part of Alternative IV. Additionally, questions were asked about the process in which the park disseminates information and how the park implements its fire education activities. Some participants asked about what specific actions the park was currently undertaking to reduce hazardous fuels and how the Whiskeytown Environmental School is impacted by the prescribed fire activity in the eastern portion of the park.

Several public comments were received either via email or through US Mail. Each letter received is represented here with a brief notation by park staff in regards to the substantive comments. In some cases, changes to this document have been made and are reflected in the text. Recall that the comments on these letters refer to the Draft Environmental Impact Statement and do not necessarily correspond to this document in terms of pagination or even, in some cases, topic.

United States Department of the Interior

Bureau of Land Management
Redding Field Office
355 Hemsted Drive
Redding, California 96002-0910
email:cawch166f@ca.blm.gov, phone (530) 224-2100, telefax (530) 224-2172

IN REPLY REFER TO

June 23, 2003

Superintendent
Whiskeytown National Recreation Area
ATTN: Fire Management Plan
Whiskeytown, CA 96095

Re: Review of Draft Environmental Impact Statement for Whiskeytown Fire Management Plan

Dear Mr. Milestone: Jim

Please accept this letter of support for the preferred alternative of your draft environmental impact statement for the updated Fire Management Plan. The Bureau of Land Management Redding Field Office manages public lands along the Whiskeytown Unit boundary to the east, west and north. We share similar vegetation conditions and are currently addressing similar land management issues with areas of heavy fuel loads due to decades of fire suppression, and challenges in maintaining healthy ecosystems while protecting public safety.

Our field office recently completed a Fire Management Plan for 16,000-acres of BLM public land within the Grass Valley watershed along Whiskeytown's western boundary. This plan identifies similar fire management activities as stated in your EIS that strive to protect and maintain watershed health. We are implementing projects such as strategically located shaded fuel breaks, prescribed fire, and mechanical treatments such as timber stand improvement.

The 1995 Federal Wildland Fire Policy has guiding principle's that call for interagency coordination and standardization of policies and procedures. Alternative IV in your EIS would provide the most opportunities for coordination and implementation of interagency fire management projects. The BLM would like to ensure that both our agencies cooperate in future fire and fuels management activities. Integrated projects will be more cost effective to the taxpayer and achieve more landscape scale vegetation management results.

If you have any additional questions regarding our BLM fire management program or need additional input regarding your draft EIS please contact our Fire Management Officer, Walter Herzog at 224-2124. We look forward to a newly updated fire management plan.

Sincerely,

Chuck

Chuck Schultz
Field Office Manager

By selecting Alternative IV, the National Park Service will be promoting the 1995 Federal Wildland Fire Policy of increased cooperation and coordination with surrounding jurisdictions.

There are widespread general concerns about potential smoke impacts from prescribed fires throughout the western United States. These concerns are ameliorated in this plan through cooperation and coordination with the Shasta Air Quality Management District.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

June 20, 2003

Jim Milestone, Superintendent
Whiskeytown National Recreation Area
P.O. Box 188
Whiskeytown, CA 96095-0188

Subject: Draft Environmental Impact Statement (DEIS) for Whiskeytown Fire Management Plan, Shasta County, California (CEQ #030190).

Rating: Lack of Objections (LO)

Dear Mr. Milestone:

The U.S. Environmental Protection Agency (EPA) has reviewed the above-referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508) and Section 309 of the Clean Air Act.

The DEIS analyzes options for managing fire and fuels at the Whiskeytown National Recreation Area. Alternative IV (Multiple Strategy Program) has been identified as the preferred alternative. In general terms, we found the document to be quite thorough. Our review revealed no significant environmental concerns with the preferred alternative. Although we have general concerns regarding potential smoke impacts, we believe these impacts have been adequately disclosed, and appropriate mitigation measures have been adequately described.

For the reasons above, we have rated the preferred alternative as Lack of Objections (LO). EPA's rating and a summary of our comments will be published in the *Federal Register*. Please see the enclosed Rating Factors for a description of EPA's rating system.

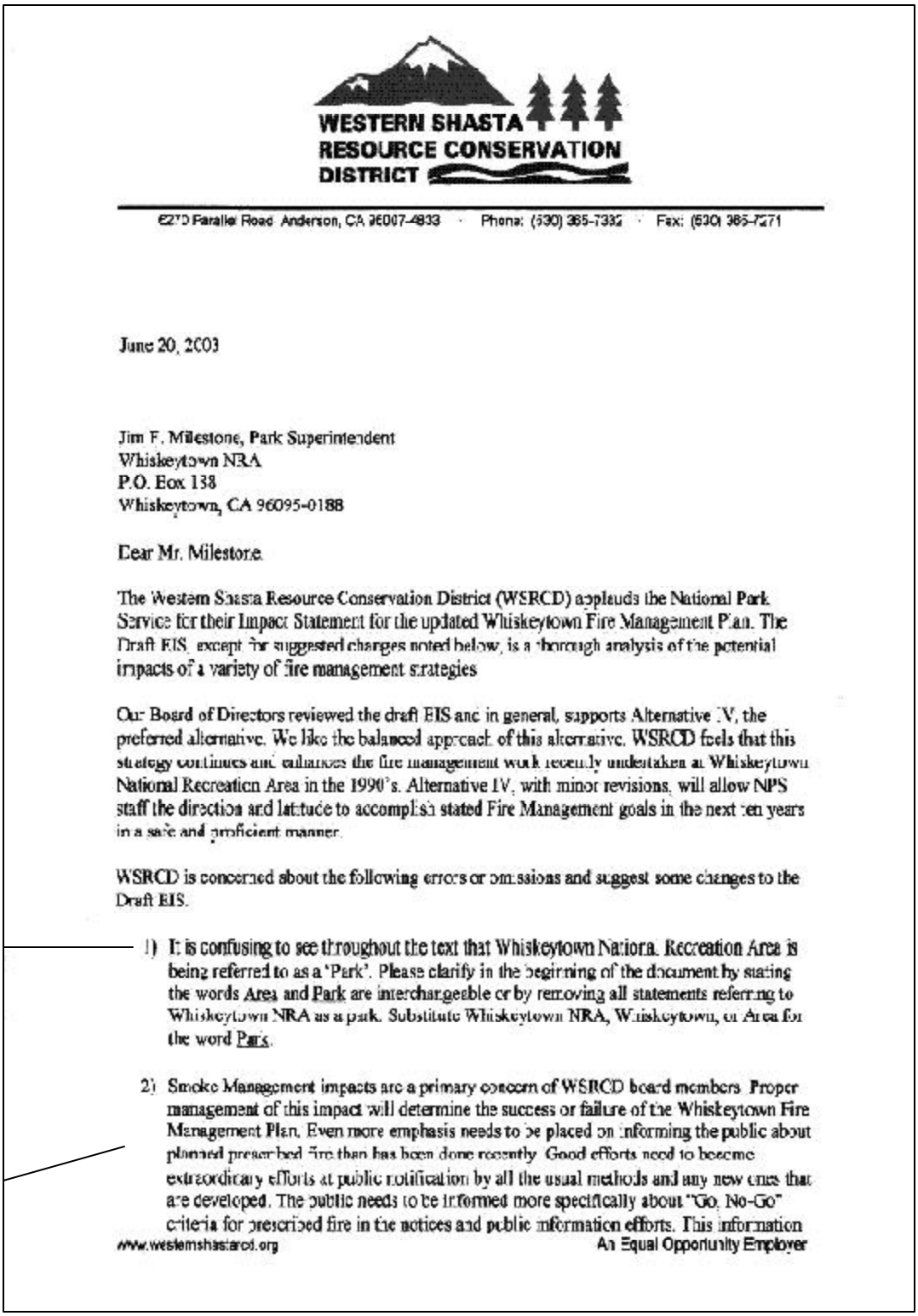
We appreciate the opportunity to review this DEIS. When the Final EIS is released for public review, please send two copies to the address above (mail code: CMD-2). If you have any questions, please contact me or Leonidas Payre, the lead reviewer for this project. Leonidas can be reached at 415 972 3847 or payre.leonidas@epa.gov.

Sincerely,

Lisa B. Hanf, Manager
Federal Activities Office

Enclosure:
Summary of EPA Rating Definitions

Printed on Recycled Paper



WESTERN SHASTA RESOURCE CONSERVATION DISTRICT

6270 Parallel Road Anderson, CA 96007-4833 · Phone: (530) 365-7332 · Fax: (530) 365-7271

June 20, 2003

Jim F. Milestone, Park Superintendent
Whiskeytown NRA
P.O. Box 188
Whiskeytown, CA 96095-0188

Dear Mr. Milestone

The Western Shasta Resource Conservation District (WSRCD) applauds the National Park Service for their Impact Statement for the updated Whiskeytown Fire Management Plan. The Draft EIS, except for suggested changes noted below, is a thorough analysis of the potential impacts of a variety of fire management strategies

Our Board of Directors reviewed the draft EIS and in general, supports Alternative IV, the preferred alternative. We like the balanced approach of this alternative. WSRCD feels that this strategy continues and enhances the fire management work recently undertaken at Whiskeytown National Recreation Area in the 1990's. Alternative IV, with minor revisions, will allow NPS staff the direction and latitude to accomplish stated Fire Management goals in the next ten years in a safe and proficient manner.

WSRCD is concerned about the following errors or omissions and suggest some changes to the Draft EIS.

1) It is confusing to see throughout the text that Whiskeytown National Recreation Area is being referred to as a 'Park'. Please clarify in the beginning of the document by stating the words Area and Park are interchangeable or by removing all statements referring to Whiskeytown NRA as a park. Substitute Whiskeytown NRA, Whiskeytown, or Area for the word Park.

2) Smoke Management impacts are a primary concern of WSRCD board members. Proper management of this impact will determine the success or failure of the Whiskeytown Fire Management Plan. Even more emphasis needs to be placed on informing the public about planned prescribed fire than has been done recently. Good efforts need to become extraordinary efforts at public notification by all the usual methods and any new ones that are developed. The public needs to be informed more specifically about "Go, No-Go" criteria for prescribed fire in the notices and public information efforts. This information

www.westernshastarcd.org An Equal Opportunity Employer

It is a standard National Park Service practice to generally referred to all units as "parks" despite their official designation. Claification of this point is made at the beginning of Chapter One.

Informing and educating the public about planned prescribed burns and smoke impacts to nearby communities and park visitors are of great importance to Whiskeytown. In 2002, Whiskeytown hired a Fire Education and Information Specialist who works on educating and informing park visitors, inholders, surrounding communities, other government agencies and park partners on planned prescribed burns.

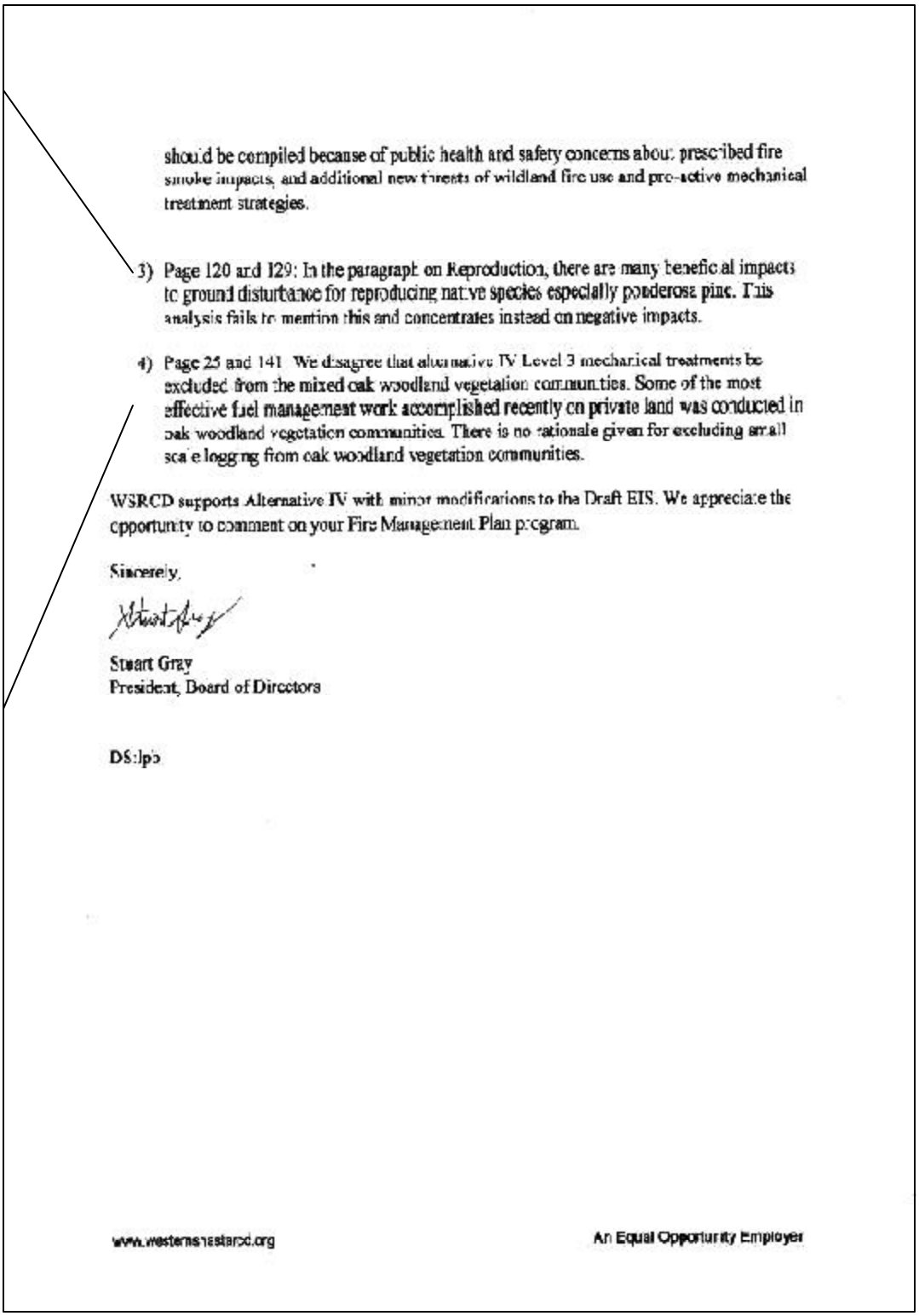
Prescribed fire notifications are done through press releases to radio stations, television stations and local newspapers. Press releases are also sent to park partners and other government and state agencies. In addition, park inholders and nearby neighbors, schools and businesses are contacted personally. Bulletin boards with fire information have been used in high public use areas like nearby markets and post offices. During large prescribed burns, fire information personnel station themselves at high visitor use areas to answer questions about the smoke and the prescribed burn.

Educating the public about Whiskeytown's fire program is done year round and incorporates articles in park publications, education programs in schools, and meetings with community members and park visitors. Summer evening programs are presented at the park amphitheater about fire related topics, as well as weekly Junior Firefighter programs.

The park will continue to strive to find new and better ways to inform the public about prescribed burns and smoke issues as we continue to manage our fuels and work towards protecting communities at risk and restoring forest health.

Ground disturbances do alter conditions at the soil surface and enhance conditions for the reproduction of many plant species. At a small scale, ground disturbances are beneficial, since they provide opportunities for many herbaceous and woody native plant species to become established and ensures their persistence in the ecosystem. Along with the beneficial impacts, non-native species increase, but these are not as significant and form a very minor negative impact. As scale increases, however, negative impacts from ground disturbance increase, with larger scale establishment of exotics gaining greater potential to out-compete or significantly alter function of ecosystems. Further, large scale degradation could occur if soil horizons are significantly altered, reducing site potential for overstory trees, and could favor shifts from more one type of species (i.e. ponderosa pine) to another species (i.e. knobcone pine).

The draft EIS stated that level 3 mechanical treatment in oak woodlands would not be considered. The primary limitations for mechanical treatment 3 is on slopes greater than 30% and on decomposed granite. For oak woodland plant communities not on steep slopes and highly erosive soils, the park will consider the use of level 2 and 3 mechanical treatments.



should be compiled because of public health and safety concerns about prescribed fire smoke impacts, and additional new threats of wildland fire use and pre-active mechanical treatment strategies.

3) Page 120 and 129: In the paragraph on Reproduction, there are many beneficial impacts to ground disturbance for reproducing native species especially ponderosa pine. This analysis fails to mention this and concentrates instead on negative impacts.

4) Page 25 and 141 We disagree that alternative IV Level 3 mechanical treatments be excluded from the mixed oak woodland vegetation communities. Some of the most effective fuel management work accomplished recently on private land was conducted in oak woodland vegetation communities. There is no rationale given for excluding small scale logging from oak woodland vegetation communities.

WSRCD supports Alternative IV with minor modifications to the Draft EIS. We appreciate the opportunity to comment on your Fire Management Plan program.

Sincerely,

Stuart Gray
President, Board of Directors

DS:lp's

www.westernsierrarcd.org

An Equal Opportunity Employer

June 26, 2003

Jim F. Milestone, Superintendent
Whiskeytown National Recreation Area
Post Office Box 188
Whiskeytown, CA 96095

RE. Fire Management Plan Comments

Dear Mr. Milestone:

Thank you for this opportunity to comment on the Draft Environmental Impact Statement for the Whiskeytown Fire Management Plan. I also appreciate the time that Jim Hutton and Carol Jandrell took to answer my questions relating to fire management matters on the June 14, 2003 field trip.

My comments regarding the DEIS are the following:

Page 84 paragraph beginning "Whiskeytown National Recreation Area is classified as..." should be corrected from the Shasta County Air Pollution Control District to the Shasta County Air Quality Management District.

Page 87 Table 3-5 indicates that Shasta County is in attainment for all Federal NAAQS. This conflicts with the statement on Page 88 - "the conformity rule applies only in federal non-attainment areas such as Shasta County. Please clarify the Federal attainment status of Shasta County.

Page 88 paragraph beginning "As noted earlier in Chapter 1," mentions the latest technology to monitor and manage smoke-related impacts. Please discuss in more detail the type of air monitoring and management techniques that have been and will be used to quantify and ameliorate the smoke-related impacts of prescribed and/or wildland fires. A chart summarizing the monitoring data gathered during Whiskeytown NRA's previous prescribed fire activities would be useful to analyze the impacts.

I cannot wholeheartedly accept Alternative IV: Multiple Strategy Program (Preferred Alternative). If it were offered with a few modifications, it could still give the fire management staff the maximum number of tools to accomplish a daunting task. The modifications to Alternative IV that I suggest are (1) to spell out stringent contractual obligations and NPS oversight guidelines for Level 3 mechanical treatment to avoid the mess that can be left behind after a logging operation, and (2) that you further restrict the use of wildland fire to only high elevation granitic zones to minimize the possibility of catastrophic spread yet be able to gain experience with this tool in Whiskeytown NRA.

I found the DEIS to be an informative and well-prepared document.

Sincerely,

Rita Caulis

Rita Caulis
Post Office Box 3
Whiskeytown, CA 96095

This change has been made in the document.

This change has been made in the document.

Whiskeytown possesses mobile smoke monitoring equipment to measure particulate matter (PM_{10}) and these will be placed at sensitive receptor locations. The park works with CARB and the Shasta County Air Quality Management District to minimize smoke impacts to as large an extent as possible by paying close attention to the smoke forecasts in the Redding Fire Weather Forecast for both prescribed and wildland fires.

The park has not collected any monitoring data from previous prescribed fire activities.

Because the aesthetic impacts from mechanical treatment level 3 will be site-specific (vegetation community, level of fuel loading, proximity to visitor developments and viewsheds), language from a contract would be difficult to spell out in this document. Aesthetic concerns will be incorporated into both the contract document and park oversight guidelines.

Wildland fire use is no longer considered an option for Alternative IV.

Whiskeytown National Recreation Area
Fire Management Plan Environmental Impact Statement
Public Review and Comment Form

Name: Verne Charlton
Address: P.O. Box 640 Shasta, Ca. 96087
Tel. 530-241-0867

Comments:

I would like to make a few comments concerning your proposed Fire Mgmt. Plan.

1. Current fuel reduction methods conducted by NPS staff appear to be working through the use of mechanical means, and prescribed fire.

2. The proposed use of wildland fire for fuel reduction on the 40,000 acre Whiskeytown NRA Unit is not acceptable. Whiskeytown is located adjacent to heavily populated areas.

Unique weather conditions exist in this area. Unpredictable west winds occur during the summer months. Redding Fire Weather personnel will tell you they are not able to accurately predict when these winds will occur. A wild land fire that is used for fuel reduction may escape from the NPS boundaries and be burning residences and other private property in a matter of hours.

The fixation of the Federal Agencies on using "NATURAL FIRE" to restore the landscape to its appearance prior to the arrival of the white man is about a half baked idea.

The Whiskeytown Fire Management Plan addresses only the park and a small buffer strip around the park. The plan does not address the surrounding environment of which Shasta, French Gulch, Centerville, and the City of Redding are a part of the area ecosystem.

The preferred alternative of using wildland fire during the time period of critically dry fuels, and unstable weather conditions is unsound.

If this course of action is followed, and a fire escapes the park boundaries, subsequently burning private lands, at the very least, it would constitute criminal negligence.

3. Please consider the article by Royal Burnett, "MANAGED WILDFIRE IS AN EXPENSIVE OXYMORON" that appeared on the opinion page of the June 12, 2003 edition of the Record Searchlight newspaper to be part of my comments.

Thank You:

Verne Charlton

We will continue to monitor and evaluate our fuels treatments in order to measure their effectiveness, and improve our methods for the future.

After a review of comments from public regarding the draft EIS as well as further consultation with the National Park Service deputy regional Fire Management Officer, the Park Superintendent decided to remove wildland fire use from consideration under Alternative IV. Reasons for doing so include the small area within the park for consideration of this practice as well as lack of agreement on the practice with neighboring jurisdictions.

The Direct Protection Area for the park includes lands within its boundary. The park has consulted closely with California Department of Forestry and Fire Protection, the Bureau of Land Management, and Western Shasta Resource Conservation District in developing cooperative fuels treatments and fire suppression activities. Alternative IV does address the fire protection concerns of surrounding communities by emphasizing fire-safe communities, and managing fuels and wildland fire preparedness in the northern and eastern areas of the Recreation Area.

'Managed wildfire' is an expensive oxymoron

By Royal Burnett

SPEAK YOUR PIECE

The staff members at Whiskeytown National Recreation Area should be commended for the two successful prescribed burns they conducted last winter and in May. The May burn removed quite a bit of dead and dry and killed some understory brush. I'm certain that with a follow-up burn or two they will achieve the desired fuel reduction and aesthetic results. The staff has demonstrated that by following a reasonable prescription they can safely reintroduce fire into the park.

I must disagree with the National Park Service and agree with Supervisor Irwin's first about the "managed wildfire" program the recreation area and Lassen Volcanic National Park have proposed.

Generally speaking, "managed wildfires" will only occur during the season. As in, speaking generally, "managed wildfires" will only escape through neglect or because humans committed taxes for the worst or were ignored.

I recall the escape on the Bandelier National Monument in May 2000. It burned off the monument, consumed thousands of acres and burned hundreds of homes in New Mexico. One of the primary excuses for this escape was underfunding or lack of staffing. Suppression costs were more than $1 million.

I also recall an escape from Lassen in the late 1980s. It also burned off the park and consumed several thousand acres of private and federal timber. This escape was blamed on an unpredicted weather shift. Suppression costs were in the thousands of dollars.

