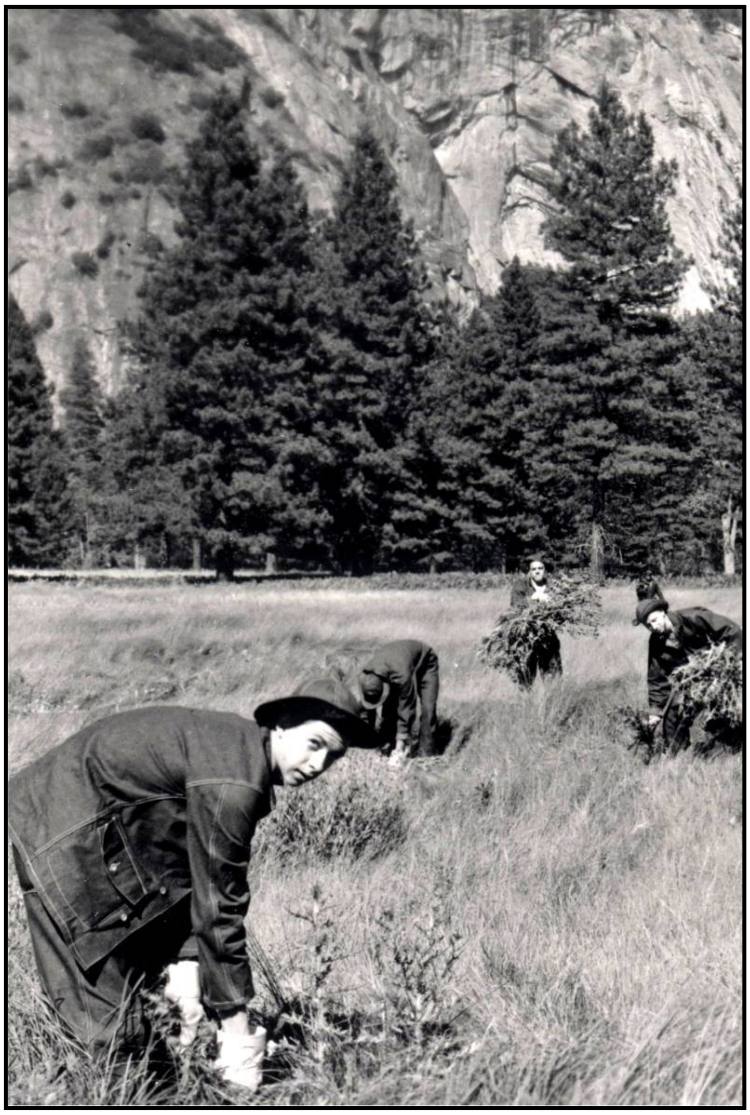
Yosemite National Park
National Park Service
U.S. Department of the Interior

Invasive Plant Management Plan for Yosemite National Park

Environmental Assessment
June 2008



Cover Photo:

Civilian Conservation Corp members removing invasive
non-native bull thistle (*Cirsium vulgare*) in Yosemite Valley Meadow.

Photographer Ralph H. Anderson. July 24, 1941

United States Department of the Interior

NATIONAL PARK SERVICE
Yosemite National Park
P. O. Box 577
Yosemite, California 95389

IN REPLY REFER TO:
D18 (YOSE)

MAY 02 2008

Dear Yosemite Friends:

On behalf of the National Park Service, I am pleased to present the *Invasive Plant Management Plan for Yosemite National Park Environmental Assessment* (Invasive Plant Management Plan). Non-native plants invade an estimated 4,600 acres of federal land every day, and already infest millions of acres in the national parks. Invasive species out-compete native plants, displace wildlife species that depend upon them, and can ultimately alter the structure and function of native ecosystems. Fortunately, Yosemite is still relatively free of invasive plants; however, almost 200 non-native plant taxa have become established within park borders, many with the potential to spread rapidly. A proactive management approach is essential to protect, maintain, and restore the park's native plant communities.

The Invasive Plant Management Plan provides this management guidance. The comprehensive plan presents a range of alternatives for preventing new invasive plants from becoming established in the park, and for eradicating or halting the spread of those that currently exist in Yosemite.

Public, tribal, and agency consultation has played an important role in developing this plan. The National Park Service conducted a 45-day public scoping period from January 1 through February 15, 2005. The park held two public meetings during the scoping period (in El Portal and Wawona) to discuss the plan and respond to questions and concerns. Park staff has also been available to answer questions and discuss the plan at monthly open houses held in Yosemite Valley. The planning team has integrated the comments and ideas generated during scoping into the range of alternatives for this plan.

The release of this plan commences a 30-day public comment period on this Environmental Assessment. The National Park Service will host a public open house on June 25, 2008 (1:00 p.m. - 5:00 p.m.), at the Yosemite Valley Visitor Center East Auditorium, where staff will be available to discuss the plan. You may also visit the park's website, www.nps.gov/yose/parkmgmt/planning.htm, to view a digital version of the plan or request additional copies. To request copies by phone, dial (209) 379-3298 and specify CD or bound version.

Comments must be submitted in writing by July 13, 2008, and may be sent via mail, e-mail, or fax, to:

Mail: Superintendent, Yosemite National Park
ATTN: Invasive Plant Management Plan
P.O. Box 577
Yosemite, California, 95389

Fax: 209-379-1294
E-mail: yose_planning@nps.gov

We appreciate your interest in this planning effort and welcome your continued participation. If this Environmental Assessment is approved, and a Finding of No Significant Impact is issued, the Preferred Alternative will be implemented.

Sincerely,

Michael J. Tollefson
Superintendent

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Invasive Plant Management Plan
Environmental Assessment

Yosemite National Park

Lead Agency: National Park Service

ABSTRACT

The National Park Service is considering a comprehensive plan to prevent the establishment and spread of invasive plants in Yosemite National Park, California. Invasive plants are one of the greatest threats to the integrity of national park lands. Non-native plants invade an estimated 4,600 acres of federal land in the United States every day, and already infest millions of acres in the national parks. Fortunately, Yosemite is at the early stage of invasion; however, almost 200 non-native plant taxa have become established within park borders. Almost half of these non-native plants have the potential to spread rapidly.

This *Invasive Plan Management Plan for Yosemite National Park Environmental Assessment* (Invasive Plant Management Plan) evaluates a range of alternative plans for managing invasive plants within the park. Actions common to all of the alternatives involve prioritizing invasive plants for early detection and control, conducting early detection activities for invasive plants that threaten Yosemite from outside its borders, using a full range of manual and mechanical control techniques, monitoring the efficacy of control actions, and fostering an understanding of invasive plant prevention and control through outreach and education.

Under Alternative 1, the No Action alternative, current management practices and invasive plant management would continue in the park. Under the existing program, park employees and volunteers would continue to use existing techniques (both manual and mechanical) to detect and prevent invasive plant populations in the park from spreading into uninfested areas. Work crews would not use herbicides for invasive plant control. The extent of the land area in Yosemite treated for invasive plants would remain approximately the same over time. While densities of selected invasive plant populations would decrease, the park would not meet its management objectives for priority invasive plants.

Under Alternative 2, the preferred alternative, an extensive program staffed by park employees and volunteers would use an integrated pest management approach to detect, control, and prevent high- and medium-high-priority invasive plants (those with the highest potential to invade natural communities in the park) from spreading into uninfested areas. Work crews would use a variety of manual and mechanical techniques for the control of invasive plants. Park crews would use one of two designated herbicides to control up to 22 invasive plant species (out of 177 non-native plants in the park) if management objectives could not be achieved by the use of other control methods and invasive plant populations met size and location thresholds. It is expected that herbicide use would decrease over time as invasive plant populations decline in size. The extent of the land area in Yosemite treated for invasive plants would increase over time.

Under Alternative 3, the park would meet management objectives for medium-priority invasive species, as well as for high- and medium-high-priority species. Medium-priority species tend to occur in disturbed areas such as road corridors, campgrounds, parking lots, and staging areas. Medium-priority species do not have as great a potential to invade natural plant communities as do the higher-priority plants. Under Alternative 3, park crews would utilize herbicides to control up to 35 invasive plant species (out of 177 non-native plants in the park) if management objectives could not be met through other control methods and invasive plant populations met size thresholds. It is expected that herbicide use would remain the same over time. The land area in Yosemite treated for invasive plants would increase over time.

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Yosemite National Park

National Park Service
U.S. Department of Interior

Invasive Plant Management Plan for Yosemite National Park

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Executive Summary

Purpose and Need

Invasive plants are one of the greatest threats to the integrity of National Park Service lands. Non-native plants invade an estimated 4,600 acres of federal land in the United States every day, and already infest millions of acres in the national parks. Fortunately, Yosemite is at the early stage of invasion; however, almost 200 non-native plant taxa have become established within park borders, many with the potential to spread rapidly. The purpose of this *Invasive Plant Management Plan for Yosemite National Park Environmental Assessment* (Invasive Plant Management Plan) is to evaluate a range of alternatives to prevent the establishment and spread of invasive plants into uninfested areas of the park, and quickly and effectively eradicate new infestations.

Legislative and Planning Context

The Invasive Plant Management Plan must conform to federal law, regulation, and policy guidance. In 1999, President Bill Clinton signed Executive Order 13112 to prevent the introduction and spread of invasive species. This federal directive provides overarching guidance for the management of invasive species on federal land. The Invasive Plant Management Plan must also conform to federal regulatory measures with respect to herbicide use.

The Organic Act of 1916 is the legal foundation of National Park Service regulation and policy. The National Park Service Management Policies is the primary policy document of the National Park Service. It states that, "Exotic species will not be allowed to displace native species if displacement can be prevented" and "In general, new exotic species will not be introduced into parks."

Legislation and policy specific to Yosemite National Park include the enabling legislation for Yosemite National Park, the California Wilderness Act of 1984, the General Management Plan for Yosemite (NPS 1980), the Merced Wild and Scenic River Comprehensive Management Plan (NPS 2005), and the in-progress Tuolumne Wild and Scenic River Comprehensive Management Plan. The General Management Plan provides overall management direction for Yosemite National Park. The Invasive Plant Management Plan tiers off the General Management Plan. The action alternatives in the Invasive Plant Management Plan are consistent with parkwide and National Park Servicewide legislation and policy, and reflect the categories identified in the national planning documents.

Overview of the Alternatives

This Environmental Assessment proposes and evaluates two Action alternatives and one No Action alternative for a comprehensive invasive plant management program in Yosemite. Each alternative includes prevention; early detection; and rapid response, control, education, research, and restoration actions to prevent the establishment and spread of non-native invasive species. Table ES-1 presents an overview of each alternative, along with a list of actions common to all of the alternatives.

Under Alternative 1 (No Action alternative), an extensive program staffed by park employees and volunteers would continue to use manual and mechanical techniques to detect, control, and prevent

invasive plant populations in the park from spreading into uninfested areas. Herbicides would not be used as a tool to control invasive plants. The land area in Yosemite treated for invasive plants would remain approximately the same size over time. The park would not meet objectives for invasive plant control.

Under Alternative 2, the preferred alternative, the park would meet management objectives for high- and medium-high-priority invasive species. These species pose the greatest threat to natural communities in the park and have the highest feasibility for control. Park crews would use herbicides to control up to 22 invasive plant species (out of 177 non-native plants in the park) if management objectives could not be achieved by the use of other control methods and invasive plant populations met size and location thresholds.

Under Alternative 3, the park would meet management objectives for medium-priority invasive species, as well as high- and medium-high-priority species. Medium-priority species are found generally in disturbed areas such as road corridors, campgrounds, parking lots, and staging areas. Medium-priority species do not have as great a potential to invade natural plant communities as higher-priority plants. Under Alternative 3, park crews would utilize herbicides to control up to 35 invasive plant species (out of 177 non-native plants in the park) if objectives could not be achieved through the use of other control methods and invasive plant populations met size thresholds.

Environmental Analysis

Chapter II of this document discusses the affected environment and the environmental consequences of the Invasive Plant Management Plan. The Affected Environment sections in Chapter III describe the existing conditions of the area that are affected by the alternatives described in Chapter II. The Environmental Consequences sections in Chapter III analyze the environmental effects associated with each of the alternatives. Table II-7 compares the environmental consequences for each alternative.