Last, let us recall the conflagration that resulted from the "managed wildfire" experiment that occurred in Yellowstone National Park in 1988. The Park Service has spent untold thousands of dollars to convince the public of the benefit of this colossal blunder. Even projected costs were in the millions of dollars.

Suffice to say, the National Park Service has a history with managed fire during the fire season.

The Park Service assures us it will have adequate forces on hand to quickly suppress any problems that may result from one of its "managed wildfires." As stated earlier, these fires are not a problem during milder burning conditions. When burning conditions become severe, the Park Service will be competing with every other fire agency in the West for scarce resources, such as air tankers, helicopters, dozers and hand crews. Too often, we have seen the harvest run dry and huge fires result.

In summary, the Park Service should be encouraged to continue fuel reduction and prescribed fire programs. Controlled ignition from pre-constructed lines in predetermined weather conditions is fine. The risk of allowing "let burn" or "managed wildfire" is much greater than any possible reward.

Royal Burnett lives in Redding.

All the comments on this review letter have been duly noted with appropriate changes made in the text of the final Environmental Impact Statement.

"John T. Waldrop" <jwaldrop@co.shasta.ca.us>
03/20/2003 10:09 AM MST

To: <whis_planning@nps.gov>
cc:
Subject: Comments on the Whiskeytown Fire Management Plan Draft EIS

Thank you for giving us the opportunity to review the Smoke Management Guide for Prescribed and Wildland Fire Draft Environmental Impact Statement. Upon review of the document, the Shasta County Air Quality Management District offers the following comments:

1) On page 84 as well as other pllrgs in the document, change Shasta County Air Pollution Control District to;

Shasta County Air Quality Management District

2) The last sentance on page 85 states "These recommendations include moderate non-attainment designations for the federal 8- hour standard for the Sacramento Valley air basin."

This statement is somewhat vague. A suggestion would be;

These recommendations include non-attainment designations for the feceral 8-hour ozone standard in all but five Sacramento Valley counties. All but one Sacramento Valley county are designated as non-attainment for the state 1 hour ozone standard of 0.09 ppm. Shasta County as well as the entire Sacramento Valley is classified as non-attainment with the State PM-10 standard.

Source; 2001 California Almanac of Emissions and Air Quality, California Air Resources Board

3) The final paragraph on page 85 discusses a transport study done by researchers from the University of California, Davis and Sacramento CARB.

A suggestion would be;

The Central California Ozone Study conducted in 2000, by researchers from the University of California, Davis and California Air Resources Board has been inconclusive as to the origin of air pollutants in Shasta County.

4) On page 87 the last sentance above the table cites a Shasta County AQMD Rule 307 "Wildland Vegetation Management Burning".

Shasta County does not have a Rule 307. The correct citation would be SCAQMD Rule 2:8 - Agricultural Burning and Rule 2:9 Procedures and Requirements for District Smoke Management Program

Also on page 87, the final sentance states that EPA is working with states and federal managers to support the development of enhanced smoke management plans. This has already been completed through the revisions made to Title 17 of the California Health and Safety Code. Shasta County adopted Rule 2:9 - Procedures and Requirements For District Smoke Management Program on 7-17-01.

5) On page 216, discussion is made as to the time of year smoke is produced.

Consideration might be given to discuss that successful prescribed burning has taken place in Whiskeytown National Recreation Area during fall and winter prescribed burns.

6) On page 217 under the Methodology heading, it is stated that area designations are defined by the Federal Clean Air Act. While this is true, the California Clean Air Act is the correct document to cite

due to the fact that the standards contained in it are more stringent than the federal standards, and therefore, are the enforceable standards in California.

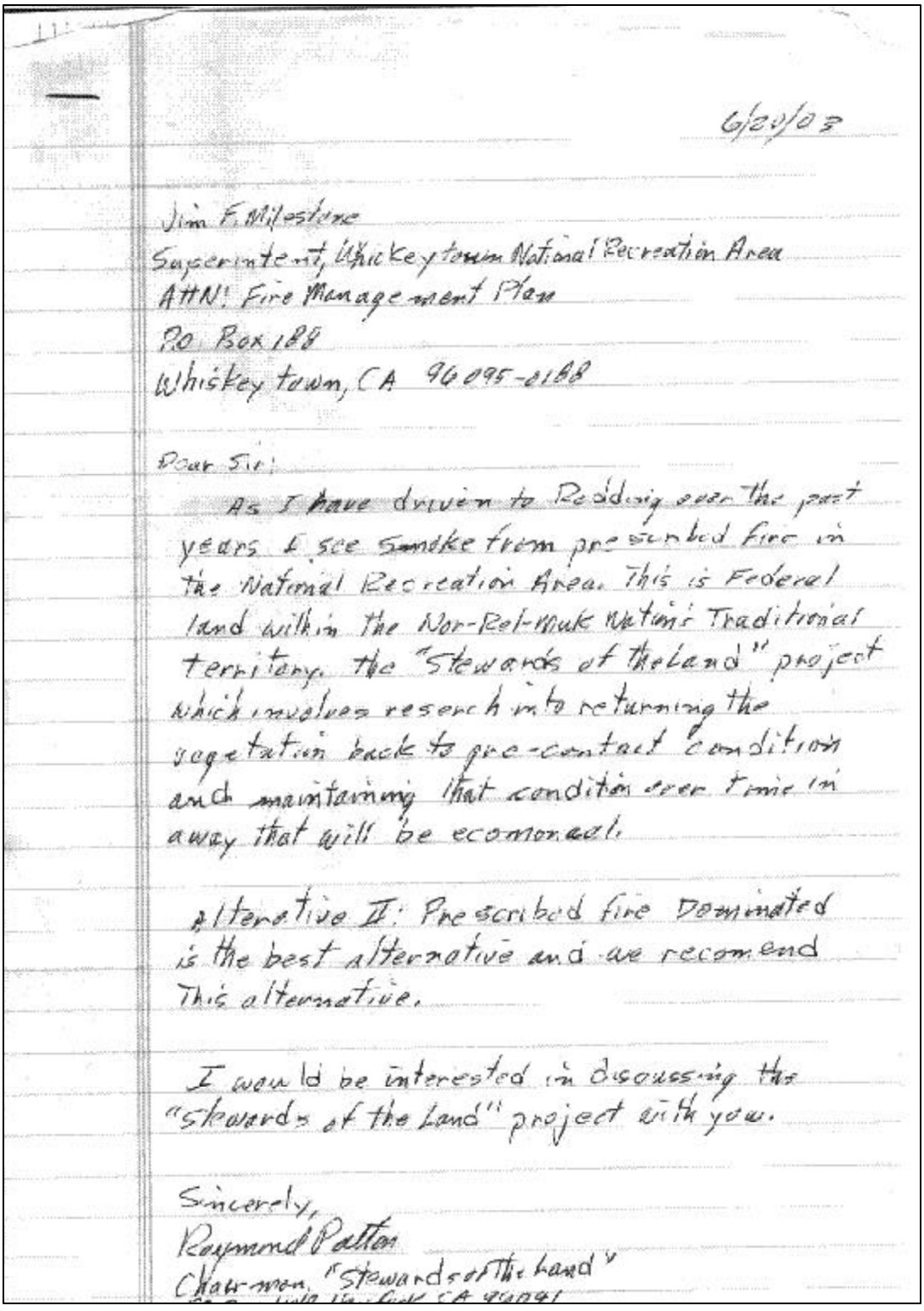
Also on the same page, reference is made to complying with National Ambient Air Quality Standards (NAAQS). As in the previous discussion, the California Ambient Air Quality Standards (CAAQS) apply and should be cited as well.

If you have any questions please do not hesitate to contact me at 530-225-5674.

Thank you.

John Waldrop
Senior Air Pollution Inspector
Shasta County AQMD
1855 Placer St. #101
Redding, CA 96001
530-225-5674

The issues raised by this review letter are addressed in various sections of the final Environmental Impact Statement (Chapter Four, Cultural Environment and Special Designations). The *Ethnographic Overview and Traditional Use Study* prepared by Emberson is cited, and the interest of contemporary Wintu (including the Nor-Rel-Muk Nation) in restoring native vegetation at Whiskeytown and allowing traditional cultural practices is identified. The park will also follow National Park Service policy to involve park-associated communities such as the Wintu and federally recognized tribes in the restoration process through consultation.



6/20/03

Jim F. Milestone
Superintendent, Whiskeytown National Recreation Area
ATTN: Fire Management Plan
P.O. Box 188
Whiskeytown, CA 96095-0188

Dear Sir:

As I have driven to Redding over the past years I see Smoke from prescribed fire in the National Recreation Area. This is Federal land within the Nor-Rel-Muk Nations Traditional territory. The "Stewards of the Land" project which involves research into returning the vegetation back to pre-contact condition and maintaining that condition over time in away that will be economical.

Alternative II: Prescribed fire Dominated is the best alternative and we recomend This alternative.

I would be interested in discussing the "Stewards of the Land" project with you.

Sincerely,
Raymond Patton
Chairman, "Stewards of the Land"
[illegible] CA 96041

1015 Continental Street, Suite 100
Redding, CA 96001
530-246-2455
530-246-7008 fax
http://www.norcalsaf.org

Northern California
SOCIETY OF AMERICAN FORESTERS 1900

June 23, 2003

Superintendent Jim Milestone
Whiskeytown National Recreation Area
ATTN: Fire Management Plan
P. O. Box 188
Whiskeytown, CA 96095-0188

Dear Jim:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Whiskeytown Fire Management Plan. The Northern California Society of American Foresters (Nor Cal SAF) represents approximately 750 forestry professionals in northern California. We commend the National Park Service (NPS) for taking a comprehensive evaluation of the fire management program on the Whiskeytown National Recreation Area (NRA). Alternative IV, the "environmentally preferred alternative", offers the best mix of tools to deal with fire and fuels issues on the NRA.

We support the use of mechanical thinning and the utilization of wood for biomass or other forest products to reduce fire hazard and improve ecosystem health within the Whiskeytown NRA. The use of prescribed fire or "managed" wildfire alone will not alleviate the fire and fuels problem. You correctly point out that the removal of trees through understory thinning reduces the quantity of ladder fuels, as well as improving the vigor of the residual stand. The alternative avoids the use of mechanical thinning in "old growth" areas; we suggest that the NPS reevaluate this restriction, as thinning may offer opportunities to enhance the formation of old growth forests and improve the health and reduce fire risk in old growth forests.

Regarding the effects of thinning, there is considerable attention given to the effect of thinning on the spread of pathogens, specifically cited are white pine blister rust and sudden oak death. Presumably spores can be carried by equipment and spread to mechanical treatment sites. The factors governing the spread of Sudden Oak Death are still being studied, but we support measures, such as cleaning equipment, to prevent the spread of spores (as well as noxious weeds) or other measures once more knowledge is gained about the spread of this disease.

Regarding white pine blister rust, spores are readily airborne and likely present within the NRA. There was no discussion as to the current extent of the disease within the Whiskeytown NRA. In any event, the spread of blister rust is a result of the combination of favorable weather conditions and the presence of the alternate host of the disease (*Ribes* spp.). Thinning has little or no effect.

OUR JOB IS GROWING

♦ STEWARDSHIP HOT LINE 1 (800) 738-TREE ♦

Mechanical treatment levels 2 and 3 will not be considered in old growth forests due to concerns about erodible soils, steep slopes, sensitive species habitat and riparian areas. However, mechanical treatment level 1 will be considered in old growth forests on a site specific condition. This point has been clarified in the document.

Whiskeytown is in the range of two necessary White Pine Blister Rust pathogen hosts sugar pine and gooseberry. However, since park staff are not aware if the disease occurs in the park, or the extent of it, and since the comment is correct as far as disturbance not spreading the disease, the reference to White Pine Blister Rust was deleted from the final Environmental Impact Statement.

Burned area emergency rehabilitation will be implemented at Whiskeytown according to National Park Service Policy. An appendix has been added to this document which outlines some of the methods and approaches that Whiskeytown will follow in the instance that burned area emergency rehabilitation is required. Wildland fire is viewed as a natural process in most cases, and standing dead trees are left on site after a burn. The exception would be tree removal necessary for public safety or development protection (i.e. hazard tree removal) .

None of the alternatives address what actions the NPS will take in regard to salvage or fire rehabilitation. Will it be the NPS policy to leave standing dead trees after a wildfire or a prescribed burn? The NPS needs to evaluate whether retaining fire-killed trees will meet public safety and other management goals.

Thank you for the opportunity to comment on the Draft Environmental Impact Statement.

Brad Seaberg
Chair Pac. Cal. SAF

After a review of comments from public regarding the draft EIS as well as further consultation with the National Park Service deputy regional Fire Management Officer, the Park Superintendent decided to remove wildland fire use from consideration under Alternative IV. Reasons for doing so include the small area within the park for consideration of this practice as well as lack of agreement on the practice with neighboring jurisdictions.

SHASTA COUNTY
FIRE DEPARTMENT

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

875 CYPRESS AVENUE
REDDING, CA 96001
(530) 225-2418
(530) 225-2418

DUANE FRY
COUNTY FIRE WARDEN
RANGER UNIT CHIEF

VOLUNTEER FIRE COMPANIES

BELLA VISTA
BIG BEND
CASSEL
CENTERVILLE
FRENCH GULCH
HAT CREEK
I-5
JONES VALLEY
KESWICK
MONTGOMERY CREEK
OAK RUN
OLD STATION
PALO CEDRO
PLATINA
LAKEHEAD
SHINGLETOWN
SOLDIER MOUNTAIN
STATION 47
WEST VALLEY
WHITMORE

COOPERATIVE FIRE PROTECTION

June 17, 2003

Mr. Jim Milestone
Park Superintendent
Attn: Fire Management Plan
Whiskeytown National Recreation Area
P. O. Box 188
Whiskeytown, CA 96095-0188

Dear Mr. Milestone:

Thank you for the opportunity to review and provide comment on the Whiskeytown Fire Management Plan Draft Environmental Impact Statement.

The Department commends the National Park on their efforts to reduce fuel loading through mechanical treatment and prescribed fire. The series of shaded fuel breaks that have been constructed within the NRA and in conjunction with the private property adjacent to Whiskeytown highlights the cooperative efforts of the fire agencies to address fire hazard conditions.

As specified in the executive summary discussion of Alternative IV (preferred alternative), wildland fire use is in conflict with the California Department of Forestry and Fire Protection's (CDF) direct protection strategy. We strongly discourage the use of wildland fire use within the Whiskeytown National Recreation Area. We believe the limited size of the recreation area, close proximity to developed parcels particularly along the eastern boundary of the NRA, continuous volatile vegetation, and local westerly wind conditions preclude wildland fire use as a management tool.

While you state in the Draft EIS that wildland fire use would average no more than 150 acres/year over a several year period it also states that individual wildland fire use projects could be up to 1000 acres per project. It may be that a natural ignition could initially meet the criteria for wildland fire use but because of weather, fuel or air quality conditions require conversion to a wildland fire. This could require a significant commitment of firefighting resources, particularly if the size at conversion is up to 1000 acres. Other fires

BOARD OF SUPERVISORS

David Kehoe | Irwin Fust | Glenn Hawes | Molly Wilson | Patricia A. "Trish" Clarke

may have already utilized these scarce firefighting resources, at the critical time necessary to prevent a fire designated for wildland fire use from damaging private property and resources outside the Whiskeytown boundary. In addition, the cost per acre would seem to out weigh the benefits of this fuel reduction method. In 1997, the 2,290 acre Huffer Fire burned in Lassen National Park. This fire started as a managed lightening fire and after 8 days reached the management threshold and was converted to a wildland fire. The fire was contained 5 days later for a total suppression cost of 1.68 million dollars.

We would agree with the author of the Draft EIS that the "appropriate conditions for this fire management strategy would not exist very often". It is our position, that the conditions required for adequate containment of a wildland fire use prescription will not provide the Park's desired result of reducing forest fuel accumulations. If pre-planned prescribed fire treatments would be considered inappropriate due to sensitive soils, limits on accessibility and other constraints then immediate fire suppression would seem to be the prudent fire management strategy.

The CDF endorses maintaining a variety of fuel reduction tools including prescribed fire, shaded fuel breaks and mechanical treatments, however wildland fire use in Whiskeytown during moderate, High, and extreme fire conditions should not be permitted as firefighting resources may not be readily available when these fires may exceed the management threshold. The potential costs to the public of large and damaging fires are too great.

Duane Fry
Unit Chief

By:

Del Walters
Deputy Chief

After a review of comments from public regarding the draft EIS as well as further consultation with the National Park Service deputy regional Fire Management Officer, the Park Superintendent decided to remove wildland fire use from consideration under Alternative IV. Reasons for doing so include the small area within the park for consideration of this practice as well as lack of agreement on the practice with neighboring jurisdictions.

Hi TOM:

THANKS FOR THE LOAN OF Y
MANAGEMENT PLAN - FMP - EIS -
NOW I CAN UNDERSTAND B
WHY TODAYS FIRE TYPES DON'T
A HELLOE A LOT DONE - THE A
WHICH HAVE TO BE COVERED AND E
OUS!

TRY ACOMPLISHING THE E
GASQUET RD - SIX RIVERS NF.
PROBLEM WITH AN EIS LIKE YOURS
FORE GOET IT.

GASQUET DISTRICT WAS A
375,000 ACRES WHEN I WAS THE D
FMO/LAW ENFORCEMENT OFFICER. TH
BOUNDARY LIES AGAINST REDWOO
N.P.'S EAST BOUNDARY. FROM THE C
CALIF. BNDRY NORTH END TO THE KLA
RIVER ON THE SO. END - SIS/2 YOU B
BNDR ON THE EAST SIDE

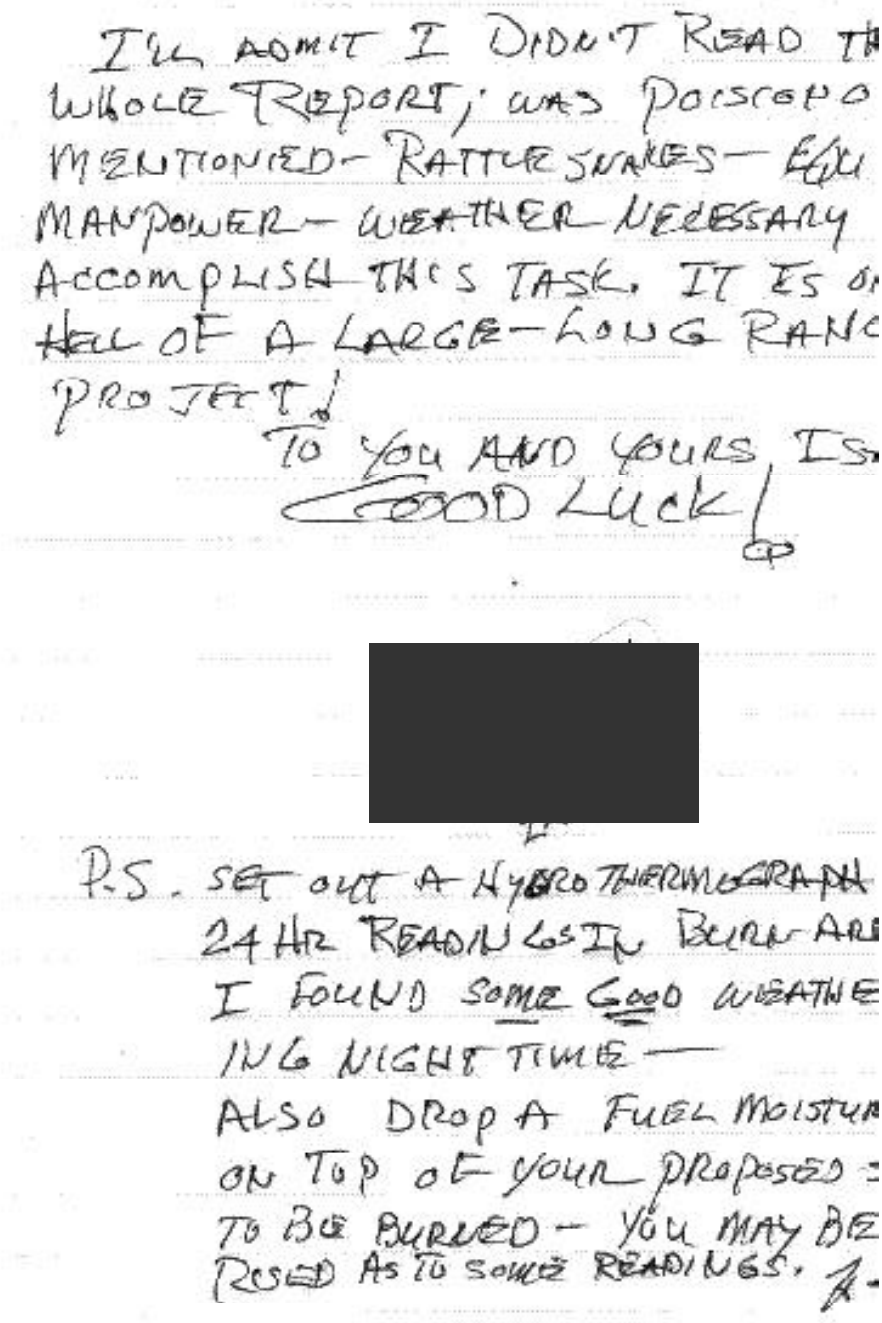
IN YOUR EIS. - WHO IS
TO DO THIS JOBS? WHAT ARE HIS/HER
-IFICATIONS?

Implementation of this Fire Management Plan will be directed by the Whiskeytown NRA's Resource Management Division Fire Management Program. The program is headed by a professional Fire Management Officer supported by a professional and technical staff. These positions are discussed in Chapter Two in the "Actions Common to All Alternatives" section. In addition to the Fire Management Program staff, other park employees in the resource, administrative, interpretive, cultural resource, law enforcement and maintenance program areas will provide support for the implementation of this plan.

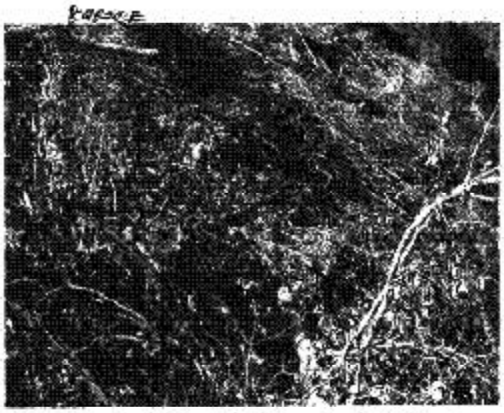
Chapter Three: The Affected Environment discusses the issues raised in this comment. Chapter Four: Environmental Consequences identifies the various impacts of the four alternatives on the affected environment.

This plan reviews possible methods for ensuring appropriate management of the burnable vegetative communities within the boundary of the park within a ten-year time frame.

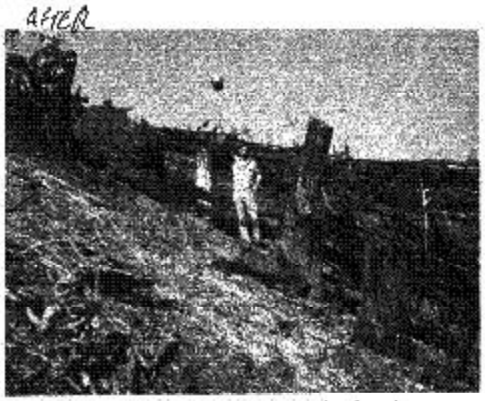
Fire research work is conducted within the park to support a better understanding of the impacts of various applications of fire management methods on the environment--both for areas within the immediate area of the park as well as for forested and brush communities in general.