Environmentally Preferable Alternative

The National Park Service is required to identify the environmentally preferable alternative in the environmental documents it produces for public review and comment. The National Park Service, in accordance with National Environmental Policy Act (NEPA) Section 101(b) (516 DM 4.10), defines the environmentally preferred alternative as the alternative that best promotes the national environmental policy. The Council on Environmental Quality's Forty Questions further defines the environmentally preferred alternative as "the alternative that causes the least damage to the biological and physical environment… [and that] best protects, preserves, and enhances historic, cultural, and native processes." Upon full consideration of Section 101 of NEPA, Alternative 2 represents the Environmentally Preferable Alternative for the Invasive Plant Management Plan. This conclusion is analyzed in detail in Chapter II.

Consultation and Coordination

The National Park Service conducted public scoping for the proposed Invasive Plant Management Plan during a 45-day period (January 1, 2005 to February 15, 2005). The park held two public meetings to discuss the plan—one in El Portal on January 11, 2005, and one in Wawona on January 18, 2005. Members

of the planning team were available to discuss the proposed plan at public open houses held monthly in Yosemite, during the public scoping and through the planning period.

The park received 46 comment letters during the public scoping process, including 29 from individuals and 17 from organizations. The planning team derived and categorized a set of concern statements from the public comment letters (see Table I-1). The issues derived from scoping are addressed in the analysis presented in Chapter III.

The public outreach called for in Section 106 of the National Historic Preservation Act was integrated with the NEPA scoping process, in accordance with a Programmatic Agreement between the National Park Service at Yosemite, the California State Historic Preservation Officer, and the Advisory Council on Historic Preservation.

Table ES-1: Summary of Alternatives

All Alternatives	Alternative 1 No Action	Alternative 2 (Preferred Alternative) Eradicate or Prevent the Spread of High- and Medium-High-Priority Invasive Plants into Natural Habitats	Alternative 3 Eradicate or Prevent the Spread of High-, Medium-High-, and Medium-Priority Invasive Plants
• The park would prioritize high- and low-priority invasive plants for early detection and control. • The park would conduct early detection activities for invasive plants on the Watch List for Yosemite. • The park would follow best management practices to prevent the introduction and spread of invasive plants. • The park would monitor the locations of invasive plants and efficacy of control techniques to determine whether objectives were being met. • The park would solicit research to promote informed decisions regarding invasive plant management and control. • The park would promote outreach and educational activities to foster an understanding of invasive plant prevention and control.	• Park employees and volunteers would continue an extensive program to detect and prevent invasive plant populations in the park from spreading into uninfested areas. • Work crews would continue to use a variety of manual and mechanical techniques to control invasive plants. The invasive plant program would not involve the use herbicides for invasive plant control. • The land area in Yosemite treated for invasive plants would remain approximately the same over time. • While densities of selected invasive plant populations would decrease, the park would not meet management objectives for priority invasive plants.	• Park employees and volunteers would implement an extensive program that uses an integrated pest management approach to detect, control, and prevent high- and medium-high-priority invasive plants from spreading into uninfested areas. • Work crews would use a variety of manual and mechanical techniques to control invasive plants. • Crews would use selected herbicides to control up to 22 invasive plant species (out of 177 non-native plants in the park) if management objectives could not be achieved by using other control methods and invasive plant populations met size and location thresholds. • The land area in Yosemite treated for invasive plants would increase over time. • The park would meet objectives for invasive plants that pose the greatest threats to natural communities in the park. • Herbicide use is expected to decrease over time.	• Park employees and volunteers would implement an extensive program that uses an integrated pest management approach to detect, control, and prevent high- and medium-high-priority invasive plants from spreading into uninfested areas. • Work crews would use a variety of manual and mechanical techniques to control invasive plants. • Crews would use selected herbicides to control up to 35 invasive plant species (out of 177 non-native plants in the park) if management objectives could not be achieved by using other control methods and invasive plant populations met size and location thresholds. • The land area in Yosemite treated for invasive plants would increase over time. • The park would meet objectives for invasive plants that pose the greatest threats to natural communities, as well as to developed and disturbed lands in the park. • Herbicide use is expected to remain the same over time.

Chapter I: Purpose and Need

Introduction

Yosemite National Park is home to a unique and intricate assemblage of plants and animals that have coexisted for thousands of years. The diversity of native plants in the park is striking; although Yosemite accounts for less than 1 percent of the land mass of California, nearly 23 percent of all plant species in the state are represented in the park. However, these spectacular resources are vulnerable to the invasion and spread of non-native plants. These invasive plants—also known as exotic, weedy, or noxious plants—can rapidly displace native species and reduce habitat and food sources for native insects, birds, and other wildlife.

Invasive species are one of the greatest threats to the ecological integrity of National Park Service lands (NPS 2004; NPS 2006a). Non-native plants invade an estimated 4,600 acres of federal land in the United States every day, and already infest millions of acres in the national parks (NPS 1996). Invasive species also produce serious economic consequences. A Cornell University study estimated that invasive plants and animals cost the United States economy $137 billion annually (Pimentel 2005). Fortunately, Yosemite is at the early stages of invasion, with less than 1 percent of the land mass in the park contaminated with invasive plants. The remaining area, much of which is designated Wilderness, is at risk of future widespread invasion. This *Invasive Plant Management Plan for Yosemite National Park Environmental Assessment* (Invasive Plant Management Plan) aims to protect the natural, cultural, and scenic resources of Yosemite National Park from the threat of invasive plant establishment and spread, now, and for future generations. This strategic plan would ensure the appropriate allocation of limited resources to provide the foundation for a safe, effective, prioritized, and timely response to the threat of invasive plants.

An invasive species is:

- *Non-native (or alien) to the ecosystem under consideration.*
- *Likely to cause economic or environmental harm or harm to human health.*

Executive Order 13112

Over 10 percent of the approximately 1,400 plant species in Yosemite are non-native (NPS 2006b). Invasive plants are present in Yosemite as a direct result of human activities that promoted their establishment and facilitated their spread. In their native habitat, invasive plants often have natural competitors and predators that effectively control population size. Such native population controls are often absent in new locations, allowing some invasive plants to quickly spread throughout their new environment. This rapid spread can often result in devastating consequences. Invasive plants can impact:

- **Native Plants.** Invasive plant species compete with native plants for limited resources such as water, sunlight, and nutrients. This can reduce native plant populations to small, isolated patches or eliminate native plants from a site. The combination of invasive species invasion and general habitat loss has caused the extinction of numerous plant species in California.
- **Native Wildlife.** Many animals rely on specific plants for food and habitat. When invasive plants replace native vegetation, sources of food and/or habitat are lost. As native plant populations shrink, the number of animals that depend on native species may decline. Additionally, many invasive species are poisonous or harmful to animals.

- **Fire Regimes.** Invasive plants can increase the frequency, seasonality, and intensity of wildland fires.
- **Visitor Experience.** Invasive plants can transform spectacular displays of native wildflowers into large, unattractive monocultures. Thorns and irritants can turn easily accessible areas into impassable thickets.
- **Wilderness Values.** The spread of invasive plants can impair the natural qualities and character of Wilderness.
- **Cultural Resources.** Yosemite is home to numerous plant species used by contemporary American Indians. These plants may thrive in areas now threatened by the spread of invasive species. Invasive plants may also threaten cultural landscapes that are often defined by their vegetation.

Invasive plants will continue to change and displace Yosemite National Park's living resources if efforts to prevent their introduction and contain their spread do not continue. This Environmental Assessment proposes and evaluates two Action alternatives and one No Action alternative for a comprehensive invasive plant management program in Yosemite. Each alternative presents a framework for preventing the establishment and spread of non-native invasive species in Yosemite National Park, and quickly and effectively eradicating new infestations.

The Integrated Pest Management Approach

As with all plant and animal pests in the National Park Service, the park manages invasive plants using integrated pest management techniques. Integrated pest management is a science-based, decision-making process that coordinates knowledge of pest biology and best available technology to prevent unacceptable levels of pest damage, while posing the least possible risk to people, resources, and the environment. Integrated pest management embraces a full range of management techniques, including manual, mechanical, chemical, and cultural control (such as prescribed fire). Integrated pest management offers alternatives to the traditional approach of using a single method, such as herbicides, to treat all pest problems. Herbicides provide one tool in an integrated pest management approach, but under National Park Service policy, the least toxic herbicides are the tool of last resort (NPS 1996).

Effective pest management often involves the integration of two or more methods, and may produce synergistic effects. For example, blackberry treatments could involve two steps - cutting to reduce the biomass followed by a herbicide application on re-sprouts. At a higher level, integrated pest management brings together invasive plant management with land management activities. Prescribed fire, for example, can be used to maintain the overall natural diversity and functioning of an ecosystem. By modifying the fire regime to exploit vulnerability in the life cycles of invasive plants, prescribed fire could become a useful management method. The National Park Service has established policies, procedures, and guidelines for evaluating integrated pest management on park lands through the integrated pest management program. Program managers would seek appropriate approval for all pesticide use and meet reporting requirements.

Management Goals and Objectives

The goals of the Invasive Plant Management Plan are based on the overarching goals identified in national guidance on invasive plants, such as the Meeting the Invasive Species Challenge: National Invasive Species

Management Plan (NISC 2001). Each goal in the Invasive Plant Management Plan has a set of related management objectives. The objectives are statements of purpose that describe what must be accomplished for the plan to be considered a success in Yosemite National Park.

The introduction and spread of invasive species into Yosemite National Park is a dynamic process. The abundance and distribution of existing invasive species in the park may change, and new species may arrive despite the best efforts of the park. As a result, the species-specific management objectives may evolve over time. Appendix A describes the species-specific management objectives for invasive plants in Yosemite. Invasive plant program managers would review and modify species-specific objectives on an annual basis and post them annually on the Yosemite National Park web site.

Goal 1 - Prevention and Early Detection: Protect ecosystems from the impacts of invasive plants through an integrated and comprehensive approach, emphasizing the prevention of spread of invasive plants, early detection, and treatment of newly established populations.

Management Objectives

- Incorporate preventive and follow-up measures to actions with the potential to bring new seed or reproductive material into the park (e.g., ground-disturbing construction, importation of roadside maintenance materials).
- Conduct surveys for new populations of invasive plants, and respond quickly to eradicate incipient populations before control treatments become difficult and costly.
- Minimize conditions that favor invasive plant introduction, establishment, and spread.
- Incorporate best management practice prevention measures associated with park operations to reduce the risk of new infestations of invasive plants.

Goal 2 - Prioritization and Control: Remove invasive plant populations that pose the greatest threat to park resources.

Management Objectives

- Identify invasive species for control that pose the greatest threat to park resources and that are the most feasible to control.
- Establish and maintain feasible objectives for invasive plants.
- Use integrated pest management tools to find the most effective and appropriate tool, or combination of tools, to eradicate or reduce the impact of invasive plants.
- Minimize secondary impacts from control efforts.
- Reduce the impact of invasive plants on sites of cultural, scenic, and high ecological value, including Wild and Scenic River corridors, sites of special importance to American Indians, and iconic historic viewsheds.

Goal 3 - Outreach and Education: Educate, inform, consult, and collaborate with park employees, concessioners, visitors, park partners, private property holders, and gateway communities to address invasive plant issues.

Management Objectives

- Maintain relationships with the American Indian community to encourage its participation in the management of traditional gathering areas.
- Expand collaborative efforts among park neighbors, park partners, gateway communities, and the public to share methods of preventing and controlling the spread of invasive plants.
- Ensure that interested parties are well informed about the timing and locations of upcoming invasive plant control treatments.
- Educate and inform park visitors on invasive plant issues.
- Provide stewardship opportunities for the public.

Goal 4 - Monitoring and Research: Ensure that the invasive plant program is regularly monitored and improved, environmentally safe, and supported by science and research.

Management Objectives

- Monitor and evaluate the effectiveness of control techniques and adapt them based on results.
- Document the abundance and distribution of invasive plants in the park.
- Detect changes in non-native species distribution, abundance, and rate of spread.
- Identify vectors of spread to determine ways of preventing new species and populations from becoming established in the park.
- Promote research in the park upon which to base future management decisions.