I'll admit I didn't read th
whole report, was pointed
mentioned - Rattlesnakes - Equi
manpower - weather necessary
accomplish this task. It is o
hell of a large-long rang
project!
To you and yours, Is
Good Luck!

P.S. Set out a Hygrothermograph
24 hr readings in burn ar
I found some good weathe
ing night time -
Also drop a fuel moistur
on top of your proposed
to be burned - You may be
rised as to some readings.



Muzzleloader--B.k A:---Pete Munson's Face---He :s standing on the ground holding a size "0" shovel in the air w/hard hat. See other picture with Pete in same area after burning-----Burnt 10/69 HM



Muzzleloader B.k A---Pete Munson after burning---- Note stump height with shows fuel depth prior to burning Pete is at same spot shown in other picture Burnt 10/59 HM

1174

A Statement on Slash - Gasquet R.D. SKRVERS N.F.

Slash burning on the Gasquet Ranger District.

While talking about slash burning one should be reminded of the District's makeup.

The District has extremes in elevations. Its west boundary lies at 250' (5 air line miles from the Pacific Ocean) to 6425' (18 air line miles easterly, from west boundary) on the Siskiyou Mountains. Within these elevations we find the following species which make up our slash:

JN	DC	POC
DF	WF	RF
PP	SP	W
KP	SS	HD

Rainfall, on shallow soils, averages 95" annually. Temperatures reach 100° in August and September and fall below freezing during winter months. Four thousand feet through 6000' elevations are snowed in from mid November until the last of June or first of July, normally. All weather is coastal influenced which means quite unsteady.

Looking for available months for burning slash we find the following:

22 Yr. Ave. Rain	July .41	Aug. .67	Sept. 1.73	Oct. 7.32	Nov. 13.96	Dec. 16.58	Jan. 18.44	Feb. 12.00	Mar. 11.60	April 6.52	May 4.45	June 1.03	Total Ave. 94.90

With the above mentioned rainfall I believe it safe to say we have to eliminate November, December, January, February, March and April as being too wet for broadcast burning. This leaves six months. Let's take a look at them:

May.

Depending upon which type of a Spring we have, May could be too early for broadcast burning. North slopes are not dry enough to burn. 3500' through 6000' elevations are in snow.

June.

East, south and west slopes will burn. Some exposed north slopes (wind whipped) will burn. 4000' to 6000' coming out of the snow. 100% mopup necessary. Weather normally steady.

Probably, the best month for burning however expensive due to 100% mopup. Soil damage is slight at this time. Problems starting with personnel ceilings.

July.

Control of burning becomes a problem during daylight hours. However, burning at night works well. Soil damage increases with aspects. 4000' to 6000' new out of snow.

Some problems of burning during this period of time are:

1. 100% mopup costs "$".
2. Fire season is on. District plans on its allowable personnel (ceilings) for fire prevention and suppression.
3. It would take all District personnel a minimum of 3 days to burn, hold and mopup one highlead unit, should no problem arise.

August.

Same as July except soil damage due to extremely hot burns on all aspects may be prohibitive.

September.

Same as August. Weather starts becoming unsteady. Unsteady weather instigates holding problems. Soil damage is at its worst.

October.

Until rain starts this is a continuation of September's problems. After rains start, it's a race against time as to how much burning is accomplished.

To recap we've said:

1. November through April are too wet.
2. May is questionable
3. June is probably the best month, however expensive for mopup.
4. July through September are very dry, soil damage is excessive, it takes all the District personnel and equipment to burn, hold and mopup a unit. APPROX 15 people.
5. October is a fight for time. Your confronted with July-September problems prior to a rain and November through April after the heavy rains.

Burns vs. no burn is in the back of the scribes mind however statistics have not been documented yet.

Some things we could do to improve our lot:

1. If all units were YCM yarded, we would be able to burn the yarded material in October or November (like cat piles). However, this would not prepare a site on those units with heavy Salal/Rhododendrons or brush.

2. We could purchase enough equipment (bumper units/mother tankers) to burn with and not rely upon the fire organization. This could be done on a Forest wide basis (like the road crew). Equipment could be used in the north end and moved southerly as weather conditions warrant.

3. Should personnel ceilings allow, hire a floating crew to man the above mentioned equipment. This crew would be under the direction of fire control in the S.O. network for the D.F.C.O. when working on the District. They would be financed from all Forest timber sales.

4. Do have the option of purchasing systems to haul and chip the slash.

5. Etc. EQUIPS WHO WILL DONATE? NEARLY CLEAR CUTS — HELICOPTER LOGGING — NO CAT LOGGING VERY SHALLOW SOIL, ETC

HENRY S. MONTOYA
Fire Management Officer

HSM:cs

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Index

Appendix A: Whiskeytown National Recreation Area Species List

VEGETATION AND MAMMALS LISTED SEPARATELY

	Plant Family	NamePlant Species Name	Common Plant Name	California Native Plant Society Listing
		Native Plants are in bold font		
		Exotic Plants are regular font		
1	**ACERACEAE**	**ACER GLABRUM var TORREYI**	**MOUNTAIN MAPLE**	
2	**ACERACEAE**	**ACER MACROPHYLLUM**	**BIG LEAF MAPLE**	
3	**ALISMATACEAE**	**ALISMA PLANTAGO-AQUATICA**	**WATER PLANTAIN**	
4	**ALISMATACEAE**	**SAGITTARIA MONTEVIDENSIS ssp CALYCINIA**	**MONTEVIDEO ARROWHEAD**	
5	**ALISMATACEAE**	**SAGITTARIA SANFORDII**	**SANFORD'S ARROWHEAD**	**CNPS LIST 4**
6	ANACARDIACEAE	PISTACIA CHINENSIS	CHINESE PISTACHE	
7	**ANACARDIACEAE**	**RHUS OVATA**	**SUGAR BUSH**	
8	**ANACARDIACEAE**	**RHUS TRILOBATA**	**SQUAW BUSH**	
9	**ANACARDIACEAE**	**TOXICODENDRON DIVERSILOBUM**	**POISON OAK**	
10	**APIACEAE**	**ANGELICA TOMENTOSA**	**WOOLY ANGELICA**	
11	APIACEAE	ANTHRISCUS CAUCALIS	BUR-CHERVIL	
12	APIACEAE	CONIUM MACULATUM	POISON HEMLOCK	
13	**APIACEAE**	**DAUCUS PUSILLUS**	**WILD CARROT, RATTLESNAKE WEED**	
14	APIACEAE	FOENICULUM VULGARE	BISCUIT ROOT, SWEET FENNEL	
15	**APIACEAE**	**HERACLEUM LANATUM**	**COW PARSNIP**	
16	**APIACEAE**	**LIGUSTICUM CALIFORNICUM**	**CALIFORNIA LOVAGE**	
17	**APIACEAE**	**LOMATIUM MACROCARPUM**	**LARGE-FRUITED LOMATIUM**	
18	**APIACEAE**	**LOMATIUM UTRICULATUM**	**COMMON LOMATIUM**	
19	**APIACEAE**	**OSMORHIZA CHILENSIS**	**MOUNTAIN SWEET CICELY**	
20	**APIACEAE**	**PERIDERIDIA KELLOGGII**	**KELLOGG'S YAMPAH**	
21	**APIACEAE**	**SANICULA BIPINNATIFIDA**	**PURPLE SANICLE, SNAKEROOT**	
22	**APIACEAE**	**SANICULA CRASSICAULIS**	**PACIFIC SANICLE**	
23	**APIACEAE**	**SANICULA TUBEROSA**	**TUBEROUS SANICLE**	
24	APIACEAE	SCANDIX PECTEN-VENERIS	SHEPHERD'S NEEDLE	
25	APIACEAE	TORILIS ARVENSIS	HEDGE PARSLEY	
26	APIACEAE	TORILIS NODOSA	WILD PARSLEY	
27	**APIACEAE**	**YABEA MICROCARPA**	**HEDGE PARSLEY**	
28	**APOCYNACEAE**	**APOCYNUM ANDROSAEMIFOLIUM**	**MOUNTAIN DOGBANE**	
29	**APOCYNACEAE**	**CYCLADENIA HUMILIS**	**CYCLADENIA, LAMB'S HORNS**	
30	APOCYNACEAE	NERIUM OLEANDER	OLEANDER	
31	APOCYNACEAE	VINCA MAJOR	VINCA, PERIWINKLE	
32	**ARALIACEAE**	**ARALIA CALIFORNICA**	**CALIFORNIA SPIKENARD**	
33	ARALIACEAE	HEDERA HELIX	ENGLISH IVY	
34	**ARISTOLOCHIACEAE**	**ARISTOLOCHIA CALIFORNICA**	**CALIFORNIA PIPEVINE**	
35	**ARISTOLOCHIACEAE**	**ASARUM HARTWEGII**	**WILD GINGER**	
36	**ASCLEPIADACEAE**	**ASCLEPIAS CALIFORNICA**	**CALIFORNA MILKWEED**	
37	**ASCLEPIADACEAE**	**ASCLEPIAS CORDIFOLIA**	**PURPLE MILKWEED**	
38	**ASCLEPIADACEAE**	**ASCLEPIAS FASCICULARIS**	**NARROW-LEAVED MILKWEED**	
39	**ASTERACEAE**	**ACHILLEA MILLEFOLIUM**	**YARROW**	
40	**ASTERACEAE**	**ACHYRACHAENA MOLLIS**	**BLOW WIVES**	
41	**ASTERACEAE**	**ADENOCAULON BICOLOR**	**TRAIL PLANT**	
42	**ASTERACEAE**	**AGOSERIS GRANDIFLORA**	**LARGE-FLOWERED AGOSERIS**	
43	**ASTERACEAE**	**AGOSERIS HETEROPHYLLA**	**ANNUAL AGOSERIS**	
44	**ASTERACEAE**	**AGOSERIS RETRORSA**	**SPEAR-LEAVED AGOSERIS**	
45	**ASTERACEAE**	**AMBROSIA PSILOSTACHYA**	**WESTERN RAGWEED**	
46	**ASTERACEAE**	**ANTENNARIA ARGENTEA**	**SILVERY EVERLASTING**	
47	**ASTERACEAE**	**ANTENNARIA ROSEA**	**ROSY EVERLASTING**	
48	ASTERACEAE	ANTHEMIS COTULA	MAYWEED	
49	ASTERACEAE	ARCTIUM MINUS	COMMON BURDOCK	
50	**ASTERACEAE**	**ARNICA DISCOIDEA**	**RAYLESS ARNICA**	
51	**ASTERACEAE**	**ARNICA VENOSA**	**SHASTA COUNTY ARNICA**	**CNPS LIST 4**
52	**ASTERACEAE**	**ARTEMISIA DOUGLASIANA**	**CALIFORNIA MUGWORT**	
53	**ASTERACEAE**	**ASTER OREGONENSIS**	**OREGON WHITE-TOPPED ASTER**	
54	**ASTERACEAE**	**BACCHARIS PILULARIS**	**COYOTE BRUSH, CHAPARRAL BROOM**	
55	**ASTERACEAE**	**BALSAMORHIZA DELTOIDEA**	**BALSAM DELTOID**	
56	**ASTERACEAE**	**BIDENS FRONDOSA**	**STICK-TIGHT**	
57	**ASTERACEAE**	**BRICKELLIA CALIFORNICA**	**CALIFORNIA BRICKELLIA**	
58	**ASTERACEAE**	**CALYCADENIA FREMONTII**	**FREMONT'S ROSIN WEED**	
59	**ASTERACEAE**	**CALYCADENIA TRUNCATA**	**ROSIN WEED**	
60	ASTERACEAE	CENTAUREA MELITENSIS	TOCALOTE, NAPA THISTLE	
61	ASTERACEAE	CENTAUREA SOLSTITIALIS	YELLOW STAR THISTLE	
62	**ASTERACEAE**	**CHAENACTIS DOUGLASII**	**HOARY CHAENACTIS**	
63	ASTERACEAE	CHAMOMILLA SUAVEOLENS	PINEAPPLE WEED	
64	**ASTERACEAE**	**CHRYSOTHAMNUS VISCIDIFLORUS**	**STICKY-LEAVED RABBIT BUSH**	
65	ASTERACEAE	CICHORIUM INTYBUS	CHICORY	
66	**ASTERACEAE**	**CIRSIUM OCCIDENTALE var CANDIDISSIMUM**	**SNOWY THISTLE**	
67	**ASTERACEAE**	**CIRSIUM OCCIDENTALE var VENUSTUM**	**RED THISTLE, COULTER'S THISTLE**	
68	ASTERACEAE	CIRSIUM VULGARE	BULL THISTLE	
69	**ASTERACEAE**	**CONYZA CANADENSIS**	**HORSEWEED**	
70	**ASTERACEAE**	**ERICAMERIA BLOOMERI**	**BLOOMER'S GOLDBUSH**	
71	**ASTERACEAE**	**ERIGERON INORNATUS var INORNATUS**	**FLEABANE**	
72	**ASTERACEAE**	**ERIGERON REDUCTUS**	**FLEABANE, RAYLESS DAISY**	
73	**ASTERACEAE**	**ERIOPHYLLUM LANATUM**	**WOOLY SUNFLOWER**	
74	**ASTERACEAE**	**EUTHAMIA OCCIDENTALIS**	**WESTERN GOLDENROD**	
75	ASTERACEAE	FILAGO GALLICA	NARROW-LEAVED FILAGO	
76	**ASTERACEAE**	**GNAPHALIUM CALIFORNICUM**	**CALIFORNIA CUDWEED**	
77	ASTERACEAE	GNAPHALIUM LUTEO-ALBUM	FRAGRANT EVERLASTING	
78	**ASTERACEAE**	**GNAPHALIUM PALUSTRE**	**LOWLAND CUDWEED**	
79	**ASTERACEAE**	**GRINDELIA CAMPORUM**	**GUMWEED**	
80	**ASTERACEAE**	**HELENIUM PUBERULUM**	**SNEEZEWEED**	
81	**ASTERACEAE**	**HELIANTHELLA CALIFORNICA**	**CALIFORNIA HELIANTHELLA**	

82	**ASTERACEAE**	**HESPEREVAX ACAULIS**	**DWARF EVAX**
83	**ASTERACEAE**	**HETEROTHECA GRANDIFLORA**	**TELEGRAPH WEED**
84	**ASTERACEAE**	**HETEROTHECA OREGONA**	**OREGON GOLDEN-ASTER**
85	**ASTERACEAE**	**HIERACIUM ALBIFLORUM**	**WHITE HAWKWEED**
86	**ASTERACEAE**	**HOLOZONIA FILIPES**	**HOLOZONIA**
87	ASTERACEAE	HYPOCHAERIS GLABRA	SMOOTH CAT'S EAR
88	ASTERACEAE	HYPOCHAERIS RADICATA	HAIRY CAT'S EAR
89	ASTERACEAE	LACTUCA SERRIOLA	PRICKLY LETTUCE
90	ASTERACEAE	LAPSANA COMMUNIS	NIPPLEWORT
91	ASTERACEAE	LEONTODON TARAXACOIDES	HAWKBIT
92	**ASTERACEAE**	**LESSINGIA NEMACLADA**	**SLENDER-STEMMED LESSINGIA**
93	**ASTERACEAE**	**MADIA ELEGANS**	**COMMON MADIA**
94	**ASTERACEAE**	**MADIA ELEGANS ssp VERNALIS**	**COMMON MADIA**
95	**ASTERACEAE**	**MADIA EXIGUA**	**SMALL TARWEED**
96	**ASTERACEAE**	**MADIA GRACILIS**	**GUMWEED**
97	**ASTERACEAE**	**MADIA MINIMA**	**SMALL MADIA**
98	**ASTERACEAE**	**MALACOTHRIX CLEVELANDII**	**CLEVELAND'S MALACOTHRIX**
99	**ASTERACEAE**	**MALACOTHRIX FLOCCIFERA**	**WOOLY MALACOTHRIX**
100	**ASTERACEAE**	**MICROPUS CALIFORNICUS**	**Q TIPS, SLENDER COTTONWEED**
101	**ASTERACEAE**	**MICROSERIS NUTANS**	**NODDING SCORZONELLA**
102	**ASTERACEAE**	**PSILOCARPHUS OREGONUS**	**WOOLY MARBLES**
103	ASTERACEAE	SCORZONERA HISPANICA	VIPER'S GRASS
104	**ASTERACEAE**	**SENECIO ARONICOIDES**	**CALIFORNIA BUTTERWEED**
105	**ASTERACEAE**	**SENECIO EURYCEPHALUS**	**CUT-LEAVED BUTTERWEED**
106	**ASTERACEAE**	**SENECIO TRIANGULARIS**	**ARROW BUTTERWEED**
107	ASTERACEAE	SENECIO VULGARIS	OLD MAN OF SPRING, GROUNDSEL
108	**ASTERACEAE**	**SOLIDAGO CANADENSIS var ELONGATA**	**MEADOW GOLDENROD**
109	ASTERACEAE	SOLIVA SESSILIS	SOUTH AMERICAN SOLIVA
110	ASTERACEAE	SONCHUS ASPER	PRICKLY SOW THISTLE
111	**ASTERACEAE**	**STEPHANOMERIA VIRGATA**	**TALL STEPHANOMERIA**
112	ASTERACEAE	TANACETUM PARTHENIUM	FEVERFEW
113	ASTERACEAE	TANACETUM VULGARE	TANSY
114	ASTERACEAE	TARAXACUM OFFICINALE	COMMON DANDELION
115	ASTERACEAE	TRAGOPOGON DUBIUS	YELLOW SALSIFY
116	**ASTERACEAE**	**UROPAPPUS LINDLEYI**	**SILVER PUFFS**
117	**ASTERACEAE**	**WYETHIA ANGUSTIFOLIA**	**NARROW-LEAVED MULE EARS**
118	**ASTERACEAE**	**WYETHIA HELENOIDES**	**GRAY MULE EARS**
119	**ASTERACEAE**	**XANTHIUM STRUMARIUM**	**COCKLEBUR**
120	**BERBERIDACEAE**	**BERBERIS AQUIFOLIUM var AQUIFOLIUM**	**PIPER'S BARBERRY**
121	**BERBERIDACEAE**	**BERBERIS AQUIFOLIUM var DICTOYA**	**JEPSON'S OREGON GRAPE**
122	**BERBERIDACEAE**	**BERBERIS AQUIFOLIUM var REPENS**	**DWARF MAHONIA**
123	BERBERIDACEAE	BERBERIS VULGARIS	EUROPEAN BARBERRY
124	**BETULACEAE**	**ALNUS INCANA ssp TENUIFOLIA**	**MOUNTAIN ALDER**
125	**BETULACEAE**	**ALNUS RHOMBIFOLIA**	**WHITE ALDER**
126	**BETULACEAE**	**ALNUS VIRIDIS ssp SINUATA**	**SITKA ALDER**
127	**BETULACEAE**	**CORYLUS CORNUTA var CALIFORNICA**	**CALIFORNIA HAZELNUT**
128	BIGNONIACEAE	CATALPA OVATA	CHINESE CATALPA
129	**BLECHNACEAE**	**WOODWARDIA FIMBRIATA**	**GIANT CHAIN FERN**
130	**BORAGINACEAE**	**AMSINCKIA MENZEISII var INTERMEDIA**	**FIDDLENECK**
131	**BORAGINACEAE**	**CRYPTANTHA AFFINIS**	**COMMON CRYPTANTHA**
132	**BORAGINACEAE**	**CRYPTANTHA CLOKEYI**	**PRICKLY CRYPTANTHA**
133	**BORAGINACEAE**	**CRYPTANTHA INTERMEDIA**	**COMMON CRYPTANTHA**
134	**BORAGINACEAE**	**CRYPTANTHA MILOBAKERI**	**MILO BAKER'S CRYPTANTHA**
135	**BORAGINACEAE**	**CRYPTANTHA MURICATA**	**PRICKLY CRYPTANTHA**
136	**BORAGINACEAE**	**CRYPTANTHA ROSTELLATA**	**BEAKED CRYPTANTHA**
137	**BORAGINACEAE**	**CRYPTANTHA TORREYANA**	**TORREY'S CRYPTANTHA**
138	**BORAGINACEAE**	**CYNOGLOSSUM GRANDE**	**WESTERN HOUND'S TONGUE**
139	**BORAGINACEAE**	**CYNOGLOSSUM OCCIDENTALE**	**HOUND'S TONGUE**
140	**BORAGINACEAE**	**LITHOSPERMUM CALIFORNICUM**	**GROMWELL, SHASTA PUCCOON**
141	**BORAGINACEAE**	**PECTOCARYA PENICILLATA**	**SHORT LEAF COMB SEED**
142	**BORAGINACEAE**	**PLAGIOBOTHRYS COGNATUS**	**POPCORN FLOWER**
143	**BORAGINACEAE**	**PLAGIOBOTHRYS NOTHOFULVUS**	**RUSTY POPCORN FLOWER**
144	**BORAGINACEAE**	**PLAGIOBOTHRYS TENELLUS**	**SLENDER POPCORN FLOWER**
145	**BORAGINACEAE**	**PLAGIOBOTHRYS TENER**	**SLENDER POPCORN FLOWER**
146	BRASSICACEAE	ARABIDOPIS THALIANA	MOUSE EAR
147	**BRASSICACEAE**	**ARABIS GLABRA**	**TOWER MUSTARD**
148	**BRASSICACEAE**	**ARABIS PLATYSPERMA**	
149	**BRASSICACEAE**	**ATHYSANUS PUSILLUS**	**DWARF ATHYSANUS**
150	BRASSICACEAE	BARBAREA VERNA	WINTERCRESS
151	BRASSICACEAE	BARBAREA VULGARIS	COMMON WINTERCRESS
152	BRASSICACEAE	BRASSICA NIGRA	BLACK MUSTARD
153	BRASSICACEAE	BRASSICA TOURNEFORTII	ASIAN MUSTARD
154	BRASSICACEAE	CAPSELLA BURSA-PASTORIS	SHEPHERD'S PURSE
155	**BRASSICACEAE**	**CARDAMINE CALIFORNICA**	**MILKMAIDS, TOOTHWORT**
156	**BRASSICACEAE**	**CARDAMINE CALIFORNICA var SINUATA**	**MILKMAIDS, TOOTHWORT**
157	**BRASSICACEAE**	**CARDAMINE OLIGOSPERMA**	**IDAHO BITTER CRESS**
158	**BRASSICACEAE**	**DRABA VERNA**	**WHITLOW GRASS**
159	**BRASSICACEAE**	**ERYSIMUM CAPITATUM**	**WALLFLOWER**
160	BRASSICACEAE	HIRSCHFELDIA INCANA	WILD MUSTARD
161	BRASSICACEAE	ISATIS TINCTORIA	DYER'S WOAD
162	BRASSICACEAE	LEPIDIUM CAMPESTRE	ENGLISH PEPPER GRASS
163	**BRASSICACEAE**	**LEPIDIUM NITIDUM**	**SHINING PEPPER GRASS**
164	**BRASSICACEAE**	**LEPIDIUM VIRGINICUM**	**WILD PEPPER GRASS**
165	BRASSICACEAE	RAPHANUS SATIVUS	WILD RADISH
166	**BRASSICACEAE**	**RORIPPA NASTURTIUM-AQUATICUM**	**WATER CRESS**
167	BRASSICACEAE	SISYMBRIUM ALTISSIMUM	TUMBLE MUSTARD
168	BRASSICACEAE	SISYMBRIUM OFFICINALE	HEDGE MUSTARD
169	**BRASSICACEAE**	**STREPTANTHUS TORTUOSUS**	**JEWELWEED**
170	**BRASSICACEAE**	**THYSANOCARPUS CURVIPES**	**FRINGE POD**
171	**CALYCANTHACEAE**	**CALYCANTHUS OCCIDENTALIS**	**SPICE BUSH**
172	**CAMPANULACEAE**	**CAMPANULA MEDIUM**	**BLUEBELL**
173	**CAMPANULACEAE**	**CAMPANULA PRENANTHOIDES**	**CALIFORNIA HAREBELL**
174	**CAMPANULACEAE**	**GITHOPSIS SPECULARIOIDES**	**BLUE CUP, VENUS'LOOKING GLASS**
175	**CAMPANULACEAE**	**HETEROCODON RARIFLORUM**	**HETEROCODON**
176	**CAPRIFOLIACEAE**	**LINNAEA BOREALIS var LONGIFLORIA**	**TWINFLOWER**
177	**CAPRIFOLIACEAE**	**LONICERA CILIOSA**	**ORANGE HONEYSUCKLE**
178	**CAPRIFOLIACEAE**	**LONICERA HISPIDULA var VACILLANS**	**HAIRY HONEYSUCKLE**
179	**CAPRIFOLIACEAE**	**LONICERA INTERRUPTA**	**CHAPARRAL HONEYSUCKLE**
180	**CAPRIFOLIACEAE**	**SAMBUCUS MEXICANA**	**BLUE ELDERBERRY**
181	**CAPRIFOLIACEAE**	**SYMPHORICARPOS ALBUS**	**COMMON SNOWBERRY**