Goal 5 – Ecological Restoration: Restore ecosystems and key ecological processes that have been impacted by invasive species to meet desired future conditions.

Management Objective

- Integrate ecological restoration practices in invasive plant control treatments to guard against re-infestations.

Public Participation and Scoping

The goal of the public participation effort for the Invasive Plant Management Plan is to inform the public about the need for the plan, identify key issues, and provide the public with opportunities for meaningful involvement in the planning process. The planning team provided informational materials on the Invasive Plant Management Plan in a 2004 press release, the Yosemite National Park Electronic Newsletter (e-mailed to about 7,600 individuals, agencies, and organizations), the Gateway Partners Update, the Yosemite National Park Daily Report, the Mariposa Gazette, and the Yosemite National Park website. The park held two public meetings to discuss the plan—one in El Portal on January 11, 2005, and one in Wawona on January 18, 2005. Members of the planning team were available at public open houses held monthly in Yosemite, during the public scoping and through the planning period.

The public scoping period for the Invasive Plant Management Plan took place from January 1, 2005 to February 15, 2005. The park received 46 comment letters during the public scoping process, including 29 from individuals and 17 from organizations. Written comments arrived via mail, e-mail, and fax. The

planning team derived and categorized a set of concern statements from the public comment letters (see Table I-1). The issues derived from the scoping process are analyzed in Chapter III.

Table I-1: Public Scoping Concern Statements

Public Scoping Concern Statements Regarding Planning Process and Policy
• Prepare the Invasive Plant Management Plan in collaboration with citizen organizations and agencies with knowledge and experience in controlling invasive species. • Post all public comments on the Invasive Plant Management Plan to the Yosemite Planning Web page at www.nps.gov/yose/parkmgmt/planning.htm. • Prepare a full environmental impact statement to analyze the impacts of the proposed Invasive Plant Management Plan. • Directly involve Native American tribes with cultural ties to Yosemite National Park in invasive plant management. • Ensure that the planning process is clear and includes public participation. • Develop management options through coordination with other divisions in the park. • Include proposals for participation in prescribed fire planning. • Require a public review and comment period each time an herbicide or biological control method is proposed for use. • Develop a process to approve or reject the use of herbicides.
Public Concern Statements Regarding the Scope of the Plan
• Analyze the threat of invasive plants from outside park boundaries. • Address the effects of proposed actions on the park soils. • Consider restoring plant species that have been lost. • Include information about the invasion of exotic plants following road projects. • Do not propose removal of non-native plants that are not invasive. • Evaluate if native trees are invasive in some instances and should be controlled.
Public Concern Statements Regarding Methods and Techniques
• Carefully examine the criteria for determining which plants are considered "non-native" and "undesirable." • Examine each proposed invasive plant control treatment, and evaluate and weigh its positive and negative impacts. • Employ invasive plant control techniques and strategies based on knowledge of the disturbance regime of each ecosystem. • Ensure that methods used are based on the results of scientific research. • Evaluate the effectiveness of herbicides as an invasive plant control treatment. • Examine the relationship between park development activities and the invasion of non-native plants. • Evaluate the need to use volunteers for invasive plant monitoring and control treatments. • Evaluate the costs and chance for success of the varied invasive plant treatment methods. • Call for the removal of the non-native invasive Black Locust tree from the park. • Consider all available invasive plant treatment options, except herbicides. • Articulate and evaluate the strategies the park will use for prioritizing species. • Pursue the control of invasive plants with the primary goal of allowing natural processes to prevail.

Table I-1: Public Scoping Concern Statements
Public Concern Statements Regarding Potential Impacts or Environmental Effects
• Evaluate the potential for proposed actions to cause significant impact to designated Wilderness and Wild and Scenic River Corridors. • Protect Wilderness areas. • Prescribe buffers from streams in the Tuolumne River watershed when herbicides are used. • Evaluate the secondary, unintended consequences of herbicide use. • Do not propose the massive, indiscriminate use of herbicides. • Evaluate the potential unintended consequences of introducing non-native biological control agents into the park before considering them an invasive plant treatment option. • Evaluate the effects of using fire for invasive plant treatment on the park and on regional air quality. • Do not propose the use of Clopyralid or Triclopyr on vegetation that may subsequently be burned.

Issues and Concerns Not Addressed in this Document

The following issues and concerns generated during public scoping were considered in the planning process, but were determined to be outside the scope of the plan. They will not be addressed in this Environmental Assessment.

- Integrate the management of invasive plants with the management of non-native plant and animal diseases.
- Develop a joint invasive plant management plan with Sequoia and Kings Canyon National Parks and Devil's Postpile National Monument.
- Assess the threat from the introduction of genetically modified plants.
- Ban private horses and mules in Yosemite National Park.

Legislative and Planning Context

The Invasive Plant Management Plan must conform to federal law, regulation, and policy guidance. In 1999, President Bill Clinton signed Executive Order 13112 to prevent the introduction and spread of invasive species. This federal directive provides overarching guidance for the management of invasive species, and calls for emphasis in seven categories: leadership and coordination, prevention, early detection and rapid response, control, education, research, and restoration. Executive Order 13112 established the National Invasive Species Council to provide national leadership and ensure that federal agency activities concerning invasive species are coordinated, complementary, cost-effective, and efficient. Executive Order 13112 also called for the preparation of the National Invasive Species Management Plan (NISC 2001). The updated 2008-2012 National Invasive Species Management Plan was distributed for public comment from December 28, 2007 through February 11, 2008 (NISC 2008).

The Invasive Plant Management Plan must conform to federal regulatory measures with respect to herbicide use. Applicable legislation includes the Federal Insecticide, Fungicide, and Rodenticide Act and the Occupational Safety and Health Administration's (OSHA's) Hazard Communication Standard. Under the Federal Insecticide, Fungicide, and Rodenticide Act, the U.S. Environmental Protection Agency (EPA) must evaluate herbicides for potential adverse effects on the environment. Herbicides must be tested for

safety and registered with the Office of Pesticide Programs. Under OSHA standards, employers must provide workers with training, protective equipment, and information about hazardous substances. In addition, the National Park Service Management Policies (NPS 2006c) requires that all National Park Service pesticide application is supervised by individuals licensed under the procedures of a federal or state certification system (4.4.5.3). Yosemite National Park must also meet the requirements of National Park Service Directors Order 77-7 Integrated Pest Management.

The Organic Act of 1916 is the legal foundation of National Park Service regulation and policy. The Organic Act directs the National Park Service "to conserve the scenery and natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner as will leave them unimpaired for the enjoyment of future generations." The National Park Service Management Policies (NPS 2006c) is the primary policy document of the National Park Service. It contains text relevant to the control of non-native plant species, including these statements: "Exotic species will not be allowed to displace native species if displacement can be prevented" and "In general, new exotic species will not be introduced into parks." More specific guidance on implementing National Park Servicewide policy on invasive species in the form of Director's Orders and reference manuals is in progress. Until such policies are developed, National Park Service invasive species management programs are expected to reside with individual park staff, Inventory and Monitoring Network staff, Exotic Plant Management Teams, and regional and national technical support specialists.

Legislation and policy specific to Yosemite National Park include the enabling legislation for Yosemite National Park, the California Wilderness Act of 1984, the General Management Plan for Yosemite (NPS 1980), and the in-progress Merced Wild and Scenic River Comprehensive Management Plan (NPS 2005) and Tuolumne Wild and Scenic River Comprehensive Management Plan (in progress). The park's Resources Management Plan directs specific activities for the management of natural and cultural resources throughout the park, consistent with the broad direction provided by the General Management Plan. The General Management Plan provides overall management direction for Yosemite National Park. The Invasive Plant Management Plan tiers off the General Management Plan, and directly supports two goals of the plan:

- Reclaim priceless natural beauty.
- Allow natural processes to prevail.

In 2000, the Natural Resource Challenge Exotic Action Plan created a funding roadmap to improve the National Park Service's response to harmful plant species. In 2006, the National Park Service finalized the Invasive Species Action Plan, building on the Natural Resource Challenge Exotic Action Plan, further addressing the categories required under Executive Order 13112 and the National Invasive Species Management Plan. The action alternatives in the Invasive Plant Management Plan are consistent with parkwide and Servicewide legislation and policy, and reflect the categories identified in the national planning documents.

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Chapter II: Alternatives

This chapter describes two Action alternatives to meet the goals of the Invasive Plant Management Plan, and a No Action alternative that represents existing conditions. These alternatives were developed through a collaborative interdisciplinary analysis based on the expertise of planning team members, as well as on consultation with American Indian tribes and interested agencies, organizations, and individuals. Each Action alternative is a comprehensive proposal that includes the following elements for the management of invasive plants: prevention, early detection and rapid response, prioritization, monitoring, education, and research. The projected lifespan of this plan is ten to fifteen years. This chapter consists of the following sections:

- Description of the Alternatives
- Actions Common to All Alternatives
- Alternative 1: The No Action Alternative
- Alternative 2 (Preferred Alternative): Eradicate or Prevent the Spread of High- and Medium-High-Priority Invasive Plants into Natural Habitats
- Alternative 3: Eradicate or Prevent the Spread of High-, Medium-High-, and Medium-Priority Invasive Plants
- Alternatives Considered but Dismissed
- Mitigation Measures Common to All Action Alternatives
- Environmentally Preferable Alternative
- Summary of Environmental Consequences

Description of the Alternatives

All of the alternatives in the Invasive Plant Management Plan aim to protect uninfested areas in Yosemite from the impacts of invasive plants; the alternatives differ primarily in management strategies.

Under Alternative 1 (No Action Alternative), an extensive program staffed by park employees and volunteers would detect, control, and prevent invasive plant populations in the park from spreading into uninfested areas using existing techniques. The invasive plant program would not employ herbicides as a tool to control invasive plants. The land area in Yosemite treated for invasive plants would remain approximately the same size over time. Under existing conditions and trends, Yosemite would not meet its species-specific management objectives for invasive plants (see Appendix A).

Under Alternative 2 (Preferred Alternative), the park would meet management objectives for high- and medium-high-priority invasive species. These species pose the greatest threat to natural communities in the park, and have the highest feasibility for control. Park crews would use herbicides to control up to 22 invasive plant species (out of 177 non-native plants in the park) if management objectives could not be achieved with the use of other control methods and invasive plant populations meet size and location thresholds (see Table II-6). The National Park Service has identified Alternative 2 as the preferred alternative for the Invasive Plant Management Plan.

Under Alternative 3, the park would meet management objectives for medium-priority invasive species, as well as high- and medium-high-priority species. Medium-priority species are mainly found in disturbed areas such as road corridors, campgrounds, parking lots, and staging areas. Medium-priority species do not have as great a potential to invade natural plant communities as higherpriority plants. Under Alternative 3, park crews would utilize herbicides to control up to 35 invasive plant species if objectives could not be met through other control methods and invasive plant populations meet size thresholds (see Table II-4).

Actions Common to All Alternatives

Prioritization

All of the alternatives in the Invasive Plant Management Plan follow the same ranking system to prioritize invasive plants for treatment. Currently, 177 non-native plant taxa occur in Yosemite (see Appendix B). While many of these non-native plants do not pose a threat to park resources, some non-native plants (also known as "transformer species") have the potential to form monotypic stands, greatly altering resource availability, trophic structure, ecosystem productivity, and/or natural disturbance regimes (D'Antonio 2004). Program managers used three main characteristics to determine the priority order for invasive plant control: the current impacts on an invasive species on park resources; the potential threat of an invasive species on park resources; and the feasibility of controlling the species. Initially, program managers screened the 177 non-native plant species documented in the park to determine whether any were a documented threat in California. Program managers assigned a low-priority ranking to species that did not meet at least one of the following criteria:

- Present on the California Department of Food and Agriculture (CDFA) List of Noxious Weeds (CDFA 2007)
- Present on the California Invasive Plant Council (Cal-IPC) list of Invasive Non-Native Plants that Threaten Wildlands in California (Cal-IPC 2006)
- Present on the U.S. Geological Survey (USGS) Alien Plant Species Threat Assessment for Yosemite (Gerlach, Moore et al. 2003)
- Considered a threat to resources by land managers in Yosemite National park

Ninety-one non-native species failed to meet the above criteria, and thus were assigned a low-priority status (see Table II-1). Many of these low priority non-native plant species are restricted to disturbed areas such as road corridors, campgrounds and parking areas, and do not appear to be spreading into natural areas. Other low-priority species are so widespread within Yosemite and surrounding areas (e.g., some of the Mediterranean grasses), it is currently not feasible to control these species.

Program managers evaluated the remaining 88 higher-priority species using a modified version of the USGS Alien Plants Ranking System (USGS 2000). The Alien Plants Ranking System is an analytical software tool created to assist land managers in prioritizing non-native plant species based on site-specific impacts as well as feasibility of control. This ranking system takes into consideration whether invasive plants are likely to be found in areas of special protection—such as Wilderness, meadow, or riparian habitats; Wild and Scenic River corridors; traditional gathering areas; or special-status species habitat. The results of the ranking of the higher-priority invasive plants for treatment in Yosemite are listed in

Table II-2. All botanical nomenclature follows The Jepson Manual of Higher Plants of California (Hickman 1993).

Table II-1: Non-Native Plants with a Low Priority for Treatment in Yosemite National Park

Scientific Name	Common Name	Scientific Name	Common Name
Aira caryophyllea	silver European hairgrass	*Medicago lupulina*	black medick
Anagallis arvensis	scarlet pimpernel	*Mollugo verticillata*	carpet-weed, indian chickweed
Anthemis cotula	stinkweed	*Nicotiana glauca*	tree tobacco
Anthriscus caucalis	burr chervil	*Oxalis corniculata*	creeping woodsorrel
Arabidopsis thaliana	mouse ear cress	*Panicum miliaceum*	broomcorn millet
Bidens tripartita	threelobe beggarticks	*Parapholis incurva*	curved sickle grass
Briza minor	little quaking grass	*Plantago major*	common plantain
Bromus arenarius	Australian brome	*Poa annua*	annual bluegrass
Bromus catharticus	rescue grass	*Poa nemoralis*	wood bluegrass
Bromus japonicus	field brome	*Poa palustris*	fowl bluegrass
Bromus secalinus	rye brome	*Polycarpon tetraphyllum*	four-leaved allseed
Bromus sterilis	poverty brome	*Polygonum arenastrum*	common knotweed
Capsella bursa-pastoris	shepherd's purse	*Polygonum persicaria*	spotted ladysthumb
Cerastium fontanum ssp. *vulgare*	big chickweed	*Polygonum ramosissimum*	bushy knotweed
Cerastium glomeratum	sticky chickweed	*Polypogon maritimus*	Mediterranean beard grass
Chamomilla suaveolens	pineapple weed	*Portulaca oleracea*	little hogweed
Cnicus benedictus	blessed thistle	*Ranunculus muricatus*	spinyfruit buttercup
Crepis capillaris	smooth hawksbeard	*Raphanus raphanistrum*	jointed charlock
Dianthus barbatus ssp. *barbatus*	sweet William	*Rumex conglomeratus*	dock
Digitaria ischaemum	smooth crabgrass	*Scirpus cyperinus*	woolgrass
Digitaria sanguinalis	hairy crabgrass	*Secale cereale*	cereal rye
Epipactis helleborine	broadleaf helleborine	*Senecio vulgaris*	common groundsel
Eragrostis cilianensis	lovegrass	*Setaria pumila*	yellow foxtail
Erigeron annuus	eastern daisy fleabane	*Setaria viridis*	green bristlegrass
Erodium botrys	long-beaked stork's bill	*Silene gallica*	common catchfly
Erodium brachycarpum	short fruit stork's bill	*Silene latifolia* ssp. *alba*	bladder campion
Filago gallica	narrow-leaved herba impia	*Sisymbrium officinale*	hedge mustard
Gaillardia pulchella	firewheel	*Soliva sessilis*	field burrweed
Galium parisiense	wall bedstraw	*Sonchus oleraceus*	common sow thistle
Glechoma hederacea	ground ivy	*Spergularia rubra*	red sandspurry
Herniaria hirsuta ssp. *cinerea*	rupture wort	*Stellaria media*	common chickweed
Herniaria hirsuta ssp. *hirsuta*	hairy rupture wort	*Trifolium dubium*	little hop clover
Hordeum marinum ssp. *gussoneanum*	mediterranean barley	*Trifolium pratense*	red clover
Hordeum murinum ssp. *glaucum*	smooth barley	*Trifolium repens*	white clover
Hordeum murinum ssp. *leporinum*	leporinum barley	*Triticum aestivum*	common wheat
Hordeum murinum ssp. *murinum*	wall barley	*Verbascum blattaria*	moth mullein
Lamium amplexicaule	henbit dead nettle	*Veronica anagallis-aquatica*	water speedwell
Lepidium virginicum var. *virginicum*	Virginia pepperweed	*Veronica arvensis*	corn speedwell
Lolium temulentum	darnel	*Veronica persica*	Persian speedwell
Lunaria annua	annual honesty	*Vicia cracca*	bird vetch
Malva nicaeensis	bull mallow	*Viola arvensis*	European field pansy
Malva parviflora	cheeseweed	*Vitis vinifera*	wine grape

Table II-2: Highest Priority Invasive Plants for Treatment in Yosemite National Park					
Scientific Name	**Common Name**	**Impact**	**Threat**	**Difficulty to Control**	**Ranking Score**
High-Priority Species (Ranking Score >3)					
Bromus tectorum	Cheat grass	High	High	High	4
Carduus pycnocephalus	Italian thistle	Low	High	Low	4
Centaurea maculosa	Spotted knapweed	Medium	High	Low	5
Centaurea solstitialis	Yellow star-thistle	High	High	Medium	5
Cirsium vulgare	Bull thistle	Medium	High	Medium	4
Genista monspessulana	French broom	Low	High	Low	4
Holcus lanatus	Common velvet grass	Medium	High	Medium	4
Lepidium latifolium	Perennial pepperweed	Medium	High	Low	5
Rubus discolor	Himalayan blackberry	High	High	High	4
Medium-High-Priority Species (Ranking Score =3)					
Ailanthus altissima	Tree-of-heaven	Low	High	Medium	3
Amaranthus albus	Prostrate pigweed	Low	Medium	Low	3
Arundo donax	Giant reed	Low	High	Medium	3
Brassica nigra	Black mustard	Low	Medium	Low	3
Brassica rapa	Field mustard	Low	Medium	Low	3
Centaurea melitensis	Tocolote	Medium	Medium	Medium	3
Cynodon dactylon	Bermuda grass	Low	Medium	Low	3
Digitalis purpurea	Foxglove	Low	Medium	Low	3
Hedera helix	English ivy	Low	Medium	Low	3
Hirschfeldia incana	Shortpod mustard	Low	Medium	Low	3
Humulus lupulus	Hops	Medium	Medium	Medium	3
Lathyrus latifolius	Perennial sweet pea	Low	Medium	Low	3
Leucanthemum vulgare	Oxeye daisy	Medium	High	High	3
Lychnis coronaria	Rose campion	Medium	Medium	Medium	3
Melilotus alba	White sweetclover	Low	Medium	Low	3
Melilotus indica	Sourclover	Low	Medium	Low	3
Melilotus officinalis	Yellow sweetclover	Low	Medium	Low	3
Mentha spicata var. *spicata*	Spearmint	Medium	Medium	Medium	3
Nicotiana acuminata var. *multiflora*	Manyflower tobacco	Low	Medium	Low	3
Parthenocissus vitacea	Woodbine, Virginia creeper	Low	Medium	Low	3
Robinia pseudoacacia	Black locust	Low	Medium	Medium	3
Rubus laciniatus	Cutleaf blackberry	Medium	High	High	3
Sisymbrium irio	London rocket	Low	Medium	Low	3
Trifolium hirtum	Rose clover	Medium	Medium	Medium	3
Verbascum thapsus	Common mullein	Low	Medium	Low	3
Vicia benghalensis	Purple vetch	Low	Medium	Low	3
Medium-Priority Species (Ranking Score =2)					
Bromus madritensis ssp. *rubens*	Foxtail chess	Low	Low	Low	2
Centaurea cyanus	Bachelor's button	Low	Medium	Medium	2
Chenopodium botrys	Jerusalem oak	Low	Low	Low	2

Table II-2: Highest Priority Invasive Plants for Treatment in Yosemite National Park					
Scientific Name	**Common Name**	**Impact**	**Threat**	**Difficulty to Control**	**Ranking Score**
Coreopsis lanceolata	Lanceleaf tickseed	Low	Low	Low	2
Cynoglossum officinale	Gypsyflower	Low	Low	Low	2
Festuca arundinacea	Tall fescue	Low	Low	Low	2
Hypericum perforatum	Common St. Johnswort	Medium	Medium	High	2
Polygonum convolvulus	Black bindweed	Low	Medium	Medium	2
Raphanus sativus	Radish	Low	Medium	Medium	2
Rudbeckia hirta var. *pulcherrima*	Blackeyed Susan	Low	Medium	Medium	2
Saponaria officinalis	Bouncingbet	Low	Medium	Medium	2
Sinapis arvensis	Charlock mustard	Low	Low	Low	2
Taraxacum officinale	Dandelion	Low	Medium	Medium	2
Tragopogon dubius	Yellow salsify	Low	Low	Low	2
Tribulus terrestris	Puncture vine	Low	Medium	Medium	2
Vinca major	Greater periwinkle	Low	Medium	Medium	2
Vulpia myuros var. *myuros*	Foxtail fescue	Medium	Medium	High	2
Medium-Low-Priority Species (Ranking Score =1)					
Agrostis capillaris	Colonial bentgrass	Low	Low	Medium	1
Agrostis gigantea	Redtop	Low	Low	High	0
Agrostis stolonifera	Creeping bentgrass	Medium	Low	High	1
Avena barbata	Slender wild oat	Medium	Low	High	1
Avena fatua	Wild oat	Medium	Low	High	1
Bromus diandrus	Ripgut brome	Medium	Low	High	1
Bromus hordeaceus	Soft brome	Medium	Low	High	1
Bromus inermis ssp. *inermis*	Smooth brome	Low	Medium	High	1
Chenopodium album	Lambs quarters	Low	Low	Medium	1
Convolvulus arvensis	Field bindweed	Low	Low	Medium	1
Cynosurus echinatus	Hedgehog dogtail	Medium	Low	High	1
Dactylis glomerata	Orchard grass	Low	Low	High	0
Echinochloa crus-galli	Barnyard grass	Low	Low	Medium	1
Erodium cicutarium	Redstem stork's bill	Low	Low	High	0
Erigeron strigosus	Prairie fleabane	Low	Low	Medium	1
Festuca pratensis	Meadow fescue	Medium	Low	High	1
Geranium dissectum	Cutleaf geranium	Low	Low	Medium	1
Geranium robertianum	Robert geranium	Low	Low	Medium	1
Hypochaeris glabra	Smooth cat's ear	Low	Low	High	0
Hypochaeris radicata	Hairy cat's ear	Low	Low	High	0
Lactuca serriola	Prickly lettuce	Low	Low	Medium	1
Lolium multiflorum	Italian ryegrass	Low	Low	Medium	1
Lolium perenne	Perennial ryegrass	Low	Low	Medium	1
Marrubium vulgare	Horehound	Low	Low	High	0
Medicago polymorpha	California burclover	Low	Low	High	0
Medicago sativa	Alfalfa	Low	Low	Medium	1
Muhlenbergia schreberi	Nimblewell	Low	Low	High	0
Phleum pratense	Cultivated timothy	Low	Low	High	0

Table II-2: Highest Priority Invasive Plants for Treatment in Yosemite National Park

Scientific Name	Common Name	Impact	Threat	Difficulty to Control	Ranking Score
Plantago lanceolata	English plantain	Low	Low	High	0
Poa bulbosa	Bulbosa bluegrass	Low	Low	High	0
Poa compressa	Canada bluegrass	Low	Low	Medium	1
Poa pratensis ssp. *pratensis*	Kentucky bluegrass	Medium	Low	High	1
Polypogon monspeliensis	Annual beard grass	Low	Low	Medium	1
Rumex acetosella	Sheep sorrel	Medium	Low	High	1
Rumex crispus	Curly dock	Low	Low	Medium	1
Sisymbrium altissimum	Tall tumblemustard	Low	Low	Medium	1
Sonchus asper ssp. *asper*	Prickly sow thistle	Low	Low	Medium	1
Tanacetum parthenium	Feverfew	Low	Low	Medium	1
Torilus arvensis	Spreading hedge-parsley Miner's lice	Medium	Low	High	1
Urtica urens	Dwarf nettle	Low	Low	High	0
Vulpia bromoides	Brome fescue	Low	Low	High	0

The results from the Alien Plants Ranking System were grouped into High, Medium, and Low for each of the three categories: Impact, Threat, and Difficulty of Control. These results were summarized to determine a priority ranking score between 0 and 6. Impact and threat categories with a High ranking were assigned a score of 2; Medium ranking received a score of 1; and Low ranking received 0. In the Difficulty of Control category, Low (or more easily controlled) received a score of 2; Medium difficulty received a 1; and High (i.e., difficult to control) received a 0.