182	**CAPRIFOLIACEAE**	**SYMPHORICARPOS MOLLIS var LAEVIGATUS**	**CREEPING SNOWBERRY**	
183	**CARYOPHYLLACEAE**	**ARENARIA CONGESTA**	**CAPITATE SANDWORT**	
184	CARYOPHYLLACEAE	CERASTIUM GLOMERATUM	MOUSE-EAR CHICKWEED	
185	**CARYOPHYLLACEAE**	**MINUARTIA DOUGLASII**	**DOUGLAS' SANDWORT**	
186	**CARYOPHYLLACEAE**	**MINUARTIA NUTTALLII**	**NUTTALL'S SANDWORT**	
187	CARYOPHYLLACEAE	PETRORHAGIA DUBIA	WINDMILL PINK	
188	CARYOPHYLLACEAE	SAPONARIA OFFICINALIS	SOAPWORT, BOUNCING BET	
189	CARYOPHYLLACEAE	SCLERANTHUS ANNUUS ssp ANNUUS	GERMAN KNOTGRASS	
190	**CARYOPHYLLACEAE**	**SILENE ANTIRRHINA**	**SLEEPY CATCHFLY**	
191	**CARYOPHYLLACEAE**	**SILENE CALIFORNICA**	**CALIFORNIA INDIAN PINK**	
192	**CARYOPHYLLACEAE**	**SILENE CAMPANULATA ssp GLANDULOSA**	**BELL CATCHFLY**	
193	CARYOPHYLLACEAE	SILENE GALLICA	COMMON CATCHFLY	
194	CARYOPHYLLACEAE	SPERGULARIA BOCCONII	BOCCONE'S SAND SPURRY	
195	**CARYOPHYLLACEAE**	**SPERGULARIA MARINA**	**SALTMARSH SPURRY**	
196	CARYOPHYLLACEAE	STELLARIA MEDIA	CHICKWEED	
197	CHENOPODIACEAE	ATRIPLEX ROSEA	TUMBLING ORACLE	
198	CHENOPODIACEAE	CHENOPODIUM ALBUM	LAMB'S QUARTERS	
199	CHENOPODIACEAE	CHENOPODIUM BOTRYS	JERUSALEM OAK, GOOSEFOOT	
200	CHENOPODIACEAE	CHENOPODIUM PUMILIO	TASMANIAN GOOSEFOOT	
201	**CONVOLVULACEAE**	**CALYSTEGIA OCCIDENTALIS**	**WESTERN MORNING GLORY**	
202	**CONVOLVULACEAE**	**CALYSTEGIA OCCIDENTALIS ssp OCCIDENTALIS**	**MODOC MORNING GLORY**	
203	CONVOLVULACEAE	CONVOLVULUS ARVENSIS	FIELD BINDWEED	
204	**CORNACEAE**	**CORNUS GLABRATA**	**BROWN DOGWOOD**	
205	**CORNACEAE**	**CORNUS NUTTALLII**	**PACIFIC MOUNTAIN DOGWOOD**	
206	**CORNACEAE**	**CORNUS SERICEA ssp SERICEA**	**AMERICAN DOGWOOD**	
207	**CORNACEAE**	**CORNUS SESSILIS**	**MINER'S DOGWWOD**	
208	**CRASSULACEAE**	**CRASSULA CONNATA**	**PYGMY WEED**	
209	**CRASSULACEAE**	**SEDUM OBTUSATUM ssp BOREALE**	**SIERRA GORMANIA**	
210	**CRASSULACEAE**	**SEDUM PARADISUM**	**CANYON CREEK STONECROP**	**CNPS LIST 1B**
211	**CRASSULACEAE**	**SEDUM SPATHULIFOLIUM**	**PACIFIC STONECROP**	
212	**CUCURBITACEAE**	**MARAH WATSONII**	**MANROOT**	
213	**CUPRESSACEAE**	**CALOCEDRUS DECURRENS**	**INCENSE CEDAR**	
214	**CUPRESSACEAE**	**CUPRESSUS MACNABIANA**	**MCNAB CYPRESS**	
215	**CUSCUTACEAE**	**CUSCUTA CALIFORNICA var BREVIFLORA**	**SAN JOAQUIN DODDER**	
216	**CUSCUTACEAE**	**CUSCUTA CEPHALANTHI**	**CANYON DODDER**	
217	**CYPERACEAE**	**CAREX AMPLIFOLIA**	**AMPLE-LEAVED SEDGE**	
218	**CYPERACEAE**	**CAREX BARBARAE**	**SANTA BARBARA SEDGE**	
219	**CYPERACEAE**	**CAREX BOLANDERI**	**BOLANDER'S SEDGE**	
220	**CYPERACEAE**	**CAREX CUSICKII**	**CUSICK'S SEDGE**	
221	**CYPERACEAE**	**CAREX DEWEYANA ssp LEPTOPODA**	**SHORTER SCALED SEDGE**	
222	**CYPERACEAE**	**CAREX DUDLEYI**	**DUDLEY'S SEDGE**	
223	**CYPERACEAE**	**CAREX FETA**	**GREEN SHEATHED SEDGE**	
224	**CYPERACEAE**	**CAREX FRACTA**	**FRAGILE SHEATHED SEDGE**	
225	**CYPERACEAE**	**CAREX ILLOTA**	**SMALL HEADED SEDGE**	
226	**CYPERACEAE**	**CAREX MARIPOSANA**	**MARIPOSA SEDGE**	
227	**CYPERACEAE**	**CAREX MULTICAULIS**	**MANY-STEMMED SEDGE**	
228	CYPERACEAE	CAREX MULTICOSTATA	MANY RIBBED SEDGE	
229	CYPERACEAE	CAREX NUDATA	NAKED SEDGE	
230	**CYPERACEAE**	**CAREX ROSSII**	**ROSS' SEDGE**	
231	**CYPERACEAE**	**CAREX STIPATA**	**AWL-FRUITED SEDGE**	
232	**CYPERACEAE**	**CAREX UTRICULATA**	**BEAKED SEDGE**	
233	**CYPERACEAE**	**CYPERUS ACUMINATUS**	**SHORT POINTED CYPERUS**	
234	**CYPERACEAE**	**CYPERUS ERAGROSTIS**	**TALL FLAT SEDGE**	
235	**CYPERACEAE**	**CYPERUS ERYTHRORHIZOS**	**RED-ROOTED CYPERUS**	
236	**CYPERACEAE**	**CYPERUS NIGER**	**BROWN CYPERUS**	
237	CYPERACEAE	CYPERUS ONISTATUS		
238	**CYPERACEAE**	**CYPERUS SQUARROSUS**	**AWNED CYPERUS**	
239	CYPERACEAE	CYPERUS STRIGOSUS	NUTSEDGE	
240	**CYPERACEAE**	**ELEOCHARIS MACROSTACHYA**	**CREEPING SPIKE RUSH**	
241	**CYPERACEAE**	**ELEOCHARIS MONTEVIDENSIS**	**MONTEVIDEO SPIKE RUSH**	
242	**CYPERACEAE**	**ELEOCHARIS OBTUSA**	**BLUNT SPIKE RUSH**	
243	**CYPERACEAE**	**ELEOCHARIS PARVULA**	**SMALL SPIKE RUSH**	**CNPS LIST 4**
244	CYPERACEAE	LIPOCARPHA ARISTULATA	AWNED HALFCHAFF SEDGE	
245	**CYPERACEAE**	**SCIRPUS ACUTUS var OCCIDENTALIS**	**VISCID BULRUSH, TULE**	
246	CYPERACEAE	SCIRPUS AMERICANUS	OLNEY'S BULRUSH	
247	**CYPERACEAE**	**SCIRPUS MICROCARPUS**	**SMALL-FRUITED BULRUSH**	
248	CYPERACEAE	SCIRPUS TABERNAEMONTANI	AMERICAN GREAT BULRUSH, TULE	
249	**DATISCACEAE**	**DATISCA GLOMERATA**	**DURANGO ROOT**	
250	**DENNSTAEDTIACEAE**	**PTERIDIUM AQUILINUM var PUBESCENS**	**BRACKEN FERN**	
251	**DRYOPTERIDACEAE**	**ATHYRIUM FILIX-FEMINA var CYCLOSORUM**	**LADY FERN**	
252	**DRYOPTERIDACEAE**	**CYSTOPTERIS FRAGILIS**	**BRITTLE FERN**	
253	**DRYOPTERIDACEAE**	**DRYOPTERIS ARGUTA**	**WOOD FERN**	
254	**DRYOPTERIDACEAE**	**POLYSTICHUM MUNITUM**	**SWORD FERN**	
255	EBENACEAE	DIOSPYROS VIRGINIANA	AMERICAN PERSIMMON	
256	**EQUISETACEAE**	**EQUISETUM ARVENSE**	**COMMON HORSETAIL**	
257	**EQUISETACEAE**	**EQUISETUM HYEMALE var AFFINE**	**COMMON SCOURING RUSH**	
258	**EQUISETACEAE**	**EQUISETUM HYEMALE var ROBUSTUM**		
259	**EQUISETACEAE**	**EQUISETUM LAEVIGATUM**	**SMOOTH SCOURING RUSH**	
260	**EQUISETACEAE**	**EQUISETUM TELMATEIA ssp BRAUNII**	**GIANT HORSETAIL**	
261	**ERICACEAE**	**ARBUTUS MENZIESII**	**MADRONE**	
262	**ERICACEAE**	**ARCTOSTAPHYLOS MANZANITA**	**COMMON MANZANITA**	
263	**ERICACEAE**	**ARCTOSTAPHYLOS MANZANITA ssp ROOFII**	**COMMON MANZANITA**	
264	**ERICACEAE**	**ARCTOSTAPHYLOS MANZANITA ssp WIESLANDERI**	**COMMON MANZANITA**	
265	**ERICACEAE**	**ARCTOSTAPHYLOS NEVADENSIS**	**PINEMAT MANZANITA**	
266	**ERICACEAE**	**ARCTOSTAPHYLOS PATULA**	**GREENLEAF MANZANITA**	
267	**ERICACEAE**	**ARCTOSTAPHYLOS VISCIDA**	**WHITELEAF MANZANITA**	
268	**ERICACEAE**	**CHIMAPHILA MENZIESII**	**LITTLE PRINCE'S PINE, PIPSISSEWA**	
269	**ERICACEAE**	**CHIMAPHILA UMBELLATA**	**BLAKE'S PRINCE'S PINE**	
270	**ERICACEAE**	**LEUCOTHOE DAVISIAE**	**SIERRA LAUREL**	
271	**ERICACEAE**	**PLEURICOSPORA FIMBRIOLATA**		
272	**ERICACEAE**	**PTEROSPORA ANDROMEDEA**		
273	**ERICACEAE**	**PYROLA ASARAFOLIA ssp ASARAFOLIA**	**BOG WINTERGREEN**	
274	**ERICACEAE**	**PYROLA PICTA**	**WINTERGREEN**	
275	**ERICACEAE**	**RHODODENDRON OCCIDENTALE**	**WESTERN AZALEA**	
276	**ERICACEAE**	**VACCINUM CESPITOSUM**	**HUCKLEBERRY**	
277	**EUPHORBIACEAE**	**CHAMAESYCE GLYPTOSPERMA**	**RIDGE-SEEDED SPURGE**	
278	EUPHORBIACEAE	CHAMAESYCE MACULATA	SPOTTED SPURGE	
279	EUPHORBIACEAE	CHAMAESYCE NUTANS	LARGE SPURGE	
280	EUPHORBIACEAE	CHAMAESYCE PROSTRATA	PROSTRATE SPURGE	
281	**EUPHORBIACEAE**	**CHAMAESYCE SERPYLLIFOLIA**	**THYME LEAF SPURGE**	

282	**EUPHORBIACEAE**	**EREMOCARPUS SETIGERUS**	**DOVEWEED, TURKEY MULLEIN**
283	EUPHORBIACEAE	EUPHORBIA CRENULATA	CHINESE CAPS
284	**EUPHORBIACEAE**	**EUPHORBIA SPATHULATA**	**RETICULATE SEEDED SPURGE**
285	FABACEAE	ACACIA SPP.	ACACIA
286	FABACEAE	ALBIZIA JULIBRISSIN	MIMOSA, SILK TREE
287	**FABACEAE**	**AMORPHA CALIFORNICA**	**FALSE INDIGO**
288	**FABACEAE**	**AMORPHA CALIFORNICA var NAPENSIS**	**INDIGO BUSH**
289	**FABACEAE**	**ASTRAGALUS GAMBELIANUS**	**GAMBEL'S LOCOWEED**
290	**FABACEAE**	**CERCIS OCCIDENTALIS**	**REDBUD**
291	FABACEAE	CYTISUS SCOPARIUS	SCOTCH BROOM
292	FABACEAE	GENISTA MONSPESSULANA	FRENCH BROOM
293	FABACEAE	GLEDITSIA SINENSIA	CHINESE HONEY LOCUST
294	FABACEAE	LATHYRUS LATIFOLIUS	SWEET PEA
295	**FABACEAE**	**LATHYRUS SULPHUREUS**	**SULPHUR PEA**
296	**FABACEAE**	**LATHYRUS VESTITUS**	**COMMON PACIFIC PEA**
297	**FABACEAE**	**LATHYRUS VESTITUS ssp BOLANDERI**	**BOLANDER'S PACIFIC PEA**
298	**FABACEAE**	**LOTUS BALSAMIFEROUS**	**BALSAM LOTUS**
299	FABACEAE	LOTUS CORNICULATUS	BIRD'S FOOT TREFOIL
300	**FABACEAE**	**LOTUS CRASSIFOLIUS**	**BROAD-LEAVED LOTUS**
301	**FABACEAE**	**LOTUS GRANDIFLORUS**	**LARGE-LEAVED LOTUS**
302	**FABACEAE**	**LOTUS HUMISTRATUS**	**BIRD'S FOOT LOTUS**
303	**FABACEAE**	**LOTUS MICRANTHUS**	**SMALL-FLOWERED LOTUS**
304	**FABACEAE**	**LOTUS OBLONGIFOLIUS var OBLONGIFOLIUS**	**STREAMSIDE TREFOIL**
305	**FABACEAE**	**LOTUS PINNATUS**	**PINNATE LOTUS**
306	**FABACEAE**	**LOTUS PURSHIANUS**	**SPANISH LOTUS**
307	**FABACEAE**	**LOTUS WRANGELIANUS**	**CHILE LOTUS**
308	**FABACEAE**	**LUPINUS ALBIFRONS**	**SILVER BUSH LUPINE**
309	**FABACEAE**	**LUPINUS APERTUS**	**SUMMIT LUPINE**
310	**FABACEAE**	**LUPINUS BICOLOR**	**BICOLORED LUPINE**
311	**FABACEAE**	**LUPINUS FORMOSUS**	**SUMMER LUPINE**
312	**FABACEAE**	**LUPINUS LATIFOLIUS**	**BROAD-LEAVED LUPINE**
313	**FABACEAE**	**LUPINUS LEPIDUS**	**DWARF LUPINE**
314	**FABACEAE**	**LUPINUS NANUS**	**VALLEY SKY LUPINE**
315	**FABACEAE**	**LUPINUS SUCCULENTUS**	**ARROYO LUPINE**
316	FABACEAE	MEDICAGO LUPULINA	BLACK MEDICK
317	FABACEAE	MEDICAGO MINIMA	SMALL BUR CLOVER
318	FABACEAE	MEDICAGO POLYMORPHA	BUR CLOVER
319	FABACEAE	MEDICAGO SATIVA	ALFALFA
320	FABACEAE	MELILOTUS ALBA	WHITE SWEET CLOVER
321	FABACEAE	MELILOTUS INDICA	YELLOW SWEET CLOVER
322	FABACEAE	ROBINIA PSEUDOACACIA	BLACK LOCUST
323	FABACEAE	SPARTIUM JUNCEUM	SPANISH BROOM
324	**FABACEAE**	**THERMOPSIS MACROPHYLLA var VENOSA**	**SLENDER FALSE LUPINE**
325	**FABACEAE**	**THERMOPSIS RHOMBIFOLIA var MONTANA**	**FALSE LUPINE**
326	**FABACEAE**	**TRIFOLIUM ALBOPURPUREUM var OLIVACEUM**	**OWL'S CLOVER**
327	**FABACEAE**	**TRIFOLIUM BIFIDUM**	**NOTCH LEAF CLOVER**
328	FABACEAE	TRIFOLIUM CAMPESTRE	LOW HOP CLOVER
329	**FABACEAE**	**TRIFOLIUM CILIOLATUM**	**TREE CLOVER**
330	FABACEAE	TRIFOLIUM DUBIUM	SHAMROCK
331	**FABACEAE**	**TRIFOLIUM GRACILENTUM**	**PINPOINT CLOVER**
332	FABACEAE	TRIFOLIUM HIRTUM	ROSE CLOVER
333	**FABACEAE**	**TRIFOLIUM MICROCEPHALUM**	**SMALL-HEAD CLOVER**
334	**FABACEAE**	**TRIFOLIUM MICRODON**	**VALPARAISO CLOVER**
335	**FABACEAE**	**TRIFOLIUM OBTUSIFLORUM**	**CLAMMY CLOVER**
336	FABACEAE	TRIFOLIUM REPENS	WHITE CLOVER
337	FABACEAE	TRIFOLIUM SUBTERRANEUM	BURROWING CLOVER
338	**FABACEAE**	**TRIFOLIUM VARIEGATUM**	**WHITE TIPPED CLOVER**
339	**FABACEAE**	**TRIFOLIUM WILLDENOVII**	**TOMCAT CLOVER**
340	**FABACEAE**	**TRIFOLIUM WORMSKIOLDII**	**COW CLOVER**
341	**FABACEAE**	**VICIA AMERICANA var AMERICANA**	**AMERICAN VETCH**
342	FABACEAE	VICIA SATIVA var NIGRA	SPRING VETCH
343	FABACEAE	VICIA VILLOSA var VARIA	WINTER VETCH
344	**FAGACEAE**	**CHRYSOLEPIS SEMPERVIRENS**	**CHINQUAPIN**
345	**FAGACEAE**	**LITHOCARPUS DENSIFLORUS var DENSIFLORUS**	**TAN OAK**
346	**FAGACEAE**	**LITHOCARPUS DENSIFLORUS var ECHINOIDES**	**TAN OAK SHRUB**
347	**FAGACEAE**	**QUERCUS AGRIFOLIA var FRUTESCENS**	**COAST LIVE OAK**
348	**FAGACEAE**	**QUERCUS CHRYSOLEPIS**	**CANYON LIVE OAK**
349	**FAGACEAE**	**QUERCUS DOUGLASII**	**BLUE OAK**
350	**FAGACEAE**	**QUERCUS DURATA**	**LEATHER OAK**
351	**FAGACEAE**	**QUERCUS GARRYANA**	**OREGON OAK, GARRY'S OAK**
352	**FAGACEAE**	**QUERCUS GARRYANA var BREWERI**	**BREWER'S OAK, OREGON OAK**
353	**FAGACEAE**	**QUERCUS KELLOGGII**	**BLACK OAK**
354	**FAGACEAE**	**QUERCUS LOBATA**	**VALLEY OAK**
355	**FAGACEAE**	**QUERCUS VACCINIFOLIA**	**HUCKLEBERRY OAK**
356	**FAGACEAE**	**QUERCUS WISLIZENII**	**INTERIOR LIVE OAK**
357	**FAGACEAE**	**QUERCUS WISLIZENII var FRUTESCENS**	**LIVE OAK**
358	**FAGACEAE**	**QUERCUS X MOREHUS**	**ORACLE OAK**
359	**GARRYACEAE**	**GARRYA FREMONTII**	**FREMONT'S SILKTASSEL**
360	**GENTIANACEAE**	**CENTAURIUM VENUSTUM**	**BEAUTIFUL CENTAURY**
361	**GENTIANACEAE**	**SWERTIA ALBICAULIS var NITIDA**	**SHINING SWERTIA**
362	GERANIACEAE	ERODIUM BOTRYS	BIG HERON BILL, FILAREE
363	GERANIACEAE	ERODIUM BRACHYCARPUM	WHITE-STEMMED FILAREE
364	GERANIACEAE	ERODIUM CICUTARIUM	RED-STEMMED FILAREE
365	**GERANIACEAE**	**GERANIUM CAROLINIANUM**	**CAROLINA GERANIUM**
366	GERANIACEAE	GERANIUM DISSECTUM	CUT-LEAVED GERANIUM
367	GERANIACEAE	GERANIUM MOLLE	DOVE'S FOOT GERANIUM
368	GERANIACEAE	GERANIUM POTENTILLOIDES	NEW ZEALAND GERANIUM
369	**GROSSULARIACEAE**	**RIBES LOBBII**	**GUMMY GOOSEBERRY**
370	**GROSSULARIACEAE**	**RIBES ROEZLII**	**SIERRA GOOSEBERRY**
371	**GROSSULARIACEAE**	**RIBES VISCOSISSIMUM**	**STICKY CURRANT**
372	HALORAGACEAE	MYRIOPHYLLUM SPICATUM	WATER MILFOIL, AMERICAN MILFOIL
373	HAMAMELIDACEACE	LIQUIDAMBAR STYRACIFLUA	SWEET GUM
374	**HIPPOCASTANACEAE**	**AESCULUS CALIFORNICA**	**BUCKEYE, HORSE CHESTNUT**
375	**HYDROCHARITACEAE**	**ELODEA CANADENSIS**	**COMMON WATERWEED**
376	**HYDROPHYLLACEAE**	**DRAPERIA SYSTYLA**	**DRAPERIA**
377	**HYDROPHYLLACEAE**	**ERIODICTYON CALIFORNICUM**	**YERBA SANTA**
378	**HYDROPHYLLACEAE**	**HYDROPHYLLUM OCCIDENTALE**	**WESTERN WATERLEAF**
379	**HYDROPHYLLACEAE**	**NEMOPHILA HETEROPHYLLA**	**CANYON NEMOPHILA**
380	**HYDROPHYLLACEAE**	**NEMOPHILA PARVIFLORA**	**SMALL-FLOWERED NEMOPHILA**
381	**HYDROPHYLLACEAE**	**NEMOPHILA PEDUNCULATA**	**MEADOW NEMOPHILA**