The results of the Impact, Threat, and Difficulty of Control categories were added together to give a priority ranking. Species that received ranking scores of 4 or greater were considered High Priority. Ranking scores of 3 were considered Medium-High Priority. Ranking scores of 0 and 1 were considered Medium-Low Priority.

Prioritization by Site

In some cases, program managers gave all populations of a high-priority species equal priority for control efforts. Occasionally, program managers prioritized specific populations for control. Specific populations were given priority if they were outlier populations found at higher elevations; populations found in Wilderness, meadow, riparian areas, or Wild and Scenic River corridors; populations that threaten traditional cultural properties such as traditional gathering areas; and populations that threaten sensitive species populations or habitat.

Early Detection and Rapid Response, Prevention, Control Techniques, Monitoring, Research, and Outreach and Education

Table II-3 lists the programmatic actions common to all of the alternatives.

Table II-3: Programmatic Actions Common to All Alternatives

Early Detection and Rapid Response Actions

Detect and eradicate invasive plant populations in their earliest stages, before they establish a persistent seed bank or affect park ecosystems. Prioritize invasive plants for early detection and control using the Watch List for Invasive Plant Species Not Yet Found in Yosemite National Park(see Appendix C), along with other invasive plants known to be in Yosemite (see Appendix B). Prime sites for early detection include:

Construction Sites. Construction and other operations that involve earthmoving activities create ideal conditions for the establishment of new invasive plant populations. The park would conduct directed surveys for non-native species, before and after construction activities that involve ground disturbance, for a minimum of two years after construction is completed.

Burned Areas. Fire is a natural process that occurs throughout natural areas in Yosemite National Park. While fire is integral to ecosystem processes, it can also facilitate the introduction and spread of non-native invasive plants. To reduce the risk of spreading invasive plants, the park would conduct directed surveys within burn areas following prescribed or naturally occurring fires to locate and control new invasive plants.

Wilderness. Nearly 95 percent of Yosemite is designated Wilderness, yet invasive plants are found in only a small portion of Wilderness lands in Yosemite. The Wilderness Restoration Program in Yosemite's Resources Management & Science Division would continue early detection activities for high-priority invasive species populations.

Prevention Actions

Follow best management practices for the prevention of the introduction and spread of invasive plants (see Appendix D). These practices are applicable to park staff, park partners, and contractors.

Invasive Plant Control Techniques

The following invasive plant control methods would be used to treat invasive plant populations:

Manual Control. Hand-pulling, lopping, or cutting using non-motorized equipment such as shovels is a labor-intensive control method, ideally suited for many invasive species in the park.

Mechanical Control. This control method utilizes hand-held motorized equipment such as brush cutters (with strings or blades) or hedge-trimmers to remove the aboveground portion of invasive plants. It is ideally suited for sites where an invasive plant has displaced all other plants. This is a common and effective tool currently used on many invasive species in the park.

Tilling with Heavy Equipment. Tilling, or turning over of soil with heavy equipment such as a bobcat, would be used only in heavily disturbed sites.

Smothering Using Mulch or Plastic. Soil solarization is the technique of placing a cover (usually black or clear plastic) over the soil surface to trap solar radiation, so that soil temperatures increase to levels that kill plants and seeds.

Flaming. This technique uses fire to scorch and kill selected plants. This technique does not cause ignition, and is conducted under wet weather conditions to prevent any risk of fire.

Steam. This technique is similar to flaming, but uses steam rather than fire to scorch and kill invasive plants. One example is a tool called "Waipuna," which utilizes a nontoxic, biodegradable, organic hot foam that is applied to plants, killing them instantly. The organic foam solution contains a natural plant sugar extract from corn and coconut.

Biological Control. Yosemite National Park introduced a chrysomelid beetle in Yosemite Valley to control St. John's wort (Hypericum perforatum) in the 1980s. In 1994 and 1995, the peacock fly (Chaetorellia australis), the hairy weevil (Eustonopus villosus), and the false peacock fly (Chaetorellia succinea) were introduced in El Portal to help control yellow star-thistle. Biocontrol can be an effective method of controlling some species. Currently, no invasive species in Yosemite require the release of a biological control agent to meet management objectives. The only biocontrol agents that would be released in Yosemite National Park are the four species previously released to control yellow star-thistle and St. John's Wort.

Use of "Natural" Herbicides.

Invasive plant program managers would explore methods of invasive plant control that involve the use of herbicides derived from ingredients found in nature.

Table II-3: Programmatic Actions Common to All Alternatives

Ecological Restoration.

Integrate the ecological restoration actions to control invasive plants and prevent invasive plant re-infestation

Monitoring

Park staff would monitor to document the locations of invasive plants, determine whether management objectives were met, and ensure the effectiveness of control techniques. The National Park Service Inventory & Monitoring Program is developing a standardized system to monitor invasive species. This system would be enacted to the extent that funding and staffing is available. Monitoring would take place on the following levels:

Monitoring Trends. This type of monitoring tracks changes in the abundance and distribution of non-native species in the park. This monitoring would provide information on the location and extent of non-native species, and provide insight into the mechanisms and vectors that promote the spread of invasive species in the park. Trends monitoring can also identify new invasive species that were not known to occur in the park or were not known to be invasive elsewhere. Trends monitoring includes the following goals:

- Detect changes in non-native species distribution and abundance
- Evaluate the rate of spread of invasive non-native plants
- Inventory and map non-native species
- Identify uninfested acres in the park
- Identify vectors of spread to determine how to better prevent new species and populations from becoming established in the park
- Gather new information on new invasive species that pose a potential threat to park resources

Monitoring the Efficacy of Management Actions. Efficacy monitoring involves gathering information on the effectiveness of non-native species control and prevention efforts. This form of monitoring would help determine whether management objectives were being met through the current management techniques. The goals of efficacy monitoring are to:

- Evaluate the effectiveness of management efforts to control, contain, or eradicate specific non-native species to a target level on a given site, over a given period of time
- Evaluate the effectiveness of management actions toward establishing natural ecosystem structure and ecosystem processes over a period of one to five years

Monitoring the Secondary Effects of Management Actions. The indirect consequences of management actions on other park resources are referred to as secondary effects. The park would monitor secondary effects to understand how the invasive plant program is affecting other components of the ecosystem (i.e., not just the target invasive species). When necessary and feasible, monitoring would be implemented to determine:

- Effects of control efforts on water quality
- Secondary effects of treatments on native vegetation and other native taxa (e.g., invertebrates, amphibians)
- Effects of treatments on the fire regime, fuels, and fire hazards (i.e., increased or decreased hazard)

Monitoring Ecological Restoration and Recovery. Restoration and recovery monitoring would examine the long-term status of sites where invasive plants treatments take place. The goals of this type of monitoring are:

- Detect colonization by other (non-target) invasive plants after treatment within the first five years (or until no invasions are detected for three years)
- Determine if restored sites are within the natural range of conditions with respect to ecosystem composition and structure

Research

The park would solicit research to facilitate informed decisions about the invasive plant program. Program managers would conduct periodic literature searches on published research relative to invasion ecology and the management of invasive plants. During the annual review of the program's management objectives, managers would incorporate new information from the research community. The Division of Resources Management and Science would maintain a literature database on invasive species.

Table II-3: Programmatic Actions Common to All Alternatives

Outreach and Education

One goal of the Invasive Plant Management Plan is to foster an understanding of invasive plant prevention and control through outreach and education. The following actions would foster this goal:

Internal Training Programs. These programs would train park employees, concession employees, park partners, contractors, commercial outfitters, and volunteers in invasive plant identification and management. These programs could:

- Provide information on how to identify priority invasive plants of concern.
- Identify a National Park Service point of contact for reporting the locations of new invasive plant infestations
- Incorporate invasive plant information into National Park Service training, planning and design, management, construction, interpretation, maintenance, law enforcement, and resource management
- Use established media (electronic media, publications, authorizations, permits, and contracts) to inform National Park Service staff and other commercial users about invasive plant management issues
- Interpret and communicate the results of the latest research on invasive plants to resource managers, interpreters, maintenance personnel, and others

Visitor and Public Interpretation Programs. These programs would provide park visitors and other interested parties with information regarding the threats posed by invasive plant species as well as human behavior that can result in the spread of invasive plants. These programs could include:

- Ranger-led programs to address invasive plant issues—either as specific detailed programs devoted to invasive plant issues, or as part of related programs such as wildflower, wildlife, fire ecology, or ethnobotany programs
- Organized volunteer efforts that provide hands-on opportunities to become involved in invasive plant management
- Open house meetings that provide opportunities for the public to interact with resource management and other National Park Service staff, as well as outreach programs for local schools and communities
- Interpretive services for visitors, including press releases, articles in newsletters and/or journals, brochures, visitor center exhibits, and web sites

Other Outreach Measures. A variety of other education and outreach measures could take place under the action alternatives, including:

- Develop incentive programs to encourage invasive plant awareness, detection, reporting, and identification of new species and populations
- Place weed awareness messages at strategic locations such as trailheads and information kiosks
- Include weed prevention guidelines on Wilderness permits and Commercial Use Authorizations

Sierra – San Joaquin Noxious Weed Alliance

Yosemite National Park would continue membership in the Sierra-San Joaquin Noxious Weed Alliance, a local organization that brings together county, California State, federal, and private landowners from Fresno, Mariposa, and Madera Counties to coordinate and combine action and expertise to control and/or eradicate common invasive plants. This group functions under the authority of a mutually developed Memorandum of Understanding (MOU), and is subject to statutory and regulatory invasive plant control requirements.

Alternative 1: The No Action Alternative

Overview

Under the No Action alternative, the park would continue existing invasive plant management practices. An extensive program staffed by park employees and volunteers would strive to detect, control, and prevent invasive plant populations in the park from spreading into uninfested areas using manual and mechanical techniques. This invasive plant program has been in place for over a decade. In 2007, volunteers spent over 10,000 hours removing invasive plants from wetlands and meadows (NPS 2007a); in addition, one to two National Park Service crews work throughout the growing season to control invasive plants. Under this alternative, the invasive plant program would not use herbicides as part of invasive plant control treatments.

Current resource conditions and trends would continue. Over the past decade, the park has reduced the rate of spread of existing invasive plant populations. For example, after decades of work, eradication efforts have reduced the density of large populations of yellow star-thistle, one of the park's most noxious weeds. Because mowing treatments for yellow star-thistle are most effective when two to five percent of the plant is in bloom, mowing is restricted to a few weeks of the year. It is difficult to treat all populations within this small time window, and smaller outlying populations of yellow star-thistle would continue to grow and spread. In the case of non-native blackberry, park staff and volunteers have been treating or retreating non-native blackberry in Yosemite Valley using hand-pulling or mowing at a rate of about five acres a year (about three acres of re-treatment and two acres of new treatment) (NPS 2006d). The total acreage of blackberry in Yosemite Valley is about 85 acres. Individual blackberry plants can spread at the rate of 10 feet per year, and the rate of re-growth and spread of blackberry may surpass this rate of treatment. Under Alternative 1, the park is not likely to increase noticeably the total acreage of invasive plant treatment in the park. As invasive plants continue to spread into uninfested areas, the park would not meet its overarching goal of protecting the natural, cultural, and scenic resources of Yosemite National Park from the threat of non-native plant invasion.

Early Detection and Rapid Response, Prioritization, Prevention, Monitoring, Research, and Outreach and Education

See Actions Common to All Alternatives.

Invasive Plant Control Techniques

See Actions Common to All Alternatives.

Alternative 2: Eradicate or Prevent the Spread of High- and Medium-High-Priority Invasive Plants into Natural Habitats (Preferred Alternative)

Overview

Under Alternative 2, an extensive program staffed by park employees and volunteers would employ an integrated pest management approach to detect, control, and prevent high- and medium-high-priority

invasive plants from spreading into uninfested areas. Work crews would use a variety of manual and mechanical control techniques. Additionally, work crews would use herbicides to control up to 22 high- and medium-high-priority invasive plants, those that pose the greatest threats to natural communities in the park. Work crews would treat medium-priority plants—those that tend to favor disturbed sites and generally do not have the potential to invade into undisturbed natural communities—with manual and mechanical control techniques.

Program managers would develop annual work plans that would include the time and planned locations of herbicide applications, and distribute this information to the public via the Yosemite National Park website and other print media before herbicide applications take place. Herbicide use is expected to decline over time as invasive plant populations decline in size.

Currently, 15 of the 22 invasive plant species proposed for herbicide use under Alternative 2 meet the specified population size and location criteria. Work crews would not use herbicides on the remaining seven species unless population sizes change to meet the thresholds identified in Table II-4. Program managers would also consider herbicide use for newly discovered invasive plants in the park if the Cal-IPC or CDFA consider the species an ecological threat (see Control Treatments section).

Table II-4: Species Identified for Herbicide Use and Herbicide Use Thresholds under Alternative 2

Species	Estimated Acres in Yosemite	Herbicide[1]	Herbicide Use Population Size or Location Thresholds
Invasive Plants That Currently Meet Thresholds for Herbicide Use Under Alternative 2			
Ailanthus altissima (Tree-of-heaven)	<1 acre estimated parkwide	Glyphosate	Population size of one or more plants (due to lack of effective alternative methods to control this species)
Bromus tectorum Cheat grass	Unknown	Glyphosate	Population must be larger than 20 square meters
Centaurea maculosa (Spotted knapweed)	<1 acre	Aminopyralid	Population size of one or more plants (due to extreme invasibility and tenacious qualities of the species)
Centaurea melitensis (tocalote)	Estimated 5 acres to be treated (100 acres estimated parkwide)	Glyphosate, Aminopyralid	Population must be larger than 10 square meters
Centaurea solstitialis (Yellow star-thistle)	Estimated 5 acres to be treated (100 acres documented parkwide)	Glyphosate, Aminopyralid	Population must be larger than 10 square meters, and located on steep or hard-to-access slopes
Cirsium vulgare (bull thistle)	Estimated <1 acre to be treated (>100 acres estimated parkwide)	Glyphosate	Non-wilderness populations where the density of individuals exceeds 10 per square meter; herbicides would be used only on first-year rosettes (not flowering plants)
Holcus lanatus (Common velvet grass)	Estimated <10 acres to be treated (1,000 total acres estimated parkwide)	Glyphosate	Population must be larger than 5 square meters
Humulus lupulus (Hops)	<1 acre estimated parkwide	Glyphosate	Population must be larger than 5 square meters

Table II-4: Species Identified for Herbicide Use and Herbicide Use Thresholds under Alternative 2

Species	Estimated Acres in Yosemite	Herbicide[1]	Herbicide Use Population Size or Location Thresholds
Lathyrus latifolius (Perennial sweet pea)	Estimated 2 acres to be treated (3 acres estimated parkwide)	Glyphosate	Population size of one or more plants (due to lack of alternative methods to effectively control this species)
Lepidium latifolium (Perennial pepperweed)	<1 acre	Glyphosate	Population size of one or more plants (due to extreme invasibility and tenacious qualities of the species)
Leucanthemum vulgare (Oxeye daisy)	Estimated <1 acre to be treated (5 acres estimated parkwide)	Glyphosate, Aminopyralid	Populations must be larger than 10 square meters
Robinia pseudoacacia (Black locust)	<1 acre estimated parkwide	Glyphosate	Population size of one or more plants (due to lack of alternative methods to effectively control this species)
Rubus discolor (Himalayan blackberry)	Estimated 50 acres to be treated (60 acres estimated parkwide)	Glyphosate	Population size of one or more plants (due to lack of other methods to effectively control this species)
Rubus laciniatus (Cutleaf blackberry)			
Vicia benghalensis (vetch)	<5 acres	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Invasive Plants That Do Not Currently Meet Herbicide Use Thresholds Under Alternative 2, but May Meet Thresholds in the Future			
Arundo donax (Giant reed)	<1 acre	Glyphosate	If plants persist after two timed manual and/or mechanical treatments
Carduus pycnocephalus (Italian thistle)	<1 acre	Glyphosate, Aminopyralid	Population must be larger than 5 square meters with greater than 50% cover
Cynodon dactylon (Bermuda grass)	<1 acre	Glyphosate	Population must be larger than 1 square meter with greater than 50% cover
Genista monspessulana (French broom)	<1 acre	Glyphosate	Population must be larger than 5 square meters with greater than 50% cover
Hedera helix (English ivy)	<1 acre	Glyphosate	Population must threaten a wetland or riparian area and be larger than 2 square meters with greater than 50% cover
Trifolium hirtum (Rose clover)	10 acre	Glyphosate	Population must be found above 4,000 feet in elevation and larger than 5 square meters with greater than 50% cover
Vinca major (Greater periwinkle)	<1 acre	Glyphosate	Population must threaten a wetland or riparian area and be larger than 2 square meters with greater than 50% cover

[1] Glyphosate would be applied at no more than the equivalent of 4 quarts per acre per year.
Aminopyralid (currently only available in the form of Milestone®) would be applied at no more than the equivalent of 7 ounces per acre per year.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

See Actions Common to All Alternatives.

Control Treatments

The manual and mechanical control methods outlined in Actions Common to All Alternatives would be the preferred methods to treat invasive plants in the park. Work crews would use herbicides to control specific invasive plant populations when management objectives could not be met with the use of manual or mechanical control techniques. Two herbicides—glyphosate and aminopyralid—would be utilized (see Appendices E, F, G, and H). In upland areas, work crews would use terrestrial-approved formulations of glyphosate or aminopyralid. Glyphosate would be applied at the maximum equivalent of four quarts per acre per year. Aminopyralid (currently available only in the form of Milestone®) would be applied at the maximum equivalent of seven ounces per acre per year. In seasonally flooded wetlands (such as habitat for Himalayan blackberry), work crews would use aquatic-approved formulations of glyphosate with an R-11 surfactant. This is the only surfactant approved for aquatic use in California. This aquatic formulation would be used only in seasonally flooded wetlands, and only during the dry phase of the year. Work crews would not apply herbicides within six feet of standing or flowing water, within the bed and banks of Wild and Scenic Rivers, or to plants growing in water. All applications would take place using manually applied applications from backpack sprayers, hand-held wands extending from truck-mounted tanks, or individual containers of herbicide and a wiper tool such as a paintbrush. Work crews would not use aerial applications such as from an airplane or helicopter, or applications from truck-mounted tanks with boom attachments. All herbicide use would follow the Herbicide Use and Storage Protocol (see Appendix I).

Invasive plant program managers followed a four-step process to determine the invasive plant species that would be treated with herbicides under Alternative 2. First, program managers prioritized invasive plants in the park for treatment (see Tables II-1 and II-2). Secondly, program managers developed species-specific management objectives for the highest-priority species (see Appendix A). Next, managers determined which priority species are responsive to herbicide use, and which species would require herbicide use to meet management objectives (see Table II-4). Lastly, managers developed species-specific population size and location criteria that invasive plants must meet before herbicides would be applied (see Table II-4). Work crews would also follow special measures in protection zones such as Wild and Scenic River corridors, Wilderness, special-status species habitat, wetlands, riparian zones, cultural landscapes, and areas the contain traditional cultural properties (see Table II-5).

Program managers would consider the use of herbicides on newly discovered invasive plant species if the Cal-IPC or CDFA considers them an ecological threat. These species must be:

- Assigned a medium or high ranking on the Cal-IPC List of Invasive Plants of Greatest Ecological Concern, or considered a Cal-IPC red-alert species; or
- Considered a Class A, B, or C invasive species by the CDFA; or
- Rank out as a high- or medium-high-priority species using the Yosemite modified version of the USGS Alien Plants Ranking System (APRS 2000).

The Cal-IPC List of Invasive Plants of Greatest Ecological Concern is currently available online at http://www.cal-ipc.org/. The CDFA Noxious Weed List is available online at http://www.cdfa.ca.gov/phpps/ipc/weedinfo/winfo_list-pestrating.htm.

Herbicide Application Rates and Methods

National Park Service work crews would use one of four herbicide application methods. All application rates and methods would be consistent with product specimen labels (DowAgroSciences 1999; Monsanto 2006b). The application methods are as follows:

- **Cut Stump:** Work crews would apply herbicides to the stump of a woody species (tree, shrub, or vine) within one minute after cutting down the tree or shrub. The herbicide would penetrate into the plant's vascular system and translocate to the remaining belowground portions of the plant to kill roots and prevent re-sprouting.
- **Frill:** This is similar to the cut stump process, but work crews would leave the tree or shrub standing. Multiple small cuts would be made into the cambium of the tree, and work crews would immediately apply herbicides. The herbicide would translocate throughout the plant.
- **Wiper:** Work crews would wipe herbicides onto the leaves of plants using a wick, sponge, paintbrush, or similar tool.
- **Foliar Spray:** Work crews would spray leaves with a mixture of herbicide, water, and non-ionic surfactant from a backpack or other sprayer. Precise mixes would vary depending on the species, the life cycle of the species, and other factors. In some cases, work crews may cut perennial plants first, allowing plants to re-sprout before herbicide spraying takes place; this would reduce the amount of herbicide used.
- In the case of non-native blackberry, work crews would cut down and remove plants prior to herbicide treatments. Later in the year or during the following year, work crews would follow up with herbicide spray treatments of leaves on re-sprouting leaves, which have not developed berries. This would reduce the risk of wildlife or humans ingesting sprayed berries.

Herbicide Use Special Protection Zones

Invasive plant populations must meet the established criteria listed in Table II-4 before managers would consider herbicide use. In addition, work crews must meet additional requirements in special protection zones (see Table II-5).

Alternative 3: Eradicate or Prevent the Spread of High-, Medium-High-, and Medium-Priority Invasive Plants

Overview

Under Alternative 3, an extensive program staffed by park employees and volunteers would use a variety of techniques to meet management objectives for medium-priority invasive species, as well as high- and medium-high-priority species. Medium-priority species are mainly found in disturbed areas such as road corridors, campgrounds, parking lots, and staging areas. Medium-priority species do not have as great a potential to invade natural plant communities as higher-priority plants. Under Alternative 3, park crews would utilize herbicides to control up to 35 invasive plant species if objectives could not be met through other control methods and invasive plant populations meet size and location thresholds (see Table II-6).