382	**HYDROPHYLLACEAE**	**PHACELIA CORYMBOSA**	**SERPENTINE PHACELIA**	
383	**HYDROPHYLLACEAE**	**PHACELIA EGENA**	**SCORPIAN WEED**	
384	**HYDROPHYLLACEAE**	**PHACELIA HASTADA**	**TIMBERLINE PHACELIA**	
385	**HYDROPHYLLACEAE**	**PHACELIA HETEROPHYLLA ssp VIRGATA**	**VIRGATE PHACELIA**	
386	**HYDROPHYLLACEAE**	**PHACELIA IMBRICATA**	**IMBRICATE PHACELIA**	
387	**HYDROPHYLLACEAE**	**PHACELIA MUTABILIS**	**CHANGEABLE PHACELIA**	
388	HYPERICACEAE	HYPERICUM CALYCINUM	ST. JOHN'S WORT	
389	**HYPERICACEAE**	**HYPERICUM CONCINNUM**	**GOLDWIRE**	
390	HYPERICACEAE	HYPERICUM MUTILUM	SMALL-FLOWERED ST.JOHNS WORT	
391	HYPERICACEAE	HYPERICUM PERFORATUM	KLAMATH WEED	
392	**IRIDACEAE**	**IRIS HARTWEGII**	**HARTWEG'S IRIS**	
393	**IRIDACEAE**	**IRIS MACROSIPHON**		
394	**IRIDACEAE**	**IRIS PURDYI**	**PURDY'S IRIS**	
395	IRIDACEAE	IRIS SPP	GARDEN IRIS	
396	**IRIDACEAE**	**IRIS TENUISSIMA var PURDYIFORMIS**		
397	**IRIDACEAE**	**IRIS TENUISSIMA var TENUISSIMA**	**LONG TUBE IRIS**	
398	**IRIDACEAE**	**SISYRINCHIUM BELLUM**	**BLUE-EYED GRASS**	
399	**JUNCACEAE**	**JUNCUS ACUMINATUS**	**SHARP-FRUITED RUSH**	
400	**JUNCACEAE**	**JUNCUS ARTICULATUS**	**JOINTED RUSH**	
401	**JUNCACEAE**	**JUNCUS BALTICUS**	**BALTIC RUSH**	
402	**JUNCACEAE**	**JUNCUS BOLANDERI**	**BOLANDER'S RUSH**	
403	**JUNCACEAE**	**JUNCUS BUFONIUS**	**TOAD RUSH**	
404	**JUNCACEAE**	**JUNCUS CONFUSUS**	**COLORADO RUSH**	
405	**JUNCACEAE**	**JUNCUS COVILLEI**	**COVILLE'S RUSH**	
406	**JUNCACEAE**	**JUNCUS DUBIUS**	**MARIPOSA RUSH**	
407	**JUNCACEAE**	**JUNCUS EFFUSUS var PACIFICUS**	**COMMON RUSH**	
408	**JUNCACEAE**	**JUNCUS ENSIFOLIUS**	**THREE-STEMMED RUSH**	
409	**JUNCACEAE**	**JUNCUS MARGINATUS var MARGINATUS**	**GRASS LEAF RUSH**	**CNPS LIST 2**
410	**JUNCACEAE**	**JUNCUS OCCIDENTALIS**	**SLENDER JUNCUS**	
411	**JUNCACEAE**	**JUNCUS ORTHOPHYLLUS**	**STRAIGHT-LEAVED RUSH**	
412	**JUNCACEAE**	**JUNCUS PARRYI**	**PARRY'S RUSH**	
413	**JUNCACEAE**	**JUNCUS TENUIS**	**SLENDER RUSH**	
414	**JUNCACEAE**	**JUNCUS XIPHIOIDES**	**IRIS-LEAVED RUSH**	
415	**JUNCACEAE**	**LUZULA COMOSA**	**HEATHWOOD RUSH**	
416	**JUNCAGINACEAE**	**TRIGLOCHIN MARITIMA**	**ARROW GRASS**	
417	LAMIACEAE	LAMIUM AMPLEXICAULE	HENBIT	
418	LAMIACEAE	MARRUBIUM VULGARE	HOREHOUND	
419	LAMIACEAE	MELISSA OFFICINALIS	LEMON BALM	
420	**LAMIACEAE**	**MENTHA ARVENSIS**	**FIELD MINT**	
421	LAMIACEAE	MENTHA PIPERITA	PEPPERMINT	
422	LAMIACEAE	MENTHA PULEGIUM	PENNYROYAL	
423	LAMIACEAE	MENTHA SPICATA	SPEARMINT	
424	**LAMIACEAE**	**MONARDELLA LANCEOLATA**	**MUSTANG MINT**	
425	**LAMIACEAE**	**MONARDELLA ODORATISSIMA**	**COYOTE MINT**	
426	**LAMIACEAE**	**MONARDELLA SHELTONII**	**COYOTE MINT**	
427	**LAMIACEAE**	**MONARDELLA VILLOSA**	**COYOTE MINT**	
428	**LAMIACEAE**	**PRUNELLA VULGARIS**	**SELF-HEAL**	
429	**LAMIACEAE**	**PRUNELLA VULGARIS var LANCEOLATA**	**SELF-HEAL**	
430	**LAMIACEAE**	**PYCNANTHEMUM CALIFORNICUM**	**MOUNTAIN MINT, CALIFORNIA MINT**	
431	**LAMIACEAE**	**SALVIA SONOMENSIS**	**CREEPING SAGE**	
432	**LAMIACEAE**	**SCUTELLARIA SYMPHOCAMPYLOIDES**	**SKULLCAP**	
433	**LAMIACEAE**	**STACHYS AJUGOIDES var RIGIDA**	**RIGID HEDGE NETTLE**	
434	**LAMIACEAE**	**STACHYS STRICTA**	**SONOMA HEDGE NETTLE**	
435	**LAMIACEAE**	**TRICHOSTEMA LANCEOLATUM**	**VINEGAR WEED**	
436	**LEMNACEAE**	**LEMNA MINUTA**	**LEAST DUCKWEED**	
437	**LILIACEAE**	**ALLIUM AMPLECTENS**	**NARROW-LEAVED ONION**	
438	**LILIACEAE**	**ALLIUM CAMPANULATUM**	**DUSKY ONION**	
439	**LILIACEAE**	**ALLIUM MEMBRANACEUM**	**PAPERY ONION**	
440	**LILIACEAE**	**ALLIUM OBTUSUM**	**RED SIERRA ONION**	
441	**LILIACEAE**	**ALLIUM SANBORNII var SANBORNII**	**SANBORN'S ALLIUM**	**CNPS LIST 4**
442	**LILIACEAE**	**ALLIUM TRIBRACTEATUM**	**THREE-BRACTED ONION**	**CNPS LIST 1B**
443	**LILIACEAE**	**ALLIUM VALIDUM**	**SWAMP ONION**	
444	LILIACEAE	ASPARAGUS OFFICINALIS	ASPARAGUS	
445	**LILIACEAE**	**BRODIAEA CORONARIA**	**HARVEST BRODIAEA**	
446	**LILIACEAE**	**BRODIAEA ELEGANS**	**ELEGANT BRODIAEA**	
447	**LILIACEAE**	**CALOCHORTUS SUPERBUS**	**SUPERB MARIPOSA LILY**	
448	**LILIACEAE**	**CALOCHORTUS TOLMIEI**	**WHITE PUSSY EARS**	
449	**LILIACEAE**	**CHLOROGALUM POMERIDIANUM**	**SOAP ROOT, SOAP PLANT, AMOLE**	
450	**LILIACEAE**	**CLINTONIA UNIFLORA**	**BRIDE'S BONNET**	
451	**LILIACEAE**	**DICHELOSTEMMA CAPITATUM**	**BLUE DICKS**	
452	**LILIACEAE**	**DICHELOSTEMMA CONGESTUM**	**OOKOW**	
453	**LILIACEAE**	**DICHELOSTEMMA IDA-MAIA**	**FIRECRACKER FLOWER**	
454	**LILIACEAE**	**DICHELOSTEMMA MULTIFLORUM**	**MANY-FLOWERED BRODIAEA**	
455	**LILIACEAE**	**DISPORUM HOOKERI**	**FAIRY BELLS**	
456	**LILIACEAE**	**ERYTHRONIUM CALIFORNICUM**	**CALIFORNIA FAWN LILY**	
457	**LILIACEAE**	**FRITILLARIA AFFINIS**	**MISSION BELLS**	
458	**LILIACEAE**	**FRITILLARIA ATROPURPUREA**	**PURPLE FRITILLARY**	
459	**LILIACEAE**	**LILIUM PARDALINUM**	**LEOPARD LILY, TIGER LILY**	
460	**LILIACEAE**	**ODONTOSTOMUM HARTWEGII**	**HARTWEG'S ODONTOSTONUM**	
461	**LILIACEAE**	**SMILACINA RACEMOSA**	**BRANCHED SOLOMON'S SEAL**	
462	**LILIACEAE**	**SMILACINA STELLATA**	**FALSE SOLOMON'S SEAL**	
463	**LILIACEAE**	**SMILAX CALIFORNICA**	**GREENBRIAR**	
464	**LILIACEAE**	**STREPTOPUS AMPLEXIFOLIUS var AMERICANUS**	**TWISTED STALK**	
465	**LILIACEAE**	**TRILLIUM OVATUM var OETTINGERI**	**TRILLIUM, WESTERN WAKE-ROBIN**	**CNPS LIST 4**
466	**LILIACEAE**	**TRITELEIA CROCEA var CROCEA**	**YELLOW TRITELEIA**	**CNPS LIST 4**
467	**LILIACEAE**	**TRITELEIA HYACINTHINA**	**WHITE TRITELEIA**	
468	**LILIACEAE**	**TRITILEIA IXIODES var ANALINA**	**PRETTY FACE**	
469	**LILIACEAE**	**VERATRUM CALIFORNICUM var CALIFORNICUM**	**FALSE HELLEBORE**	
470	**LILIACEAE**	**ZIGADENUS FREMONTII**	**DEATH CAMAS**	
471	**LILIACEAE**	**ZIGADENUS VENENOSUS var VENOSUS**	**DEATH CAMAS**	
472	**LIMNANTHACEAE**	**LIMNANTHES ALBA**	**WHITE MEADOW FOAM**	
473	LINACEAE	LINUM BIENNE	NARROW-LEAVED FLAX	
474	**LINACEAE**	**LINUM MICRANTHUM**	**THREADSTEM FLAX**	
475	**LOSACEAE**	**MENTZELIA LAEVICAULIS**	**GIANT BLAZING STAR**	
476	LYTHRACEAE	LYTHRUM HYSSOPIFOLIUM	LOOSESTRIFE	
477	**MARSILEACEAE**	**PILULARIA AMERICANA**	**AMERICAN PILLWORT**	
478	MOLLUGINACEAE	MOLLUGO VERTICILLATA	INDIAN CHICKWEED	
479	MORACEAE	FICUS CARICA	EDIBLE FIG	
480	MORACEAE	MORUS ALBA	COMMON MULBERRY	
481	**OLEACEAE**	**FRAXINUS DIPETALA**	**FLOWERING ASH**	

482	**OLEACEAE**	**FRAXINUS LATIFOLIA**	**OREGON ASH**	
483	OLEACEAE	SYRINGA SPP.	LILAC	
484	**ONAGRACEAE**	**CIRCAEA ALPINA var PACIFICA**	**ENCHANTER'S NIGHTSHADE**	
485	**ONAGRACEAE**	**CLARKIA GRACILIS**	**CLARKIA**	
486	**ONAGRACEAE**	**CLARKIA HETERANDRA**	**CALIFORNIA GAURA**	
487	**ONAGRACEAE**	**CLARKIA MILDREDIAE**	**CLARKIA**	**CNPS LIST 4**
488	**ONAGRACEAE**	**CLARKIA PURPUREA ssp QUADRIVULNERA**	**CLARKIA**	
489	**ONAGRACEAE**	**CLARKIA RHOMBOIDEA**	**CLARKIA**	
490	**ONAGRACEAE**	**CLARKIA VIRGATA**	**CLARKIA**	**CNPS LIST 4**
491	**ONAGRACEAE**	**EPILOBIUM BRACHYCARPUM**	**WILLOW HERB**	
492	**ONAGRACEAE**	**EPILOBIUM CILIATUM**	**FRINGED WILLOW HERB**	
493	**ONAGRACEAE**	**EPILOBIUM DENSIFLORUM**	**WILLOW HERB**	
494	**ONAGRACEAE**	**EPILOBIUM GLABERRIMUM**	**GLAUCOUS WILLOW HERB**	
495	**ONAGRACEAE**	**EPILOBIUM MINUTUM**	**CHAPARRAL WILLOW HERB**	
496	**ONAGRACEAE**	**GAYOPHYTUM DIFFUSUM**	**DIFFUSE GAYOPHYTUM**	
497	**ONAGRACEAE**	**GAYOPHYTUM HETEROZYGUM**	**ZIGZAG GROUNDSMOKE**	
498	**ONAGRACEAE**	**GAYOPHYTUM HUMILE**	**LOW GAYOPHYTUM**	
499	**ONAGRACEAE**	**LUDWIGIA PALUSTRIS**	**MARSH PURSLANE**	
500	**ONAGRACEAE**	**OENOTHERA ELATA ssp HOOKERI**	**EVENING PRIMROSE**	
501	**OPHIOGLOSSACEAE**	**BOTRYCHIUM MULTIFIDUM**	**CLAUSEN GRAPE FERN**	
502	**ORCHIDACEAE**	**CEPHALANTHERA AUSTINAE**	**PHANTOM ORCHID**	
503	**ORCHIDACEAE**	**CORALLORHIZA MACULATA**	**SPOTTED CORAL ROOT**	
504	**ORCHIDACEAE**	**CYPRIPEDIUM FASCICULATUM**	**CLUSTERED LADY'S SLIPPER**	**CNPS LIST 4**
505	**ORCHIDACEAE**	**GOODYERA OBLONGIFOLIA**	**RATTLESNAKE PLANTAIN**	
506	**ORCHIDACEAE**	**LISTERA CONVALLARIOIDES**	**BROAD-LEAVED TWAYBLADE**	
507	**ORCHIDACEAE**	**PIPERIA ELEGANS**	**ELEGANT PIPERIA**	
508	**ORCHIDACEAE**	**PIPERIA TRANSVERSA**	**PIPERIA**	
509	**ORCHIDACEAE**	**PIPERIA UNALASCENSIS**	**ALASKA PIPERIA**	
510	**ORCHIDACEAE**	**PLANTANTHERA LEUCOSTACHYS**	**WHITE FLOWERED BOG ORCHID**	
511	**ORCHIDACEAE**	**SPIRANTHES ROMANZOFFIANA**	**HOODED LADIES TRESSES**	
512	**OROBANCHACEAE**	**BOSCHNIAKIA STROBILACEA**	**GROUND CONE**	
513	**OROBANCHACEAE**	**OROBANCHE FASCICULATA**	**CLUSTERED BROOMRAPE**	
514	**OROBANCHACEAE**	**OROBANCHE UNIFLORA**	**NAKED BROOMRAPE**	
515	OXALIDACEAE	OXALIS CORNICULATA	CREEPING WOOD SORREL	
516	OXALIDACEAE	OXALIS LAXA	OXALIS	
517	**PAPAVERACEAE**	**DENDROMECON RIGIDA**	**BUSH POPPY**	
518	**PAPAVERACEAE**	**DICENTRA FORMOSA**	**BLEEDING HEARTS**	
519	**PAPAVERACEAE**	**ESCHSCHOLZIA CAESPITOSA**	**FOOTHILL POPPY, TUFTED POPPY**	
520	**PAPAVERACEAE**	**ESCHSCHOLZIA CALIFORNICA**	**CALIFORNIA POPPY**	
521	**PHILADELPHACEAE**	**PHILADELPHUS LEWISII**	**MOCK ORANGE**	
522	**PHILADELPHACEAE**	**WHIPPLEA MODESTA**	**YERBA DE SELVA**	
523	**PINACEAE**	**ABIES CONCOLOR**	**WHITE FIR**	
524	**PINACEAE**	**ABIES MAGNIFICA**	**RED FIR**	
525	**PINACEAE**	**PINUS ATTENUATA**	**KNOBCONE PINE**	
526	**PINACEAE**	**PINUS JEFFREYI**	**JEFFREY PINE**	
527	**PINACEAE**	**PINUS LAMBERTIANA**	**SUGAR PINE**	
528	**PINACEAE**	**PINUS PONDEROSA**	**PONDEROSA PINE**	
529	**PINACEAE**	**PINUS SABINIANA**	**GREY PINE**	
530	**PINACEAE**	**PSEUDOTSUGA MENZIESII**	**DOUGLAS FIR**	
531	PLANTAGINACEAE	PLANTAGO CORONOPUS	CUT-LEAVED PLANTAIN	
532	**PLANTAGINACEAE**	**PLANTAGO ERECTA**	**ENGLISH PLANTAIN**	
533	PLANTAGINACEAE	PLANTAGO LANCEOLATA	NARROW-LEAVED PLANTAIN	
534	PLANTAGINACEAE	PLANTAGO MAJOR	COMMON PLANTAIN	
535	PLANTAGINACEAE	PLANTAGO VIRGINICA	DWARF PLANTAIN	
536	**POACEAE**	**ACHNATHERUM LATIGLUME**		
537	**POACEAE**	**ACHNATHERUM LEMMONII**	**LEMMON'S STIPA**	
538	**POACEAE**	**ACHNATHERUM OCCIDENTALIS**	**CALIFORNIA STIPA**	
539	**POACEAE**	**ACHNATHERUM STILLMANII**	**STILLMAN'S STIPA**	
540	POACEAE	AEGILOPS TRIUNCIALIS	GOAT GRASS	
541	POACEAE	AGROSTIS CAPILLARIS	COLONIAL BENTGRASS	
542	**POACEAE**	**AGROSTIS EXARATA**	**WESTERN BENTGRASS, SPIKE REDTOP**	
543	POACEAE	AGROSTIS GIGANTEA	CREEPING BENTGRASS	
544	**POACEAE**	**AGROSTIS IDAHOENSIS**	**COLONIAL BENTGRASS**	
545	**POACEAE**	**AGROSTIS OREGONENSIS**	**OREGON BENTGRASS**	
546	**POACEAE**	**AGROSTIS PALLENS**	**BENT GRASS**	
547	**POACEAE**	**AGROSTIS SCABRA**	**ROUGH BENTGRASS**	
548	POACEAE	AGROSTIS STOLONIFERA	CREEPING BENT GRASS	
549	POACEAE	AGROSTIS VIRIDIS	BENT GRASS	
550	POACEAE	AIRA CARYOPHYLLEA	SILVER HAIR GRASS	
551	POACEAE	ALOPECURUS PRATENSIS	MEADOW FOXTAIL	
552	POACEAE	ANDRPOGON VIRGINICUS var VIRGINICUS	BLUESEDGE BLUESTEM	
553	**POACEAE**	**ARISTIDA OLIGANTHA**	**OLDFIELD THREE-AWN**	
554	POACEAE	ARUNDO DONAX	GIANT REED	
555	POACEAE	AVENA BARBATA	SLENDER WILD OAT	
556	POACEAE	AVENA FATUA	WILD OAT	
557	POACEAE	BRIZA MAXIMA	RATTLESNAKE GRASS	
558	POACEAE	BRIZA MINOR	LITTLE RATTLESNAKE GRASS	
559	**POACEAE**	**BROMUS CARINATUS**	**CALIFORNIA BROME**	
560	**POACEAE**	**BROMUS CARINATUS var CARINATUS**	**CALIFORNIA BROME**	
561	POACEAE	BROMUS DIANDRUS	RIPGUT BROME	
562	POACEAE	BROMUS HORDEACEUS	SOFT CHESS	
563	POACEAE	BROMUS INERMIS	SMOOTH BROME	
564	POACEAE	BROMUS JAPONICUS	DOWNY-SHEATHED CHEAT	
565	**POACEAE**	**BROMUS LAEVIPES**	**NARROW-FLOWERED BROME**	
566	POACEAE	BROMUS MADRITENSIS	FOXTAIL CHESS	
567	POACEAE	BROMUS MADRITENSIS ssp RUBENS	RED BROME, FOXTAIL	
568	**POACEAE**	**BROMUS ORCUTTIANUS**	**ORCUTT'S BROME-GRASS**	
569	POACEAE	BROMUS STERILIS	STERILE BROME	
570	POACEAE	BROMUS TECTORUM	DOWNY BROME, CHEATGRASS	
571	POACEAE	CYNODON DACTYLON	BERMUDA GRASS	
572	POACEAE	CYNOSURUS ECHINATUS	DOGTAIL GRASS	
573	POACEAE	DACTYLIS GLOMERATA	ORCHARD GRASS	
574	**POACEAE**	**DESCHAMPSIA DANTHONIOIDES**	**ANNUAL HAIR GRASS**	
575	**POACEAE**	**DESCHAMPSIA ELONGATA**	**SLENDER HAIRGRASS**	
576	POACEAE	DIGITARIA ISCHAEMUM	SMOOTH CRABGRASS	
577	**POACEAE**	**DISTICHLIS SPICATA**	**SALT GRASS**	
578	POACEAE	ECHINOCHLOA CRUS-GALLI	BARNYARD GRASS	
579	**POACEAE**	**ELYMUS ELYMOIDES**	**BOTTLEBRUSH,SQUIRREL TAIL**	
580	**POACEAE**	**ELYMUS GLAUCUS var GLAUCUS**	**BLUE WILD RYE**	
581	**POACEAE**	**ELYMUS GLAUCUS var JEPSONII**	**BLUE WILD RYE**	

582	**POACEAE**	**ELYMUS MULTISETUS**	**BIG SQUIRRELTAIL**	
583	**POACEAE**	**ELYMUS STEBBINSII**	**CALIFORNIA RYE GRASS**	
584	POACEAE	ERAGROSTIS CURVULA	WEEPING LOVEGRASS	
585	**POACEAE**	**ERAGROSTIS MEXICANA ssp VIRESCENS**	**ORCUTT'S ERAGROSTIS**	
586	POACEAE	FESTUCA ARUNDINACEAE	TALL FESCUE	
587	**POACEAE**	**FESTUCA CALIFORNICA**	**CALIFORNIIA FESCUE**	
588	**POACEAE**	**FESTUCA IDAHOENSIS**	**IDAHO FESCUE**	
589	**POACEAE**	**FESTUCA OCCIDENTALIS**	**WESTERN FESCUE**	
590	POACEAE	GASTRIDIUM VENTRICOSUM	NIT GRASS	
591	**POACEAE**	**GLYCERIA ELATA**	**FOWL MANNAGRASS**	
592	POACEAE	HOLCUS LANATUS	VELVET GRASS	
593	**POACEAE**	**HORDEUM BRACHYANTHERUM ssp CALIFORNICUM**	**CALIFORNIA BARLEY**	
594	**POACEAE**	**HORDEUM DEPRESSUM**	**LOW BARLEY**	
595	POACEAE	HORDEUM MARINUM ssp GUSSONEANU	MEDITERRANEAN BARLEY	
596	POACEAE	HORDEUM MURINUM ssp LEPORINUM	HARE BARLEY	
597	**POACEAE**	**KOELERIA MACRANTHA**	**JUNEGRASS**	
598	**POACEAE**	**LEERSIA ORYZOIDES**	**RICE CUTGRASS**	
599	**POACEAE**	**LEYMUS TRITICOIDES**	**CREEPING WILD RYE**	
600	POACEAE	LOLIUM MULTIFLORUM	ITALIAN RYE GRASS	
601	POACEAE	LOLIUM PERENNE	PERENNIAL RYEGRASS	
602	**POACEAE**	**MELICA ARISTATA**	**AWNED MELICA**	
603	**POACEAE**	**MELICA CALIFORNICA**	**CALIFORNIA MELICA**	
604	**POACEAE**	**MELICA GEYERI**	**GEYER'S ONION GRASS**	
605	**POACEAE**	**MELICA HARFORDII**	**HARFORD'S MELICA**	
606	**POACEAE**	**PANICUM ACUMINATUM**	**WESTERN WITCH GRASS**	
607	**POACEAE**	**PANICUM ACUMINATUM var ACUMINATUM**	**PACIFIC PANIC GRASS**	
608	**POACEAE**	**PANICUM ACUMINATUM var LINDHEIMERI**	**PACIFIC PANIC GRASS**	
609	**POACEAE**	**PANICUM CAPILLARE**	**OLD WITCH GRASS**	
610	POACEAE	PANICUM DICHOTOMIFLORUM	SMOOTH WITCHGRASS	
611	POACEAE	PASPALUM DILITATUM	DALLIS GRASS	
612	POACEAE	PHALARIS AQUATICA	HARDING GRASS	
613	POACEAE	PHALARIS CALIFORNICA	CANARY GRASS	
614	POACEAE	PIPTATHERUM MILIACEUM	MILLET MOUNTAIN RICE	
615	POACEAE	POA ANNUA	ANNUAL BLUEGRASS	
616	POACEAE	POA BULBOSA	BULBOUS BLUEGRASS	
617	POACEAE	POA COMPRESSA	CANADA BLUEGRASS	
618	POACEAE	POA PRATENSIS ssp PRATENSIS	KENTUCKY BLUEGRASS	
619	**POACEAE**	**POA SECUNDA ssp SECUNDA**	**ONE-SIDED BLUEGRASS**	
620	POACEAE	POLYPOGON AUSTALIS	CHILEAN BEARD GRASS	
621	POACEAE	POLYPOGON MONSPELIENSIS	RABBIT'S FOOT	
622	**POACEAE**	**PSEUDOROEGNERIA SPICATA ssp SPICATA**	**BENT GRASS**	
623	**POACEAE**	**PUCCINELLIA HOWELLII**	**HOWELL'S ALKALAI GRASS**	**CNPS LIST 1B**
624	**POACEAE**	**SCRIBNERIA BOLANDERI**	**SCRIBNER GRASS**	
625	POACEAE	SECALE CEREALE	RYE	
626	**POACEAE**	**SETARIA GRACILIS**	**BRISTLY FOXTAIL**	
627	POACEAE	SORGHUM HALEPENSE	JOHNSON GRASS	
628	POACEAE	TAENIATHERUM CAPUT-MEDUSA	MEDUSA HEAD	
629	**POACEAE**	**TRISETUM CANESCENS**	**NODDING TRISETUM**	
630	POACEAE	VULPIA BROMOIDES		
631	**POACEAE**	**VULPIA MICROSTACHYS**	**SMALL FESCUE, 3 WEEKS FESCUE**	
632	**POACEAE**	**VULPIA MICROSTACHYS VAR CILIATA**		
633	**POACEAE**	**VULPIA MICROSTACHYS var CONFUSA**	**TRACY'S FESCUE**	
634	**POACEAE**	**VULPIA MICROSTACHYS var PAUCIFLORA**	**FEW-FLOWERED FESCUE**	
635	POACEAE	VULPIA MYUROS var MYUROS	SIX WEEKS FESCUE	
636	POACEAE	VULPIA MYUROS var. HIRSUTA	ZORRO FESCUE	
637	**POACEAE**	**VULPIA OCTOFLORA**	**SIX WEEKS FESCUE**	
638	**POLEMONIACEAE**	**ALLOPHYLLUM DIVARICATUM**	**STRAGGLING GILIA**	
639	**POLEMONIACEAE**	**ALLOPHYLLUM GILIOIDES**	**DENSE FALSE GILY FLOWER**	
640	**POLEMONIACEAE**	**COLLOMIA GRANDIFLORA**	**LARGE-FLOWERED COLLOMIA**	
641	**POLEMONIACEAE**	**COLLOMIA HETEROPHYLLA**	**VARIABLE LEAF COLLOMIA**	
642	**POLEMONIACEAE**	**GILIA CAPILLARIS**	**SMOOTH-LEAVED GILIA**	
643	**POLEMONIACEAE**	**GILIA CAPITATA**	**BLUE FIELD GILIA**	
644	**POLEMONIACEAE**	**GILIA CAPITATA ssp PEDEMONTANA**	**BLUE FIELD GILIA**	
645	**POLEMONIACEAE**	**LINANTHUS ANDROSACEUS**	**FALSE BABY STARS**	
646	**POLEMONIACEAE**	**LINANTHUS BICOLOR**	**BICOLORED LINANTHUS**	
647	**POLEMONIACEAE**	**LINANTHUS CILIATUS**	**WHISKER BRUSH LINANTHUS**	
648	**POLEMONIACEAE**	**LINANTHUS RATTANII**	**RATTAN'S LINANTHUS**	**CNPS LIST 4**
649	**POLEMONIACEAE**	**NAVARRETIA HETERANDRA**	**TEHAMA NAVARRETIA**	**CNPS LIST 4**
650	**POLEMONIACEAE**	**NAVARRETIA INTERTEXTA**	**NEEDLE-LEAVED NAVERRETIA**	
651	**POLEMONIACEAE**	**PHLOX GRACILIS ssp HUMILIS**	**BEGGAR'S GILIA**	
652	**POLEMONIACEAE**	**PHLOX SPECIOSA ssp OCCIDENTALIS**	**SHOWY PHLOYES**	
653	**POLYGALACEAE**	**POLYGALA CORNUTA**	**SIERRA MILKWORT**	
654	**POLYGONACEAE**	**ERIOGONUM LOBBYII var LOBBII**	**LOBB'S BUCKWHEAT**	
655	**POLYGONACEAE**	**ERIOGONUM NUDUM**	**NAKED BUCKWHEAT**	
656	**POLYGONACEAE**	**ERIOGONUM NUDUM var PUBIFLORUM**	**NAKED BUCKWHEAT**	
657	**POLYGONACEAE**	**ERIOGONUM UMBELLATUM**	**SULPHUR BUCKWHEAT**	
658	**POLYGONACEAE**	**ERIOGONUM VIMINEUM**	**WICKER BUCKWHEAT**	
659	POLYGONACEAE	POLYGONUM ARENASTRUM	COMMON KNOTWEED	
660	**POLYGONACEAE**	**POLYGONUM BOLANDERI**	**BOLANDER'S KNOTWEED**	
661	**POLYGONACEAE**	**POLYGONUM DOUGLASII var JOHNSTONII**	**KNOTWEED**	
662	POLYGONACEAE	POLYGONUM HYDROPIPER	COMMON SMARTWEED	
663	**POLYGONACEAE**	**POLYGONUM LAPATHIFOLIUM**	**WILLOW SMARTWEED**	
664	POLYGONACEAE	POLYGONUM PERSICARIA	LADY'S THUMB	
665	POLYGONACEAE	RUMEX ACETOSELLA	SHEEP SORREL	
666	POLYGONACEAE	RUMEX CRISPUS	CURLY DOCK	
667	**POLYGONACEAE**	**RUMEX SALICIFOLIUS**	**WILLOW DOCK**	
668	**POLYPODIACEAE**	**POLYPODIUM CALIFORNICUM**	**CALIFORNIA POLYPODY**	
669	**PORTULACACEAE**	**CALANDRINA CILIATA**	**RED MAIDS**	
670	**PORTULACACEAE**	**CALYPTRIDIUM UMBELLATUM**	**PUSSY TOES**	
671	**PORTULACACEAE**	**CLATONIA EXIGUA ssp EXIGUA**	**PALE SPRING BEAUTY**	
672	**PORTULACACEAE**	**CLAYTONIA PERFOLIATA**	**MINER'S LETTUCE**	
673	**PORTULACACEAE**	**CLAYTONIA RUBRA ssp RUBRA**	**RED STEM MINER'S LETTUCE**	
674	**PORTULACACEAE**	**MONTIA PARVIFLORA**	**MINER'S LETTUCE**	
675	PORTULACACEAE	PORTULACA OLERACEA	PURSLANE	
676	POTAMOGETONACEAE	POTAMOGETON CRISPUS	CUT-LEAVED PONDWEED	
677	**POTAMOGETONACEAE**	**POTAMOGETON DIVERSIFLORUS**	**RAFINIQUE'S PONDWEED**	
678	**POTAMOGETONACEAE**	**POTAMOGETON EPIHYDRUS ssp NUTTALLII**	**NUTTALL'S PONDWEED**	
679	**POTAMOGETONACEAE**	**POTAMOGETON FOLIOUS**	**LEAFY PONDWEED**	
680	POTAMOGETONACEAE	POTAMOGETON PUSILLUS	SMALL PONDWEED	
681	**PRIMULACEAE**	**ANAGALLIS ARVENSIS**	**SCARLET PIMPERNEL**	

682	PRIMULACEAE	DODECATHEON HENDERSONII	SHOOTING STAR
683	PRIMULACEAE	TRIENTALIS LATIFOLIA	WESTERN STAR FLOWER
684	PTERIDACEAE	ADIANTUM CAPILLUS-VENERIS	MAIDENHAIR FERN
685	PTERIDACEAE	ASPIDOTIS DENSA	INDIAN'S DREAM
686	PTERIDACEAE	CHEILANTHES GRACILLIMA	LACE FERN
687	PTERIDACEAE	CRYPTOGRAMMA ACROSTICHOIDES	PARSLEY FERN
688	PTERIDACEAE	PELLAEA MUCRONATA	BIRD'S FOOT FERN
689	PTERIDACEAE	PENTAGRAMMA TRIANGULARIS	GOLDBACK FERN
690	RANUNCULACEAE	ACONITUM COLUMBIANUM	MONKSHOOD
691	RANUNCULACEAE	ACTAEA RUBRA	BEARBERRY
692	RANUNCULACEAE	AQUILEGIA FORMOSA	WESTERN COLUMBINE
693	RANUNCULACEAE	CLEMATIS LASIANTHA	PIPESTEM CLEMATIS
694	RANUNCULACEAE	CLEMATIS LIGUSTICIFOLIA	WESTERN VIRGIN'S BOWER
695	RANUNCULACEAE	DELPHINIUM DECORUM	COAST LARKSPUR
696	RANUNCULACEAE	DELPHINIUM DEPAUPERATUM	DWARF LARKSPUR
697	RANUNCULACEAE	DELPHINIUM HANSENII	HANSEN'S LARKSPUR
698	RANUNCULACEAE	DELPHINIUM HESPERIUM	WESTERN LARKSPUR
699	RANUNCULACEAE	DELPHINIUM HESPERIUM ssp PALLESCENS	PALE WESTERN LARKSPUR
700	RANUNCULACEAE	DELPHINIUM NUDICAULE	CANYON LARKSPUR, RED LARKSPUR
701	RANUNCULACEAE	ISOPYRUM STIPITATUM	SISKIYOU RUE-ANEMONE
702	RANUNCULACEAE	MYOSURUS MINIMUS	COMMON MOUSE TAIL
703	RANUNCULACEAE	RANUNCULUS AQUATILIS var CAPILLACEUS	WATER BUTTERCUP
704	RANUNCULACEAE	RANUNCULUS AQUATILIS var HISPIDULUS	WATER BUTTERCUP
705	RANUNCULACEAE	RANUNCULUS CALIFORNICUS	CALIFORNIA BUTTERCUP
706	RANUNCULACEAE	RANUNCULUS OCCIDENTALIS	WESTERN BUTTERCUP
707	RHAMNACEAE	CEANOTHUS CORDULATUS	MT.WHITE THORN, SNOW BUSH
708	RHAMNACEAE	CEANOTHUS CUNEATUS	BUCK BRUSH
709	RHAMNACEAE	CEANOTHUS INTEGERRIMUS	DEER BRUSH
710	RHAMNACEAE	CEANOTHUS LEMMONII	LEMMON'S CEANOTHUS
711	RHAMNACEAE	CEANOTHUS PROSTRATUS	SQUAW CARPET, PINEMAT
712	RHAMNACEAE	RHAMNUS ILICIFOLIA ssp ILICIFOLIA	HOLLYLEAF REDBERRY
713	RHAMNACEAE	RHAMNUS PURSHIANA	CASCARA SAGRADA
714	RHAMNACEAE	RHAMNUS RUBRA	SIERRA COFFEEBERRY
715	RHAMNACEAE	RHAMNUS TOMENTELLA ssp CRASSIFOLIA	VELVET LEAF COFFEEBERRY
716	RHAMNACEAE	RHAMNUS TOMENTELLA ssp TOMENTELLA	CHAPARRAL COFFEE BERRY
717	ROSACEAE	ADENOSTOMA FASCICULATUM	CHAMISE
718	ROSACEAE	AMELANCHIER ALNIFOLIA var PUMILA	DWARF SERVICE BERRY
719	ROSACEAE	AMELANCHIER UTAHENSIS	SERVICE BERRY
720	ROSACEAE	APHANES OCCIDENTALIS	WESTERN LADY'S MANTLE
721	ROSACEAE	ARUNCUS DIOICUS var PUBESCENS	GOAT'S BEARD
722	ROSACEAE	CERCOCARPUS BETULOIDES	MOUNTAIN MAHOGANEY
723	ROSACEAE	CRATAEGUS DOUGLASII	DOUGLAS'S HAWTHORNE
724	ROSACEAE	HETEROMELES ARBUTIFOLIA	TOYON, CHRISTMAS BERRY
725	ROSACEAE	HOLODISCUS DISCOLOR	CREAM BUSH, OCEAN SPRAY
726	ROSACEAE	HORKELIA TRIDENTATA	THREE-TOOTHED HORKELIA
727	ROSACEAE	MALUS SYLVESTRIS	APPLE
728	ROSACEAE	PHYSOCARPUS CAPITATUS	WESTERN NINEBARK
729	ROSACEAE	POTENTILLA GLANDULOSA	STICKY CINQUEFOIL
730	ROSACEAE	POTENTILLA GRACILIS	SLENDER CINQUEFOIL
731	ROSACEAE	PRUNUS EMARGINATA	BITTER CHERRY
732	ROSACEAE	PRUNUS SPP	CHERRY
733	ROSACEAE	PRUNUS SUBCORDATA	SIERRA PLUM
734	ROSACEAE	PRUNUS VIRGINIANA var DEMISSA	CHOKECHERRY
735	ROSACEAE	ROSA CALIFORNICA	CALIFORNIA WILD ROSE
736	ROSACEAE	ROSA GYMNOCARPA	WOOD ROSE
737	ROSACEAE	ROSA PINETORUM	PINE ROSE
738	ROSACEAE	ROSA SPITHAMEA	GROUND ROSE
739	ROSACEAE	RUBUS DISCOLOR	HIMALAYA BERRY
740	ROSACEAE	RUBUS GLAUCIFOLIUS	RASPBERRY
741	ROSACEAE	RUBUS LACINIATUS	CUT-LEAF BLACKBERRY
742	ROSACEAE	RUBUS LEUCODERMIS	WESTERN RASPBERRY
743	ROSACEAE	RUBUS PARVIFLORUS	THIMBLEBERRY
744	ROSACEAE	RUBUS URSINUS	PACIFIC BLACKBERRY
745	ROSACEAE	SANGUISORBA MINOR var MURICATA	BURNET
746	ROSACEAE	SPIREA DOUGLASII	DOUGLAS' SPIREA
747	RUBIACEAE	CEPHALANTHUS OCCIDENTALIS var CALIFORNICA	BUTTON BUSH
748	RUBIACEAE	CRUCIANELLA ANGUSTIFOLIA	NARROW-LEAVED CROSSWORT
749	RUBIACEAE	GALIUM APARINE	GOOSE GRASS
750	RUBIACEAE	GALIUM BOLANDERI	BOLANDER'S BEDSTRAW
751	RUBIACEAE	GALIUM DIVARICATUM	LAMARCK'S BEDSTRAW
752	RUBIACEAE	GALIUM GRAYANUM	GRAY'S BEDSTRAW
753	RUBIACEAE	GALIUM MOLLUGO	WILD MADDER
754	RUBIACEAE	GALIUM NUTTALLII	NUTTALL'S BEDSTRAW
755	RUBIACEAE	GALIUM PARISIENSE	WALL BEDSTRAW
756	RUBIACEAE	GALIUM PORRIGENS var TENUE	GRACEFUL BEDSTRAW
757	RUBIACEAE	GALIUM TRIFLORUM	SWEET BEDSTRAW
758	RUBIACEAE	KELLOGGIA GALIOIDES	KELLOGGIA
759	SALICACEAE	POPULUS BALSAMIFERA ssp TRICHOCARPA	BLACK COTTONWOOD
760	SALICACEAE	POPULUS FREMONTII ssp FREMONTII	FREMONT COTTONWOOD
761	SALICACEAE	SALIX LASIOLEPIS	ARROYO WILLOW
762	SALICACEAE	SALIX SCOULERIANA	SCOULER'S WILLOW
763	SALICACEAE	SALIX EXIGUA	SAND BAR WILLOW
764	SALICACEAE	SALIX LAEVIGATA	RED WILLOW
765	SALICACEAE	SALIX LUCIDA ssp LASIANDRA	PACIFIC WILLOW
766	SALICACEAE	SALIX MELANOPSIS	DUSKY WILLOW
767	SALICACEAE	SALIX SESSILIFOLIA	NORTHWEST WILLOW,VELVET WILLOW
768	SANTALACEAE	COMANDRA UMBELLATA ssp CALIFORNICA	BASTARD TOAD FLAX
769	SAXIFRAGACEAE	BOYKINIA MAJOR	MOUNTAIN BOYKINIA
770	SAXIFRAGACEAE	DARMERA PELTATA	UMBRELLA PLANT, INDIAN RHUBARB
771	SAXIFRAGACEAE	HEUCHERA SPP.	ALUM ROOT
772	SAXIFRAGACEAE	LITHOPHRAGMA AFFINE	WOODLAND STAR
773	SAXIFRAGACEAE	LITHOPHRAGMA BOLANDERI	HILLSTAR
774	SAXIFRAGACEAE	LITHOPHRAGMA CAMPANULATUM	WOODLAND STAR
775	SAXIFRAGACEAE	LITHOPHRAGMA PARVIFLORUM	PRAIRIE STAR
776	SAXIFRAGACEAE	SAXIFRAGA CALIFORNICA	CALIFORNIA SAXIFRAGE
777	SAXIFRAGACEAE	SAXIFRAGA NIDIFICA var NIDIFICA	PEAK SAXIFRAGE
778	SAXIFRAGACEAE	TELLIMA GRANDIFLORA	FRINGE CUPS
779	SCROPHULARIACEAE	ANTIRRHINUM VEXILLO CALYCULATUM	BREWER'S SNAPDRAGON
780	SCROPHULARIACEAE	CASTILLEJA APPLEGATEI	WAVY-LEAVED INDIAN PAINTBRUSH
781	SCROPHULARIACEAE	CASTILLEJA ATTENUATA	NARROW-LEAVED OWL'S CLOVER