Table II-5: Herbicide Use Special Protection Zones

Resource	Criteria or Conditions
Cultural Landscapes	• During the invasive plant control planning phase, project managers would consult with National Park Service cultural resource specialists to ensure no adverse impact to cultural landscapes.
Schools, Playing Fields, Pools, Playgrounds, and Other Land Assignments	• On Mariposa County and Mariposa Unified School District land assignments and leases, and other land assignments in Yosemite National Park, the National Park Service would work with agencies and partners to achieve integrated pest management goals. The National Park Service would work with residents, parents, and other interested parties to develop solutions for high-priority invasive plant control on playing fields or playgrounds on National Park Service lands and the El Portal Administrative Site. Invasive plant control efforts would not take place without prior notification of local residents.
Special-Status Plant Habitat	• During the invasive plant control planning phase, the National Park Service would determine whether special-status plant species are present in the area. If special-status species occur in the proximity of invasive plant treatment areas, botanists would develop site-specific mitigations to ensure no adverse effects on special-status plant species. If federal-protected plant species are discovered in proposed work areas, the U.S. Fish and Wildlife Service would be consulted, and no control activities would take place until that consultation is complete. No federal-listed plants are documented currently in the park.
Special-Status Wildlife Habitat	• During the invasive plant control planning phase, biologists would determine whether invasive plant control measures would take place in likely habitat for special-status wildlife. If invasive plant control work would take place in likely special-status wildlife habitat, surveys would be performed before the park conducts invasive plant control measures. In the event that special-status wildlife occupy areas slated for treatment with herbicides, chemical treatments would not take place, and managers would develop site-specific mitigations to ensure no adverse effects on special-status wildlife.
Traditional Cultural Properties	• During the invasive plant control planning phase, managers would coordinate with affiliated tribes (through the National Park Service Historic Protection Officer) to ensure that herbicides would not be used in traditional gathering areas.
Wetlands	• Herbicides would not be applied in standing water, within six feet of standing or flowing water, or on plants growing in water. • Herbicides would only be used in seasonally flooded wetlands, and only during the dry phase of the year. • Work crews would utilize only aquatic-approved formulations of glyphosate (with an R-11 surfactant) in wetlands. • Work crews would not use terrestrial-approved herbicide formulations outside of upland areas.
Wild and Scenic River Corridors	• During the invasive plant control planning phase, program managers would fill out and submit Wild and Scenic River Invasive Plant Control Questionnaires (see Appendix J) to the Environmental Planning Branch for Yosemite National Park to determine if Section 7 Determinations are necessary for the project. • Work crews would not apply herbicides below the ordinary high-water mark of Wild and Scenic Rivers or their tributaries. • Work crews would utilize only aquatic-approved formulations of glyphosate in wetlands.
Wilderness	• Program managers would consider the use of herbicides only if invasive plant populations pose ecosystem-level threats to Wilderness character and resources. • Herbicide use must meet the conditions of the Wilderness Minimum Tool Requirements Analysis.

Table II-6: Alternative 3 Species Identified for Herbicide Use and Herbicide Use Thresholds
(Species in bold would not be treated with herbicides under Alternative 2)

Species	Acres in Yosemite	Herbicide[1]	Herbicide Use Threshold
Ailanthus altissima (Tree-of-heaven)	<1 acre estimated parkwide	Glyphosate	Population size of one or more plants (due to lack of effective alternative methods to control this species)
Amaranthus albus (prostrate pigweed)	<1	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Arundo donax (Giant reed)	<1 acre	Glyphosate	If plants persist after two timed manual and/or mechanical treatments
Brassica nigra (black mustard)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Brassica rapa (field mustard)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Bromus tectorum Cheat grass	Unknown	Glyphosate	Population must be larger than 20 square meters
Carduus pycnocephalus (Italian thistle)	<1 acre	Glyphosate, Aminopyralid	Population must be larger than 5 square meters with greater than 50% cover
Centaurea maculosa (Spotted knapweed)	<1 acre	Aminopyralid	Population size of one or more plants (due to extreme invasibility and tenacious qualities of the species)
Centaurea melitensis (tocalote)	Estimated 5 acres to be treated (100 acres estimated parkwide)	Glyphosate, Aminopyralid	Population must be larger than 10 square meters
Cirsium vulgare (bull thistle)	Estimated <1 acre to be treated (>100 acres estimated parkwide)	Glyphosate	Non-wilderness populations where the density of individuals exceeds 10 per square meter; herbicides would be used only on first-year rosettes (not flowering plants)
Centaurea solstitialis (Yellow star-thistle)	Estimated 5 acres to be treated (100 acres documented parkwide)	Glyphosate, Aminopyralid	Populations must be larger than 10 square meters, and located on steep or hard-to-access slopes
Cynodon dactylon (Bermuda grass)	<1 acre	Glyphosate	Population must be larger than 1 square meter with greater than 50% cover
Digitalis purpurea (foxglove)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Genista monspessulana (French broom)	<1 acre	Glyphosate	Population must be larger than 5 square meters with greater than 50% cover
Hedera helix (English ivy)	<1 acre	Glyphosate	Population must threaten a wetland or riparian area, and be larger than 2 square meters with greater than 50% cover
Hirschfeldia incana (shortpod mustard)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Holcus lanatus (Common velvet grass)	Estimated <10 acres to be treated (1,000 total acres estimated parkwide)	Glyphosate	Population must be larger than 5 square meters
Humulus lupulus (Hops)	>1 acre estimated parkwide	Glyphosate	Population must be larger than 5 square meters

Table II-6: Alternative 3 Species Identified for Herbicide Use and Herbicide Use Thresholds
(Species in bold would not be treated with herbicides under Alternative 2)

Species	Acres in Yosemite	Herbicide[1]	Herbicide Use Threshold
Lathyrus latifolius (Perennial sweet pea)	Estimated 2 acres to be treated (3 acres estimated parkwide)	Glyphosate	Population size of one or more plants (due to lack of alternative methods to effectively control this species)
Lepidium latifolium (Perennial pepperweed)	<1 acre	Glyphosate	Population must be larger than 1 square meter with greater than 50% cover
Leucanthemum vulgare (Oxeye daisy)	Estimated <1 acre to be treated (5 acres estimated parkwide)	Glyphosate, Aminopyralid	Population must be larger than 10 square meters
Lychnis coronaria (rose campion)	Estimated <1 acre to be treated (5 acres estimated parkwide)	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Mentha spicata* var. *spicata (spearmint)	<1	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Melilotus alba (white sweetclover)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Melilotus indica (sourclover)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Melilotus officinalis (yellow sweetclover)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Nicotiana acuminate* var. *multiflora (manyflower tobacco)	<1	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Robinia pseudoacacia (Black locust)	<1 acre estimated parkwide	Glyphosate	Population size of one or more plants (due to lack of alternative methods that could effectively control this species)
Rubus discolor (Himalayan blackberry)	Estimated 50 acres to be treated (60 acres estimated parkwide)	Glyphosate	Population size of one or more plants (due to extreme invasibility and tenacious qualities of the species)
Rubus laciniatus (Cutleaf blackberry)			
Sisymbrium irio (London rocket)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Trifolium hirtum (Rose clover)	Estimated 10 acres	Glyphosate	Population must be located above 4,000 feet in elevation, and must be larger than 5 square meter with greater than 50% cover
Verbascum thapsus (wooly mullein)	Estimated 10 acres to be treated (60 acres estimated parkwide)	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Vicia benghalensis (vetch)	<5	Glyphosate	Any population where the density of rosettes exceeds 10 per square meter
Vinca major (Greater periwinkle)	<1 acre	Glyphosate	Population must be located above 4,000 feet in elevation, and must be larger than 5 square meter with greater than 50% cover

Note:
[1] Glyphosate would be applied at no more than the equivalent of four quarts per acre per year. Aminopyralid (currently only available in the form of Milestone®) would be applied at no more than the equivalent of seven ounces per acre per year.

Program managers would also consider herbicide use for newly discovered invasive plants in the park, only if the Cal-IPC or CDFA consider the species an ecological threat (see Control Treatments section). Program managers would develop annual work plans, which would include the time and planned locations of herbicide applications, and distribute this information to the public via the Yosemite National Park website and other print media before herbicide applications take place.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

See Actions Common to All Alternatives, Table II-3.

Control Treatments

The manual and mechanical control methods outlined in Actions Common to All Alternatives would be the preferred methods to treat invasive plants in the park. Work crews would use herbicides to control specific invasive plant populations when management objectives could not be met with the use of manual or mechanical control techniques. Two herbicides—glyphosate and aminopyralid—would be utilized (see Appendices E, F, G, and H). In upland areas, work crews would use terrestrial-approved formulations of glyphosate or aminopyralid. In seasonally flooded wetlands (such as habitat for Himalayan blackberry), work crews would use aquatic-approved formulations of glyphosate with an R-11 surfactant. This formulation would only be used during the dry phase of seasonally flooded wetlands. Work crews would not apply herbicides within six feet of standing or flowing water, within the bed and banks of Wild and Scenic Rivers, or to plants growing in water. Glyphosate would be applied at the maximum equivalent of four quarts per acre per year. Aminopyralid (currently available only in the form of Milestone®) would be applied at the maximum equivalent of seven ounces per acre per year. All applications would take place using manually applied applications from backpack sprayers, hand-held wands extending from truck-mounted tanks, or individual containers of herbicide and a wiper tool such as a paintbrush. Work crews would not use aerial applications such as from an airplane or helicopter, or applications from truck-mounted tanks with boom attachments. All herbicide use would follow the Herbicide Use and Storage Protocol (see Appendix I).

Under Alternative 3, 33 species are proposed for herbicide treatment, if individual populations meet specified criteria (see Table II-6). Two herbicides—glyphosate and aminopyralid—are proposed for use. All herbicide use would follow the Herbicide Use and Storage Protocol (see Appendix I).

Invasive plant program managers followed a three-step process to determine which species would be controlled with herbicides under Alternative 3. First, program managers prioritized invasive plants in the park for treatment (see Tables II-1 and II-2). Secondly, program managers developed species-specific management objectives for the highest-priority species (see Appendix A). Lastly, managers identified the high-, medium-high-, and medium-priority invasive species that respond to herbicide use and that would require the use of herbicides to reach management objectives. Managers also evaluated whether herbicide use for the selected species would substantially increase efficiency and safety, and allow work crews to treat more invasive plant populations (see Table II-6). Herbicide use must also meet special criteria in protection zones such as Wild and Scenic River corridors, Wilderness, special-status species habitat,

wetlands, riparian zones, cultural landscapes, and areas that contain traditional cultural properties (see Table II-5).

Program managers would consider the use of herbicides on newly discovered invasive plant species, if the Cal-IPC or CDFA considers them an ecological threat. These species must meet one of the following criteria:

- Assigned a medium or high ranking on the Cal-IPC List of Invasive Plants of Greatest Ecological Concern and considered a Cal-IPC red-alert species
- Considered a Class A, B, or C invasive species by the CDFA
- Rank as a high-, medium-high-, or medium-priority species using the Yosemite modified version of the USGS Alien Plants Ranking System (APRS 2000)

The Cal-IPC List of Invasive Plants of Greatest Ecological Concern is list is available online at http://www.cal-ipc.org/. The CDFA Noxious Weed List is available online at http://www.cdfa.ca.gov/phpps/ipc/weedinfo/winfo_list-pestrating.htm.

Herbicide Application Rates and Methods

Park work crews would use the same herbicide application methods as described under Alternative 2. All application rates and methods would be consistent with product specimen labels (DowAgroSciences 1999; Monsanto 2006b).

The application methods would be:

- **Cut Stump:** Work crews would apply herbicides to the stump of a woody species (tree, shrub, or vine) within one minute after cutting down the tree or shrub. The herbicide would penetrate into the plant's vascular system and translocate to the remaining belowground portions of the plant to kill roots and prevent re-sprouting.
- **Frill:** This is similar to the cut stump process, but work crews would leave the tree or shrub standing. Multiple small cuts would be made into the cambium of the tree, and work crews would immediately apply herbicides. The herbicide would translocate throughout the plant.
- **Wiper:** Work crews would wipe herbicides onto the leaves of plants using a wick, sponge, paintbrush, or similar tool.
- **Foliar Spray:** Work crews would spray leaves with a mixture of herbicide, water, and non-ionic surfactant from a backpack or other sprayer. Precise mixes would vary depending on the species, the life cycle of the species, and other factors. In some cases, work crews may cut perennial plants first, allowing plants to re-sprout before herbicide spraying takes place; this would reduce the amount of herbicide used.

  In the case of non-native blackberry, work crews would cut down and remove plants prior to herbicide treatments. Later in the year or during the following year, work crew would follow up with herbicide spray treatments of leaves on re-sprouting leaves, which have not developed berries. This would reduce the risk of wildlife or humans ingesting sprayed berries.

Herbicide Use Special Protection Zones

Invasive plant populations must meet the established criteria listed in Table II-6, as well as the additional criteria listed for Special Protection Zones in Table II-5.

Alternatives Considered but Dismissed

The National Park Service considered a range of actions when developing possible alternatives for the Invasive Plant Management Plan. Of the actions analyzed, some were dismissed for one or more of the following reasons:

- The action does not satisfy the program's purpose and need.
- Less environmentally damaging options are available.
- The action would cause unacceptable environmental, cultural, or social impacts.
- The action presents unacceptable risks or constraints with an associated increase in costs.
- The action would be inconsistent with law, regulation, or policy.