782	**SCROPHULARIACEAE**	**CASTILLEJA LACERA**	**CUT-LEAVED OWL'S CLOVER**	
783	**SCROPHULARIACEAE**	**COLLINSIA PARVIFLORA**	**FEW-FLOWERED BLUE-EYED MARY**	
784	**SCROPHULARIACEAE**	**COLLINSIA RATTANII**	**RATTAN'S BLUE-EYED MARY**	
785	**SCROPHULARIACEAE**	**COLLINSIA TINCTORIA**	**STICKY CHINESE HOUSES**	
786	**SCROPHULARIACEAE**	**CORDYLANTHUS TENIUS ssp VISCIDUS**	**VISCID BIRD'S BEAK**	
787	SCROPHULARIACEAE	DIGITALIS PURPUREA	FOXGLOVE	
788	SCROPHULARIACEAE	DOPATRIUM JUNCEUM	HORSEFLY'S EYE	
789	**SCROPHULARIACEAE**	**KECKIELLA BREVIFLORA var GLABRISEPALA**	**BEARD TONGUE**	
790	**SCROPHULARIACEAE**	**KECKIELLA CORYMBOSA**	**BUSH BEARD TONGUE**	
791	**SCROPHULARIACEAE**	**KECKIELLA LEMMONII**	**SHRUBBY PENSTEMON**	
792	SCROPHULARIACEAE	KICKXIA ELATINE	SHARP-LEAVED FLUELLIN	
793	**SCROPHULARIACEAE**	**LIMOSELLA ACAULIS**	**SOUTHERN MUDWORT**	
794	SCROPHULARIACEAE	LINARIA GENISTIFOLIA ssp DALMATICA	DALMATION TOADFLAX	
795	**SCROPHULARIACEAE**	**LINDERNIA DUBIA var ANAGALLIDEA**	**FALSE PIMPERNEL**	
796	**SCROPHULARIACEAE**	**MIMULUS CARDINALIS**	**CARDINAL MONKEYFLOWER**	
797	**SCROPHULARIACEAE**	**MIMULUS FLORIBUNDUS**	**MANY-FLOWERED MONKEYFLOWER**	
798	**SCROPHULARIACEAE**	**MIMULUS GUTTATUS**	**COMMON MONKEYFLOWER**	
799	**SCROPHULARIACEAE**	**MIMULUS KELLOGGII**	**KELLOGG'S MONKEYFLOWER**	
800	**SCROPHULARIACEAE**	**MIMULUS LAYNEAE**	**LAYNE'S MONKEYFLOWER**	
801	**SCROPHULARIACEAE**	**MIMULUS MOSCHATUS**	**MUSK MONKEYFLOWER**	
802	**SCROPHULARIACEAE**	**MIMULUS NANUS**	**DWARF MONKEYFLOWER**	
803	**SCROPHULARIACEAE**	**MIMULUS PILOSUS**	**SNOUTED MONKEYFLOWER**	
804	**SCROPHULARIACEAE**	**MIMULUS TORREYI**	**TORREY'S MONKEYFLOWER**	
805	**SCROPHULARIACEAE**	**PEDICULARIS DENSIFLORA**	**INDIAN WARRIOR**	
806	**SCROPHULARIACEAE**	**PENSTEMON AZUREUS**	**BLUE PENSTEMON**	
807	**SCROPHULARIACEAE**	**PENSTEMON AZUREUS var AZUREUS**	**BLUE PENSTEMON**	
808	**SCROPHULARIACEAE**	**PENSTEMON NEOTERICUS**	**DERIVED PENSTEMON**	
809	**SCROPHULARIACEAE**	**PENSTEMON PARVULUS**	**SMALL PENSTEMON**	
810	**SCROPHULARIACEAE**	**PENSTEMON PURPUSSII**	**SNOW MOUNTAIN BEARDTONGUE**	**CNPS LIST 4**
811	**SCROPHULARIACEAE**	**PENSTEMON RUPICOLA**	**ROCK PENSTEMON**	
812	**SCROPHULARIACEAE**	**SCROPHULARIA CALIFORNICA var FLORIBUNDA**	**FIGWORT, BEE PLANT**	
813	**SCROPHULARIACEAE**	**TONELLA TENELLA**	**SMALL-FLOWERED TONELLA**	
814	**SCROPHULARIACEAE**	**TRIPHYSARIA PUSILLA**	**DWARF OWL'S CLOVER**	
815	SCROPHULARIACEAE	VERBASCUM BLATTARIA	MOTH MULLEIN	
816	SCROPHULARIACEAE	VERBASCUM THAPSUS	COMMON MULLEIN	
817	**SCROPHULARIACEAE**	**VERONICA AMERICANA**	**AMERICAN BROOKLIME**	
818	SCROPHULARIACEAE	VERONICA ARVENSIS	SPEEDWELL	
819	**SCROPHULARIACEAE**	**VERONICA PEREGRINA var XALAPENSIS**	**PURSLANE, SPEEDWELL**	
820	SIMAROUBACEAE	AILANTHUS ALTISSIMA	TREE OF HEAVEN	
821	SOLANACEAE	DATURA STRAMONIUM	JIMSON WEED	
822	SOLANACEAE	NICOTIANA ACUMINATA MULTIFLORA	MANY-FLOWERED TOBACCO	
823	**SOLANACEAE**	**NICOTIANA QUADRIVALVIS**	**INDIAN TOBACCO**	
824	**SOLANACEAE**	**SOLANUM AMERICANUM**	**SMALL-FLOWERED NIGHTSHADE**	
825	**SOLANACEAE**	**SOLANUM PARISHII**	**NIGHTSHADE**	
826	**STERCULIACEAE**	**FREMONTODENDRON CALIFORNICUM ssp CALIFORNICUM**	**FLANNEL BUSH**	
827	**STYRACACEAE**	**STYRAX OFFICINALIS var REDIVIVUS**	**SNOWDROP BUSH**	
828	TAMARICACEAE	TAMARIX CHINENSIS	SALT CEDAR	
829	**TAXACEAE**	**TAXUS BREVIFOLIA**	**CALIFORNIA YEW**	
830	**TYPHACEAE**	**TYPHA DOMINGENSIS**	**CATTAIL**	
831	**TYPHACEAE**	**TYPHA LATIFOLIA**	**BROAD-LEAVED CATTAIL**	
832	URTICACEAE	URTICA DIOICA var HOLOSERICEA	HOARY NETTLE, STINGING NETTLE	
833	**VALERIANACEAE**	**PLECTRITIS MACROCERA**	**WHITE PLECTRITIS**	
834	VALERIANACEAE	VALERIANELLA CARINATA	CORN SALAD	
835	**VERBANACEAE**	**VERBENA LASIOSTACHYS var SCABRIDA**	**ROBUST VERVAIN**	
836	**VERBENACEAE**	**VERBENA MENTHAFOLIA**	**MINT VERVAIN**	
837	**VIOLACEAE**	**VIOLA GLABELLA**	**STREAM VIOLET**	
838	**VIOLACEAE**	**VIOLA LOBATA**	**YELLOW VIOLET, PINE VIOLET**	
839	**VIOLACEAE**	**VIOLA LOBATA var INTEGRIFOLIA**	**YELLOW VIOLET**	
840	VIOLACEAE	VIOLA ODORATA	ENGLISH VIOLET	
841	**VIOLACEAE**	**VIOLA PURPUREA**	**MOUNTAIN VIOLET**	
842	**VIOLACEAE**	**VIOLA SHELTONII**	**SHELTON'S VIOLET**	
843	**VISCACEAE**	**ARCEUTHOBIUM AMERICANUM**	**AMERICAN DWARF MISTLETOE**	
844	**VISCACEAE**	**ARCEUTHOBIUM DIVARICATUM**	**PINE MISTLETOE**	
845	**VISCACEAE**	**ARCEUTHOBIUM OCCIDENTALE**	**DIGGER PINE MISTLETOE**	
846	**VISCACEAE**	**PHORADENDRON JUNIPERINUM**	**JUNIPER MISTLETOE**	
847	**VISCACEAE**	**PHORADENDRON VILLOSUM**	**OAK MISTLETOE**	
848	**VITACEAE**	**VITIS CALIFORNICA**	**CALIFORNIA GRAPE**	

Mammal Species List

Order	Family	Scientific Name	Common Name	Presence
ARTIODACTYLA	CERVIDAE	ODOCOILEUS HEMIONUS	BLACK-TAILED DEER	confirmed
ARTIODACTYLA	SUIDAE	SUS SCROFA	WILD BOAR	confirmed
CARNIVORA	CANIDAE	CANIS LATRANS	COYOTE	confirmed
CARNIVORA	CANIDAE	UROCYON CINEREOARGENTEUS	GRAY FOX	confirmed
CARNIVORA	CANIDAE	VULPES VULPES	RED FOX	possible
CARNIVORA	FELIDAE	FELIS CONCOLOR	MOUNTAIN LION	confirmed
CARNIVORA	FELIDAE	FELIS RUFUS	BOBCAT	confirmed
CARNIVORA	MUSTELIDAE	GULO LUSCUS	WOLVERINE	possible
CARNIVORA	MUSTELIDAE	LUTRA CANADENSIS	RIVER OTTER	confirmed
CARNIVORA	MUSTELIDAE	MARTES AMERICANA	MARTEN	probable
CARNIVORA	MUSTELIDAE	MARTES PENNANTI	FISHER	confirmed
CARNIVORA	MUSTELIDAE	MEPHITIS MEPHITIS STRIPED	SKUNK	confirmed
CARNIVORA	MUSTELIDAE	MUSTELA ERMENEA	ERMINE	probable
CARNIVORA	MUSTELIDAE	MUSTELA FRENATA	LONG-TAILED WEASEL	confirmed
CARNIVORA	MUSTELIDAE	MUSTELA VISON	MINK	confirmed
CARNIVORA	MUSTELIDAE	SPILOGALE PUTORIUS	SPOTTED SKUNK	confirmed
CARNIVORA	MUSTELIDAE	TAXIDEA TAXUS	BADGER	possible
CARNIVORA	PROCYONIDAE	BASSARISCUS ASTUTUS	RINGTAIL	confirmed
CARNIVORA	PROCYONIDAE	PROCYON LOTOR	RACCOON	confirmed
CARNIVORA	URSIDAE	URSUS AMERICANUS	BLACK BEAR	confirmed
CHIROPTERA	VESPERTILIONIDAE	ANTROZOUS PALLIDUS	PALLID BAT	confirmed
CHIROPTERA	VESPERTILIONIDAE	EPTESICUS FUSCUS BIG	BROWN BAT	confirmed
CHIROPTERA	VESPERTILIONIDAE	LASIONYCTERIS NOCTIVAGANS	SILVER-HAIRED BAT	confirmed
CHIROPTERA	VESPERTILIONIDAE	LASIURUS BOREALIS	RED BAT	confirmed
CHIROPTERA	VESPERTILIONIDAE	LASIURUS CINEREUS	HOARY BAT	probable
CHIROPTERA	VESPERTILIONIDAE	MYOTIS CALIFORNICUS	CALIFORNIA MYOTIS	confirmed
CHIROPTERA	VESPERTILIONIDAE	MYOTIS EVOTIS	LONG-EARED MYOTIS	confirmed
CHIROPTERA	VESPERTILIONIDAE	MYOTIS LUCIFUGUS	LITTLE BROWN MYOTIS	possible
CHIROPTERA	VESPERTILIONIDAE	MYOTIS THYSANODES	FRINGED MYOTIS	confirmed
CHIROPTERA	VESPERTILIONIDAE	MYOTIS VOLANS	LONG-LEGGED MYOTIS	probable
CHIROPTERA	VESPERTILIONIDAE	MYOTIS YUMANENSIS	YUMA MYOTIS	confirmed
CHIROPTERA	VESPERTILIONIDAE	PLECOTUS TOWNSENDII	TOWNSEND'S BIG-EARED BAT	confirmed
CHIRPOTERA	MOLOSSIDAE	TADARIDA BRASILIENSIS	BRAZILIAN FREE-TAILED BAT	confirmed
INSECTIVORA	SORICIDAE	SOREX PALUSTRIS	WATER SHREW	probable
INSECTIVORA	SORICIDAE	SOREX TROWBRIDGII	TROWBRIDGE'S SHREW	probable
INSECTIVORA	SORICIDAE	SOREX VAGRANS	VAGRANT SHREW	possible
INSECTIVORA	TALPIDAE	NEUROTRICHUS GIBBSII	SHREW MOLE	confirmed
INSECTIVORA	TALPIDAE	SCAPANUS LATIMANUS	BROAD-HANDED MOLE	confirmed
LAGOMORPHA	LEPORIDAE	LEPUS CALIFORNICUS	BLACK-TAILED HARE	confirmed
LAGOMORPHA	LEPORIDAE	SYLVILAGUS BACHMANI	BRUSH RABBIT	confirmed
MARSUPIALIA	DIDELPHIDAE	DIDELPHIS VIRGINIANA	COMMON OPOSSOM	confirmed
RODENTIA	CASTORIDAE	CASTOR CANADENSIS	BEAVER	confirmed
RODENTIA	CRICETIDAE	CLETHRIONOMYS CALIFORNICUS	WESTERN RED-BACKED VOLE	possible
RODENTIA	CRICETIDAE	MICROTUS CALIFORNICUS	CALIFORNIA VOLE	possible
RODENTIA	CRICETIDAE	MICROTUS LONGICAUDUS	LONG-TAILED VOLE	possible
RODENTIA	CRICETIDAE	NEOTOMA CINEREA	BUSHY-TAILED WOOD RAT	probable
RODENTIA	CRICETIDAE	NEOTOMA FUSCIPES	DUSKY-FOOTED WOOD RAT	confirmed
RODENTIA	CRICETIDAE	ONDATRA ZIBETHICA	MUSKRAT	probable
RODENTIA	CRICETIDAE	PEROMYSCUS BOYLII	BRUSH MOUSE	confirmed
RODENTIA	CRICETIDAE	PEROMYSCUS MANICULATUS	DEER MOUSE	confirmed
RODENTIA	CRICETIDAE	PEROMYSCUS TRUEI	PINYON MOUSE	possible
RODENTIA	CRICETIDAE	REITHRODONTOMYS MEGALOTIS	WESTERN HARVEST MOUSE	probable
RODENTIA	ERETHIZONTIDAE	ERETHIZON DORSATUM	PORCUPINE	confirmed
RODENTIA	GEOMYIDAE	THOMOMYS BOTTAE	BOTTA'S POCKET GOPHER	confirmed
RODENTIA	HETEROMYIDE	DIPODOMYS CALIFORNICUS	CALIFORNIA KANGAROO RAT	possible
RODENTIA	MURIDAE	MUS MUSCULUS	HOUSE MOUSE	confirmed
RODENTIA	MURIDAE	RATTUS RATTUS	BLACK RAT	probable
RODENTIA	SCIURIDAE	GLAUCOMYS SABRINUS	NORTHERN FLYING SQUIRREL	confirmed
RODENTIA	SCIURIDAE	SCIURUS GRISEUS	WESTERN GRAY SQUIRREL	confirmed
RODENTIA	SCIURIDAE	SPERMOPHILUS BEECHEYI	CALIFORNIA GROUND SQUIRREL	confirmed
RODENTIA	SCIURIDAE	SPERMOPHILUS SATURATUS	GOLDEN-MANTLED GROUND SQUIRREL	confirmed
RODENTIA	SCIURIDAE	TAMIAS AMOENUS	YELLOW PINE CHIPMUNK	probable
RODENTIA	SCIURIDAE	TAMIAS SENEX	ALLEN'S CHIPMUNK	probable
RODENTIA	SCIURIDAE	TAMIAS SONOMAE	SONOMA CHIPMUNK	probable
RODENTIA	SCIURIDAE	TAMIASCIURUS DOUGLASII	CHICKAREE	confirmed

Appendix B Whiskeytown National Recreation Area Minimal Impact Suppression Techniques and Burned Area Emergency Rehabilitation Guidelines

The change from fire control to fire management has added a new perspective to the roles of fire managers and firefighters. The objective of fire management is to make unique decisions with each fire start, to consider the land and resource objectives, and to decide the appropriate suppression response and tactics which results in minimum costs and resource damage. Fire management now means managing fire "with time" as opposed to "against time." This way of doing business involves not just the firefighter, but all levels of resource management.

In the National Park Service, fire management requires fire managers and firefighters to select actions commensurate with the fire's potential or existing behavior, while leaving minimal environmental impact.

This appendix is intended to serve as a guide for the Incident Commander and Planning Section Chief, Operations Section Chief, Logistics Section Chief, Division/Group Supervisors, Strike Team/Task Force Leaders, Single Resource Bosses, Firefighters, and Burned Area Emergency Rehabilitation (BAER) teams.

Accomplishment of minimum impact suppression techniques originates with instructions that are understandable, stated in measurable terms, and communicated both verbally and in writing. Evaluation of these tactics both during and after implementation will further the understanding and achievement of good land stewardship ethics during fire management activities.

Minimum Impact Suppression Techniques for Agency Administrators, Incident Management Teams and Firefighters

The following guidelines are for park superintendents, incident management teams, and firefighters to consider. Some or all of the items may apply, depending upon the situation.

Command and General Staff

1. Evaluate each and every suppression tactic during planning and strategy sessions to see that they meet superintendent's objectives and minimum impact suppression techniques guidelines.

2. Include agency resource advisor and/or local representative in all planning and strategy sessions.

3. Discuss minimum impact suppression techniques with overhead during overhead briefings, to gain full understanding of tactics.

4. Ensure minimum impact suppression techniques are implemented during line construction as well as other resource disturbing activities.

Planning Section

1. Use resource advisor(s) to evaluate that management tactics are commensurate with land/resource objectives and incident objectives. A resource advisor should be involved in the development of the Wildland Fire Situation Analysis. The resource advisor should consult with a biologist, botanist, geologist, ecologist, cultural resource staff, and other specialists as needed. The resource advisor should provide input to the Planning Section and Incident Commander, and will review shift plans to assess the potential effects of planned actions.

2. Use an assessment team to get a different perspective of the situation.

3. Seek concurrence with National Marine Fisheries Service and US Fish and Wildlife Service.

4. Use additional consultation from "publics" or someone outside the agency, especially if the fire has been or is expected to be burning for an extended period of time.

5. Adjust line production rates to reflect the minimum impact suppression techniques.

6. Use brush blade for line building—when dozer line is determined necessary tactics.

7. Leave some trees randomly in fireline.

8. Ensure that instructions for minimum impact suppression techniques are listed in the incident action plan.

9. Detail objectives for extent of mop-up necessary—for instance: " XX meters within perimeter boundary."

10. If helicopters are involved, use long line remote hook in lieu of helispots to deliver/ retrieve gear.

11. Anticipate fire behavior and ensure all instructions can be implemented safely.

12. In extremely sensitive areas, consider use of portable facilities (heat/cook units, latrines).

Operations Section

1. Emphasize minimum impact suppression techniques during each operational period briefing.

2. Explain expectations for instructions listed in incident action plan.

3. Consider showing minimum impact suppression techniques slide-tape program or video to the crews upon arrival at airport/ incident.

4. Consider judicious use of helicopters—consider long lining instead of new helispot construction.

5. Use natural openings so far as practical.

6. Minimize or avoid stream course disturbance, sedimentation, and actions that will result in increased water temperature.

7. Maintain minimum no-touch buffer within established area of fish-bearing streams in lower Clear Creek. This could include up to 250-feet within the area of these streams and is dependent on site specific prescriptions currently being developed.

8. Consider use of helicopter bucket drops and water/foam before calling for air tanker/ retardant.

9. Chemical Fire Retardant, Foam and Fuel.

a. Wherever possible, avoid using chemicals when there is a potential for contamination of waterways (based on proximity, wind direction, wind speed, size and frequency of loads, etc.) Avoid use of retardant or foam within 300 feet of streams or within designated critical habitat. Use of retardant should also be conducted only after consulting with resource advisors.

b. Do not pump directly from streams if chemical products are going to be injected into the pump or pumping system. If chemicals are needed, use a fold-a-tank from which to pump water.

c. If possible, do not dip helicopter buckets from streams where juvenile or adult salmon may be present (lower Clear Creek). Firefighter and public safety will always take precedence, and if helicopter drops are needed, they will be utilized.

d. If possible, dipping of helicopter buckets will occur only after chemical injection systems (storage containers) have been removed from the bucket or helicopter.

e. Keep refueling, fuel storage, and fuel trucks outside designated critical habitat, or utilize spill pads and/or containment units.

f. Use spill pads under portable pumps and fuel cans/fuel lines connected to pumps.

g. The park should develop a contingency plan identifying procedures to be initiated should a chemical spill or contamination occur.

10. Monitor suppression tactics/conditions.

11. Distribute field guide to appropriate supervisory operations personnel.

Logistics Section

1. Ensure that actions performed around areas other than Incident Base, i.e. dumpsites, camps, staging areas, helibases, etc., result in minimum impact upon the environment.

2. Ensure that designated recycling areas for suppression related support supplies are utilized and operational.

Division/Group Supervisor and Strike Team/ Task Force Leaders

1. Ensure crew superintendents and single resource bosses understand what is expected.

2. Discuss minimum impact tactics with crew.

3. Ensure dozer and falling bosses understand what is expected.

4. If helicopters are involved, use natural openings as much as possible; minimize cutting only to allow safe operations.

5. Avoid construction of landing areas in high visitor use areas.

6. Monitor suppression tactics/conditions.

Crew Superintendents

1. Ensure/Monitor results expected.

2. Discuss minimum impact suppression techniques with crew.

3. Provide feedback on implementation of tactics—were they successful in halting fire spread, what revisions are necessary?

4. Look for opportunities to further minimize impact to land and resources during the suppression and mop-up phase.

Minimum Impact Suppression Technique Implementation Guide

Minimum impact suppression techniques require an increased emphasis to do the job of suppressing a wildland fire while maintaining a high standard of caring for the land. Actual fire conditions and your good judgment will dictate the actions you take. Consider what is necessary to halt fire spread and ensure it is contained within the fire line or designated perimeter boundary.

Safety

1. Safety is of utmost importance.

2. Constantly review and apply LCES, the 18 Situations That Shout Watch Out and 10 Standard Fire Orders.

3. Be particularly cautious with:

   a. Burning snags you allow to burn down.

   b. Burning or partially burning live and dead trees.

   c. Unburned fuel between you and the fire.

   d. Identify hazard trees with either an observer, flagging and/or glow-sticks.

   e. Any felled or burned trees located within designated buffers shall be retained onsite.

   f. Be constantly aware of the surroundings, of expected fire behavior, and possible fire perimeter one or two days hence.

Fire Lining Phase

1. Select procedures, tools, and equipment that least impact the environment.

2. Give serious consideration to use of water as a fireline tactic (fireline constructed with nozzle pressure, wetlining).

3. Avoid the use of tractors and heavy equipment in riparian areas.

4. In light fuels, consider:

   a. Cold trail line.

   b. Allow fire to burn to natural barrier.

   c. Consider burn out and use of "gunny" sack or swatter.

   d. Constantly re-check cold-trailed fireline.

   e. If constructed fireline is necessary, use minimum width and depth to check fire spread.

5. In medium/heavy fuels, consider:

   a. Use of natural barriers and cold-trailing.

   b. Cooling with dirt and water, and cold trailing.

   c. If constructed fireline is necessary, use minimum width and depth to check fire spread.

   d. Minimize bucking to establish fireline; preferably build line around logs.

6. Aerial fuels—brush, trees, and snags:

   a. Adjacent to fireline: limb only enough to prevent additional fire spread.

   b. Inside fireline: remove or limb only those fuels which if ignited would have potential to spread fire outside the fireline.

   c. Brush or small trees that are necessary to cut during fireline construction will be cut flush with the ground.

7. Trees, burned trees, and snags:

   a. Minimize cutting of trees, burned trees, and snags. If possible, do not fall trees within designated critical habitat.

   b. Live trees will not be cut, unless determined that they will cause fire

spread across the fireline or seriously endangers workers. If tree cutting occurs, cut stumps flush with the ground.

c. Scrape around tree bases near fireline if hot and likely to cause fire spread.

d. Identify hazard trees with either an observer, flagging and/or glow-sticks.

8. When using indirect attack:

a. Do not fall snags on the intended unburned side of the constructed fireline, unless they are an obvious safety hazard to crews working in the vicinity.

b. On the intended burnout side of the line, fall only those snags that would reach the fireline should they burn and fall over. Consider alternative means to falling, i.e. fireline explosives, bucket drops.

9. Avoid increasing fire intensities within critical habitat during burnout or backfire operations.

Mop-up Phase

1. Consider using "hot-spot" detection devices along perimeter (aerial or hand-held).

2. Light fuels:

a. Cold-trail areas adjacent to unburned fuels.

b. Do minimal spading; restrict spading to hot areas near fireline only.

3. Medium and heavy fuels:

a. Cold-trail charred logs near fireline; do minimal scraping or tool scaring.

b. Minimize bucking of logs to check for hot spots or extinguish fire: preferably roll the logs.

c. Return logs to original position after checking or ground is cool.

d. Refrain from making bone-yards: Burned/partially burned fuels that were moved would be arranged in natural position as much as possible.

e. Consider allowing larger logs near the fireline to burnout instead of bucking into manageable lengths. Use lever, etc. to move large logs.

4. Aerial fuels—brush, small trees and limbs: remove or limb only those fuels, which if ignited, have potential to spread fire outside the fireline.

5. Burning trees and snags:

a. First consideration is to allow a burning tree/snag to burn itself out or down (Ensure adequate safety measures are communicated).

b. Identify hazard trees with an observer, flagging, and/or glow-sticks.

c. If burning trees/snags pose serious threat of spreading firebrands, extinguish fire with water or dirt. Felling by chainsaw will be last means.

d. Consider falling by blasting, if available.

Camp Sites and Personal Conduct

1. Use existing campsites if available.

2. If existing campsites are not available, select a campsite that is unlikely to be observed by visitors/users.

3. Camps, staging areas, and base heliports will be located outside designated critical habitat, if at all possible, and will be identified on a map prior to implementation.

4. Select impact-resistant sites such as rocky or sandy soil, or openings within heavy timber. Avoid camping in meadows, along streams or lakeshores.

5. Change camp location if ground vegetation in and around the camp shows signs of excessive use.

6. Do minimal disturbance to land in preparing bedding and campfire sites. Do not clear vegetation or do trenching to create bedding sites.

7. Toilet sites should be located a minimum of 200 feet from water sources. Holes should be dug 6-8 inches deep. Consider the use of vault toilets in large spike camps.

8. Select alternate travel routes between camp

and fire if trail becomes excessive.

9. Evaluate the option of coyote camps versus fixed campsites in sensitive areas.

10. Recycle materials and supplies brought into the fire camp setting on an ongoing basis as practical.

After Fire Suppression Activities are finished

1. Firelines:

a. After fire spread is secured, fill in deep and wide firelines and cut trenches.

b. If cultural and natural resource advisors recommend seeding, firelines may be fertilized and seeded with an approved seed mix.

c. Waterbar, as necessary, to prevent erosion, or use wood material to act as sediment dams. Waterbars or drain dips should be constructed at a 30 to 45 degree angle to the fireline. A berm height is not to exceed six inches in height. Assure downslope end of waterbar is open and has adequate length to prevent runoff from reentering the line below.

d. Ensure stumps from cut trees/large size brush are cut flush with ground.

e. Camouflage cut stumps, if possible.

f. Any trees or large size brush cut during fireline construction should be scattered to appear natural.

2. Camps (main and spike) and Helibases:

a. Restore campsite to natural conditions as much as possible.

b. Scatter fireplace rocks, charcoal from fire; cover fire ring with soil; blend area with natural cover.

c. Clean up trash, rake up wood chips, and remove any matting placed down to limit impacts.

d. Pack out all garbage and unburnables. Recycle glass, plastic, wood, paper and aluminum

e. Block any new access routes and post closure signs.

f. If cultural and natural resource advisors recommend seeding, impacted areas may be fertilized and seeded with an approved seed mix. Heavily compacted soils may need to be ripped prior to application of seed and fertilizer.

3. Tractor lines/Safety Zones: If an emergency circumstance required the use of a tractor line in Whiskeytown, the following measures would be recommended:

a. Waterbars should be constructed at a 30 to 45 degree angle. Height of waterbars should not exceed 18 inches. Space 50 feet apart on slopes greater than 30 percent and 100 feet apart on slopes between 10 and 30 percent. The downslope side of the waterbar needs to be opened and of adequate length to allow free flow of water off the tractor line.

b. Breakup and pull all berms, tractor piles and windrows. Lop and scatter slash on disturbed areas to achieve 50 percent ground cover on disturbed sites.

4. General:

a. Remove all signs of human activity (plastic flagging, small pieces of aluminum foil, litter).

b. Restore helicopter landing sites.

c. Cover, fill in latrine site.

d. For any non-system roads: implement erosion control standards and restore the road to a pattern of use prior to its fire suppression usage.

Cultural Resources and Minimum Impact Suppression Techniques

Fire program undertakings with the potential to effect cultural resources include conducting prescribed burns and suppression or monitoring of wild fires. The scale, severity, and type of impacts vary for each type of undertaking. The majority of undertakings will occur as a function of planned management actions and program managers are liable for resource protection during these actions. However, wild fire incidents are unplanned events that have great potential to impact cultural resources. The best form of protection available for these events is to develop action guidelines and conduct preventative maintenance where appropriate. Preventative maintenance in general consists of fuel load reduction around identified cultural resources. Management guidelines in the event of wildfire are provided below:

Guidelines for cultural resource protection during wildfire suppression:

· Cultural resource digital databases and GIS layers will maintained in a current status and available on compact disks during fire season to expedite the management decision-making process.

· The Northern California Sub-cluster Fire Archeologists or Redwood National and State Parks Cultural Resources Branch Chief, if available, will be notified immediately in the event of wildfire.

· An archeological resource specialist and/or resource advisor will be assigned to the incident management team if extended attack is required.

· When Native American cultural sites are threatened by fire, or fire suppression activities the Redding Rancheria and the Wintu Tribe will be notified.

· Identified historical structures, archeological districts, cultural landscapes, and archeological sites determined eligible or listed on the National Register of Historic Places will be priorities in resource protection planning.

Burned Area Emergency Rehabilitation Guidelines

A Burned Area Emergency Rehabilitation (BAER) team, which should include a wildlife biologist, will be assigned to fires over 100 acres in size, if deemed necessary by the cultural and natural resources management staff. After a fire is declared out, a biologist should review the suppression and rehabilitation efforts to see if conservation measures were successfully implemented. Where large fires affect more than ten percent of a lower Clear Creek sub-watershed, it is recommended that a scientific group of experts be convened to prepare a peer reviewed assessment or analysis of the short term and long term effects from the wildfire, suppression actions, and rehabilitation. The assessment should also recommend actions (if there are any) that may be appropriate for the burned or unburned areas within the watershed.

Stabilization and Rehabilitation Effectiveness Monitoring

A basic level of effectiveness monitoring will be implemented for all stabilization and rehabilitation projects. Different monitoring protocols and strategies will be developed according to the needs anticipated on a case-by-case basis. Very long term monitoring protocols will be developed based on resource needs. Stabilization and rehabilitation actions in fire suppression infrastructure areas (fire line, dozer line, helibases, drop zones, spike camps, etc) will be regularly monitored for treatment effectiveness and exotic weeds and maintained on a biannual basis for three years after the fire. Monitoring will be preformed by an appropriately trained National Park Service resource professional or technician.

Areas of Unique Ecological Concern

Riparian Areas and Anadromous Fish Habitat. Teams should ensure that there is canopy cover on at least 12 percent of riparian areas, including habitat important to fish. Trees are needed to provide future stream shade, large wood recruitment, and large root mass to stabilize stream banks. Natural plant succession will occur over time, but in the short term may lack a significant conifer component because of hardwood and shrub competition. Reforestation of riparian areas could include the planting of conifer and riparian tree species, as well as the use of straw wattles, seeding and mulching, to prevent erosion. Road improvement or closing may be proposed where roads pose a risk to water quality or fisheries.

Designated Critical Habitat . Designated critical habitats of threatened and endangered species and species of special concern include late successional forest, northern spotted owl habitat, the top of Shasta Bally, anadromous fish habitat in lower Clear Creek, and the Puccinellia howellii site.

Puccinellia Howellii Mineral Springs. This area is considered sensitive and is closed to all fire management activities. In the event of a fire, or disturbance associated with fire management activities, the BAER Team must consult with the Puccinellia Conservation Group (Whiskeytown staff, California Department of Fish and Game, US Fish and Wildlife Service, and Caltrans).

The Top of Shasta Bally. Similar to the Puccinellia howellii site, this area is considered sensitive and is closed from all fire management activities. However, in the event of a severe fire, nothing is recommended to be done except in the cases of erosion and mass wasting. This will be very difficult to stabilize and rehabilitate. The recommendations made elsewhere relating to erosion, bull dozer lines, fire lines, etc. should be considered here.

Endangered Species Act Consultation Process

Whiskeytown currently has two pair of nesting bald eagles (threatened) and one known breeding pair of northern spotted owls (threatened). Lower Clear Creek (below Whiskeytown Dam) contains spring run Sacramento River spring-run Chinook salmon (threatened) and Sacramento River steelhead trout (threatened). Post-fire stabilization and rehabilitation efforts will be coordinated with the agency responsible for oversight of the species impacted (NMFS for anadromous fish, USFWS for wildlife). Stabilization and rehabilitation techniques used in the Lower Clear Creek watershed should have goals of minimizing erosion and sedimentation of streams and restoration of riparian habitats that were impacted by fire or suppression efforts.

Endangered Species Act (ESA)regulations require identification and evaluation of effects to threatened, endangered and proposed species of all Federal agency programs and activities. This includes wildland fire management activities and Burned Area Emergency Rehabilitation (BAER) activities. BAER activities are emergency measures needed to prevent loss of life or

property or to minimize unacceptable degradation of resources (see FSM 2523). The BAER program and most of its activities are usually considered emergency response actions, and ESA consultation is implemented under direction given under Emergency Procedures of Section 7 of the ESA (50 CFR 402.05). Emergencies under the ESA include "situations involving an act of God, disasters, causalities, national defense, or security emergencies, etc."

There are several documents that provide direction for emergency consultation under the ESA with the regulatory agencies, the Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS). The main source is the emergency consultation procedures given in the ESA implementing regulations at 50 CFR 402.05. Further direction is provided in Chapter 8 of the March 1998 FWS/NMFS Endangered Species Consultation Handbook, and in Forest Service Manual 2671.45f. In addition, individuals may refer to the FWS Director's memo of September 21, 1995, and to Secretary Norton's directive of August 20, 2001, on the topic of emergency consultation (see http://news.fws.gov/issues/fire.html).

Emergency response procedures under Section 7 provide for expedited informal consultation for fire suppression and related activities at the time the action is taken. The procedures provide for immediate agency response to wildland fire situations while incorporating listed species concerns into the response as time and the situation permit. In the initial stages, the FWS and/or NMFS will provide recommendations to minimize effects of the emergency response on listed species or critical habitat. If adverse effects to listed species or proposed species occur during the response, consultation with the FWS and/or NMFS should be initiated as soon as practicable. Emergency consultation assesses the effects of the emergency response activity only (usually including BAER actions), not the effects of the emergency (e.g., wildland fire) itself. The Endangered Species Consultation Handbook, pages 8-3 and 8-4, describe emergency consultation procedures.

With respect to Section 7 consultation, BAER activities usually are considered emergency actions (they are when "approved, burned-area emergency rehabilitation measures are expeditiously installed prior to the time when damaging or degrading events are likely to occur"). Normally, additional BAER activities would not be considered emergency actions if proposed several weeks or months after the originally-approved BAER activities. Any subsequent proposed burned area "restoration" activities that are not included in BAER plans are not considered emergency actions, and consultation under the ESA is to follow normal procedures.

During the emergency, BAER teams and responsible officials should be in contact with FWS and/or NMFS while developing any BAER plans that could affect listed or proposed species, or that could affect their habitat, including designated or proposed critical habitat. The FWS and/or NMFS will provide suggestions on how to minimize impacts. Upon completion, approved BAER plans should be sent to the regulatory agencies as soon as possible. As soon after the emergency as is practicable, there is a need to close the consultation loop with written documentation of the effects of BAER and suppression actions. This can be by individual fire, or by the batching of multiple fires, and can include assessments of both the suppression activities and the BAER treatments for each fire.

BAER activities should be documented, and subsequent effects determinations made for threatened, endangered, or proposed species and proposed or designated critical habitat. Documentation is to include a description of the emergency (fire), rationale for the expedited consultation, and an evaluation of the impacts of the fire and of the BAER response, together with a discussion of how any FWS/NMFS recommendations were implemented and their results. Since BAER activities are designed to mitigate adverse effects of the fire to listed species, proposed species and/or designated or proposed critical habitat, effects of the activities are usually minimal and require only informal consultation. However, if there were a case where BAER activities result in adverse affects, formal consultation would be required.

For example, a wildfire burned parts of several watersheds that flow directly into a river system that includes habitat for an endangered trout species. The park biologist made the initial determination that there may be post fire effects to the endangered species. The BAER team was formed to complete the assessment of the burn area. The Team Leader contacted the local FWS and NMFS representatives to begin informal consultation. A member of the FWS assisted with the assessment of the burned area. The BAER Team submitted for approval a Burned-Area Report (FS form 2500-8) with proposed emergency treatments. Both the FWS and NMFS representatives were provided a copy of the approved 2500-8 and were made aware of the emergency treatments. Following the

implementation of the emergency treatments, the park completed a final 2500-8 Burned-Area Report. Included in the documentation of the final report is a section documenting the effects determinations for the endangered trout. In the example above the park should assume responsibility for the consultation following the initial BAER team assessment.

Vegetation Resources Concerns

Revegetation. In most cases, revegetation will be allowed to progress naturally following fire. Some areas may require assistance accomplished by planting trees, shrubs, forbs and grasses which will be decided on a case-by-case basis. Only plants native to Whiskeytown will be used and propagules will be collected in the park whenever possible. In certain extreme situations, native plants may be purchased; the origin of the plants will be as near to the park as possible.

Fire suppression infrastructure (fire line, dozer line, helibases, drop zones, spike camps, etc) areas will be seeded and mulched to provide ground cover that protects against erosion, decreases establishment of exotics, and promotes soil health recovery. This will be decided on a case-by-case basis and only grass seed native to Whiskeytown will be used. Straw used in the park for mulch must be certified weed-free. Wood chips and shredded bark may be used as mulch in certain situations to be decided on a case-by-case basis.

All litter will be removed.

Exotic Plants. Suppression impacts such as firelines, spike camps, dozer lines, and helispots will be monitored and treated for three years. Exotic plants in the immediate area or upland of the disturbed area will also be monitored and treated to decrease seed recruitment.

All exotic plants will be removed.

Snags. Snags should be retained whenever possible for wildlife benefit. Numerous bird and mammal species present at Whiskeytown are dependent on snags for nesting, denning, or foraging. Snags, or live trees with extensive root damage from fire, should be felled when public safety is at risk or when property damage would likely occur from tree failure.

Geologic Resources and Hydrology Concerns

Culverts. When replacing or installing new culverts, with safety as the primary driver, all efforts should be made to install the culvert at the natural hydrologic grade. "Shotgun" culverts will not be installed. Energy dissipaters, such as large rocks, will be installed below the culvert exit point as needed. Only metal culverts will be utilized with a minimum gauge of 0.12 or greater. Installation will be preformed by experienced equipment operators and a National Park Service geologist or National Park Service hydrologist. Post fire watershed modeling and size of woody debris entering the culvert will be used to determine the dimensions of each culvert. Disturbed ground will be mulched with native vegetation and/or seeded with natives and mulched with weed-free straw.

Culverts in and below burned areas will be monitored and maintained prior to and immediately after precipitation events during the first year after the fire. For two years after the first year the fire, culverts will be monitored and maintained on a monthly basis. Monitoring will include an assessment of the condition of the culvert including entry and exit points, determination if the culvert has overtopped, evidence of saturation of fill material within the hydrologic crossing, and exotic weeds. Monitoring will be preformed by a National Park Service geologist, hydrologist, or suitably trained physical science technician. All exotic weeds will be removed.

Dozer-Line. All dozer line installed as result of a fire will be rehabilitated to pre-fire conditions. Dozer-line will be returned to natural grade, re-vegetated and monitored for rehabilitation effectiveness per monitoring and re-vegetation guidelines listed above.

Hand-Line. All hand line installed as result of a fire will be rehabilitated to pre-fire conditions. Hand-line will be returned to natural grade and mulched with native vegetation gathered along the hand-line. Hand-lines will be made unusable as trails. All litter will be removed.

Helispots. All helispots will be rehabilitated to pre-fire conditions unless authorized by the park. Helispots will be re-vegetated and monitored for rehabilitation effectiveness per monitoring and re-vegetation guidelines listed above

Fire Camps. All fire camps will be rehabilitated to pre-fire conditions. Fire camps will be re-vegetated and monitored for rehabilitation

effectiveness per monitoring and re-vegetation guidelines listed above

Drop Zones. All drop zones will be rehabilitated to pre-fire conditions. Drop zones will be re-vegetated and monitored for rehabilitation effectiveness per monitoring and re-vegetation guidelines listed above

Hill Slope Erosion. Methods acceptable for hill slope erosion control include:

· Hand seeding and hand straw mulching when these actions are specified.

· Aerial seeding and aerial straw mulching.

· Contour straw wattles.

· Soil netting.

· Erosion control blankets.

· Other proposed treatments will be reviewed by National Park Service personnel on a case-by-case basis.

No contour felling and log erosion barriers will be allowed, except in extreme cases with the Superintendent's approval. Only natural materials will be utilized. All installation will be preformed by trained personnel and supervised by National Park Service geologist or hydrologist. Hill slope erosion control structures will be monitored for effectiveness and exotic weeds and maintained immediately after precipitation events for the first year after the fire and monthly for two years after the first year of the fire. No structures will be installed instream* except when life and property are threatened. Monitoring will be preformed by a National Park Service geologist, hydrologist or physical science technician. All exotic weeds will be removed.

**Instream is defined as three times the vertical height of the high water mark for the stream as determined by a geologist or hydrologist, except Clear Creek which is defined as twice the vertical height of the high water mark as determined by a geologist or hydrologist.*

Roads and Trails. Methods for stabilization and rehabilitation of roads and trails include:

· Remove logs and slash along impacted park roads.

· Road rehab of fire suppression impacts.

· Install armored low water fords and armor road crossing fill.

Water Quality. Water quality will be monitored in areas where life, property, and natural resources are threatened. Water quality parameters monitored will be consummate with the value at risk.

Water Channels. No check dams will be installed. No trash racks will be installed except when life and property are threatened. No diversion channels will be constructed except when life, property, and natural and cultural resources are threatened. No removal of debris from channels and floodplains except when life and property are threatened. No instream (see definition in Hill Slope Erosion section above) energy dissipaters will be installed except immediately below culverts.

Information and Public Education Concerns

In the event of a wildfire at Whiskeytown where emergency stabilization and rehabilitation is needed, education and information efforts will be used to inform park visitors, neighbors and interagency partners on the rehabilitation efforts. These efforts will address the nature of the emergency, the current status of park resources and visitor amenities, what visitors can expect at the park, the anticipated nature of resources and visitor amenities at scheduled periods over the next few years. Over a three year period after the emergency, National Park Service public information and education specialists will implement an appropriately-scaled media campaign that includes:

· Frequent regular press releases

· Informational flyers

· Displays and information boards at the park visitor center and in the rehabilitation area

· Park web page updates

· Public service announcement on fire rehabilitation activities

· Public presentations to local community groups and organizations

· Articles in local newspapers, and,

· Interpretive hikes into affected watersheds and programs.

Soundscape Concerns

Timing of restoration activities should be completed without further adversely impacting the environment. As it relates to soundscapes, two main concerns should be addressed in BAER implementation plans: natural soundscapes important to wildlife and natural soundscapes expected by park visitors. Wildlife can be disturbed by heavy equipment, repetitive blasts, and proximity to humans working, depending on the species and time of year. Soundscape issues related to wildlife will be incorporated into consultation under the Endangered Species Act for threatened and endangered species. Additionally, soundscape concerns will be addressed for all other wildlife species when there is information available of the effect that a rehabilitation action may have on a species.

A natural soundscape is an important reason why many visitors come to National Park sites. Modification to vegetation can have an immediate, short term adverse impact on a trail if too much vegetation is removed and traffic noise is audible. BAER team actions will take into consideration the impact of their actions on the park visitor in the short term and in the long term. In cases where little can be done to mitigate an adverse soundscape impact, public information and education materials and methods will be used to address this issue.

Viewshed Concerns

Little can quickly be done to improve viewsheds affected by wildland fire. Despite this, scenery is an important reason why many visitors come to National Park sites. Stabilization and rehabilitation actions designed to improve natural resource conditions will need to be taken into consideration by the BAER team. In cases where little can be done to mitigate an adverse scenery impact, public information and education materials and methods will be used to address this issue.

Recreational Concerns

Whiskeytown visitors are often repeat-visit individuals who return to a favorite trail, beach, or hiking area. In the event of a stabilization and rehabilitation effort, portions of the park may not be safe for visitors—or park amenities may be reduced. In these cases, public information and education materials and methods will be used to address recreational concerns. Redirecting the public to different parts of the park may be necessary. Also, increasing amenities not typically available in redirected areas may be necessary to meet the needs of the visiting public.

Cultural Resource Concerns

Federal land managing agencies are required to consult with Federal, state, local, and tribal governments/organizations, identify historic properties, assess adverse effects to historic properties, and mitigate adverse effects to historic properties while engaged in any Federal or federally assisted undertaking (36 CFR Part 800). Fire program activities have the potential to adversely affect cultural resources present at Whiskeytown. Effects from these activities include the direct effect of fire itself, the direct effect of fire program operational activities, and the indirect effects of fire and operational activities on cultural resources.

Specific details relating the various direct and indirect effects of fire program undertakings on the various types of cultural resources found at Whiskeytown NRA are defined in the Environmental Consequences section of this document. In general the following guidelines will be followed for all fire program undertakings where appropriate. It is anticipated that the following procedures will ensure compliance with applicable laws and regulations and will mitigate adverse effects of fire and fire program:

· A National Park Service professional will coordinate consultation with the Redding Rancheria, the Wintu Tribe, and the California Office of Historic Preservation.

· A National Park Service archaeologist will identify cultural resources within the area of potential impact for the undertaking. In general, this is completed in three phases: reviewing archeological site records, project data, and historical overviews/literature; consulting with Native American groups, historic architects, and cultural landscape specialists; conducting field archeological inventories.

· A National Park Service cultural resource professional will assess of potential adverse effects to cultural resources.

A National Park Service professional , in consultation with the National Park Service Pacific West Regional Office cultural resource staff, will develop appropriate management recommendations to mitigate adverse effects to cultural resources. General strategies currently employed for cultural resource protection include:

· Avoiding cultural resources during fire program operational activities.

· Excluding fire from cultural resources.

· Minimizing the impact of fire through fuel load reduction around cultural materials.

· Preventative maintenance consisting of hazard fuel reduction at or around cultural resources.

· Employing minimum impact suppression techniques in the vicinity of cultural resources.

· Monitoring archeological sites as defined in the Cultural Resources Fire Monitoring Plan

General Management Strategies to Mitigate Fire Program Impacts to Cultural Resources

	Fire Effects	Operational Impacts	Indirect Impacts	Responsible Professional
Archaeological Resources	Fuel load reduction on/or near resources	Avoid resource with operation activities, and/or use MIST	Post burn monitoring and assessment	National Park Service or similarly trained archaeologist
	Exclusion of fire from the resource	Fire fighter resource awareness training	hazard fuel removal	
	Consult with archaeologist regarding ignition methods		collection of exposed artifacts	
	Fire effects research		Erosion controls where appropriate	
			Increased law enforcement patrol where appropriate	
Historical Structures	Consult with historic architect	Consult with historic architect	Consult with historic architect	National Park Service or similarly trained historian
	Conduct scheduled preventative maintenance where appropriate	Avoid resource with operational activities, and/or use MIST methods	Post burn monitoring and assessment	
	Fuel load reduction or exclusion of fire from the resource	Fire fighter awareness training	Erosion controls where appropriate	
	Apply fire shielding or foam in the event of a fire		Hazard fuel removal	
Ethnographic Resources	Native American Consultation	Native American Consultation	Native American Consultation	National Park Service or similarly trained anthropologist
	Native American fire use research	Avoid resource with operational activities, and/or use MIST methods	Post burn monitoring and assessment	
	Fuel load reduction or exclusion of fire from the resource		Erosion controls where appropriate	
	Consult with archeologist regarding ignition methods		Hazard fuel removal	
Cultural Landscapes	Consult with landscape architect	Consult with landscape architect	Consult with landscape architect	National Park Service or similarly trained landscape architect
	Fuel load reduction or exclusion of fire from the resource	Avoid resource with operational activities, and/or use MIST methods	Post burn monitoring and assessment	
	Consult with archeologist regarding ignition methods		Erosion controls where appropriate	
			Hazard fuel removal	
Museum Objects	None	None	Fund curation and archival needs with project or incident funds	National Park Service or similarly trained curation specialist or archivist

National Park Service
U.S. Department of the Interior

Whiskeytown National Recreation Area
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WHISKEYTOWN
NATIONAL RECREATION AREA

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