Use of Domestic Herbivores to Control Invasive Plant Populations

Large mammalian herbivores such as goats and cattle can be used to control invasive species. However, they can also cause unintended and unwanted secondary impacts by trampling or consuming native vegetation and by altering nutrient cycles. For example, goats have been shown to be effective at controlling yellow star-thistle. However, a majority of the yellow star-thistle in Yosemite is located on very steep slopes with thin soils that could be stripped of vegetation and topsoil if goats were released to control this species. As a result, this action was dismissed because it would cause unacceptable environmental impacts.

Use of New Biological Control Agents

Biological control (also known as biocontrol) involves the introduction of herbivores or pathogens, such as insects or fungi, which infest invasive species and reduce their ability to persist and produce seeds. An effective biological control agent introduced to attack invasive plant populations must be highly host specific. The biological control agent must only affect the target plant, and show little or no affinity for native species that may be closely related to the invasive plant. Biological control agents undergo rigorous laboratory and field testing by the U.S. Department of Agriculture and the State of California before approval for use in agricultural or natural settings.

Biocontrol has been used extensively to control invasive plant species in North America. Flea beetles (*Aphthona lacertosa* and *Aphthona nigriscutis*) have been used to reduce leafy spurge (*Euphorbia esula*) (National Invasive Species Council 2001). The beetle *Chrysolina quadrigemina* has been introduced to control populations of St. John's wort (*Hypericum perforatum*) (Harris 1988). Yosemite National Park introduced a chrysomelid beetle in Yosemite Valley to control St. John's wort in the 1980s. In 1994 and 1995, the peacock fly (*Chaetorellia australis*), the hairy weevil (*Eustonopus villosus*), and the false peacock fly (*Chaetorellia succinea*) were introduced in El Portal to help control yellow star-thistle.

Currently, no additional invasive plant species in Yosemite require the release of a biological control agent to meet management objectives. The only biocontrol agents that would be released in Yosemite National Park in the future are the four species that have been released in the past to control yellow star-thistle and St. John's Wort. Managers would consider the re-release of these biocontrol agents only when ecosystem-level threats are present.

Use of Additional Herbicides for Invasive Plant Control

Managers considered six herbicides for use during the development of this Environmental Assessment. Two of the herbicides—glyphosate and aminopyralid—were accepted and proposed for use in specific situations under Alternatives 2 and 3. Program managers rejected the use of four herbicides—triclopyr, imazapyr, clopyralid, and 2,4-D—due to the risk of human health, safety, and environmental impacts (see Appendix K).

Use of Aircraft for Aerial Herbicide Application

Program managers rejected the use of aircraft (such as airplanes and helicopters) for aerial application of herbicides, because more targeted and less-intrusive options for herbicide application are available to meet management objectives.

Mitigation Measures Common to All Action Alternatives

The National Park Service would avoid, minimize, and mitigate adverse impacts on park resources to the greatest extent possible. The National Park Service would apply the mitigation measures specified in Appendix L to protect cultural and natural resources and the quality of the visitor experience. In addition to mitigation measures, National Park Service staff would follow the Herbicide Use and Storage Protocol specified in Appendix I. Additional site-specific environmental compliance would be prepared for future invasive plant management work that falls outside the scope of this document.

Environmentally Preferable Alternative

The National Park Service is required to identify the environmentally preferable alternative in the environmental documents it produces for public review and comment. The National Park Service, in accordance with National Environmental Policy Act (NEPA) Section 101(b) (516 DM 4.10), defines the environmentally preferable alternative as the alternative that best promotes the national environmental policy. The Council on Environmental Quality's Forty Questions further defines the environmentally preferred alternative as "the alternative that causes the least damage to the biological and physical environment… [and that] best protects, preserves, and enhances historic, cultural, and native processes." The environmentally preferable alternative must meet the following six requirements described in Section 101 of NEPA:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations
- Assure safe, healthful, productive, and aesthetically and culturally pleasing surroundings for all Americans
- Attain the widest range of beneficial use of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences
- Preserve important historic, cultural, and natural aspects of our national heritage and, wherever possible, maintain an environment that supports diversity and variety of individual choice
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities

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

Alternative 1, the No Action alternative, seeks to meet the environmental policy goals by using manual and mechanical control techniques, without the use of herbicides. This alternative would not meet management objectives for the control of high-priority invasive plants. For example, particularly noxious species such as non-native blackberry and yellow star-thistle would continue to spread into uninfested areas because their rate of spread exceeds the rate of control. Highly valued resources such as wetland habitat, rare plant habitat, and scenic vistas would remain susceptible to invasive plant invasion. Over time, visitors would find deteriorating conditions in natural and scenic areas.

Alternative 2 seeks to meet the environmental policy goals by initiating a program to protect uninfested areas of Yosemite National Park from invasions of high- and medium-high-priority invasive plants. The park would selectively use herbicides only in the event that park staff is unable to meet management objectives via manual or mechanical control methods. The park would use two herbicides—glyphosate and aminopyralid—to control up to 22 identified invasive plant species that meet identified thresholds.

Alternative 3 seeks to meet the environmental policy goals by initiating a program to protect uninfested areas of Yosemite National Park from invasions of high-, medium-high-, medium-priority invasive plants. The park would use herbicides if park staff were unable to meet management objectives by using manual or mechanical control methods, and to increase efficiency (i.e., allowing park staff to treat medium-priority invasive plants as well as high-priority invasive plants). The park would use two herbicides—glyphosate and aminopyralid—to control up to 35 identified invasive plant species that meet identified thresholds.

Alternative 1 would not utilize herbicide use as an invasive plant control technique. As a result, no potential would exist for staff, visitor, or environmental safety hazards related to the use of herbicides. Under Alternatives 2 and 3, park staff would use low-toxicity herbicides to control certain species of invasive plants that have exceeded defined thresholds or that are difficult to eradicate or control using manual or mechanical techniques. Alternative 2 uses the minimum amount of low-toxicity herbicides required to prevent the highest-priority invasive plants from spreading into natural communities inside the park. Herbicide use would drop off and remain low under Alternative 2, once target invasive plant species populations reduce in size. Under Alternative 3, the park would meet management objectives for medium-priority invasive species, as well as high- and medium-high-priority species. Medium-priority species are mainly found in disturbed areas such as road corridors, campgrounds, parking lots, and staging areas. Medium-priority species do not have as great a potential to invade natural plant communities as higher-priority plants. Under Alternative 3, park crews would utilize herbicides to control up to 35 invasive plant species if objectives could not be met through other control methods and invasive plant populations met size thresholds. The amount of herbicide use is expected to remain the same over time under Alterative 3.

Alternative 2 fulfills the responsibility of this generation as trustees of the environment for succeeding generations, because it prescribes actions to effectively protect uninfested areas in Yosemite from biological, aesthetic, and cultural impacts of the park's most threatening invasive plants. Thus, Alternative 2 preserves important historic, cultural, and natural aspects of our national heritage. Alternative 2

prescribes the minimum amount of low-toxicity herbicides required to meet management objectives, minimizing unforeseen safety risks. The actions prescribed under Alternative 1 would not meet the management objectives for invasive plants in Yosemite National Park, which aim to preserve the natural aspects of our national heritage. The actions prescribed under Alternative 3 would meet management objectives for more invasive plants than Alternative 2, but these species are not as great of a threat to natural areas within Yosemite. The actions prescribed under Alternative 3 would also require more herbicide use, and for a more sustained amount of time. Thus, Alternative 3 would not be consistent with integrated pest management goals, which aim to minimize herbicide use and unforeseen safety risks, among other objectives. Of all of the alternatives analyzed for this Invasive Plant Management Plan, Alternative 2 best meets the criteria of NEPA, as outlined in Section 101.

Summary of Environmental Consequences

Table II-7 summarizes the impacts (both beneficial and adverse) that could result from implementation of the alternatives described in this chapter. Chapter III contains a more detailed analysis.

Table II-7: Summary of Environmental Consequences		
Alternative 1 **No Action**	**Alternative 2** **(Preferred Alternative)** **Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants**	**Alternative 3** **Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants**
Soils		
Alternative 1 would result in a short-term minor adverse impact on soils due to the use of ground-disturbing invasive plant control techniques, and a long-term minor beneficial impact on soils due to the removal of invasive species.	Herbicide use under Alternative 2 would help to reduce soil disturbance by minimizing the need for manual or mechanical control techniques that can disturb sensitive and other soil types. There would be a long-term moderate beneficial impact on soil microorganisms, soil chemistry, and hydrologic cycles, as invasive plant populations that could not be controlled without the use of herbicides are eradicated. The limited use of the herbicides would have a short-term negligible adverse effect on soil quality. Overall, there would be long-term moderate beneficial impacts on soil microorganisms, soil chemistry, and hydrologic cycles as invasive plant populations are controlled and eradicated.	Herbicide use under Alternative 3 would help reduce soil disturbance by minimizing the need for manual or mechanical control techniques that can disturb sensitive and other soil types. There would be a long-term moderate beneficial impact on soil microorganisms, soil chemistry, and hydrologic cycles, as invasive plant populations that could not be controlled without the use of herbicides are eradicated. The limited use of the herbicides would have a short-term negligible adverse effect on soil quality. Overall, there would be long-term moderate beneficial impacts on soil microorganisms, soil chemistry, and hydrologic cycles as invasive plant populations are controlled and eradicated.
Hydrology and Water Quality		
Ground-disturbing activities would result in short-term negligible adverse increases in sediment loading or turbidity. Inputs from potential contaminant sources such as weed trimmers would result in short-term negligible adverse impacts on water quality. Overall, there would be a long-term negligible adverse impact on water quality.	Ground-disturbing activities would result in short-term negligible adverse increases in sediment loading or turbidity. Limited herbicide use, and use of equipment such as weed trimmers, would result in long-term negligible and adverse impacts.	Ground-disturbing activities would result in short-term, negligible adverse increases in sediment loading or turbidity. Limited herbicide use, and use of equipment such as weed trimmers, would result in long-term negligible and adverse impacts.

Table II-7: Summary of Environmental Consequences		
Alternative 1 **No Action**	**Alternative 2** **(Preferred Alternative)** **Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants**	**Alternative 3** **Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants**
Wetlands		
Implementation of comprehensive measures to protect wetlands would have a long-term minor beneficial impact on wetlands. Manual and mechanical control actions would have a short-term minor adverse impacts and a long-term minor beneficial impact. Overall, Alternative 1 represents a long-term minor beneficial impact.	Early detection and prevention measures would have a long-term minor beneficial impact on wetlands. The use of herbicides would allow the park to meet management objectives for nine invasive plants with the potential to invade wetlands that otherwise would not be controlled using manual and mechanical techniques. The number of wetland acres the park could treat each year would increase, and the number of follow-up treatments would be reduced, resulting in a short-term negligible adverse impact and a long-term moderate beneficial impact on wetlands in the park. Alternative 2 would meet integrated pest management goals because work crews would use the minimum amount of herbicide necessary to meet management goals.	The impacts of invasive plant control actions on wetlands would be similar to the impacts under Alternative 2. Two additional invasive species with the potential to invade wetlands could be controlled with herbicides, but control of these two additional species would have a negligible impact on wetlands. Control actions would result in short-term negligible adverse impact and a long-term moderate beneficial impact on wetlands in the park because the proposed actions would increase the area of restored wetlands and allow the park to meet management objectives for invasive plants. Overall, Alternative 3 would result in long-term moderate beneficial impacts on wetlands.
Vegetation		
The park is not likely to meet management objectives for high- and medium-high-priority invasive species. These are species with a high potential to invade natural plant communities in the park. For example, Himalayan blackberry populations would continue to invade meadow habitat, and yellow star-thistle would continue to invade foothill woodland communities. The land area in Yosemite treated for invasive plants is expected to remain essentially the same. While the densities of invasive plant populations would decrease, the park would be unable to keep up with the rate of spread of high-priority invasive populations. Overall, Alternative 1 would result in a long-term minor adverse impact on native vegetation in the park.	The park would meet management objectives for high- and medium-high-priority invasive plants—i.e., species with the highest potential to invade natural communities. This would protect a variety of native plant communities, including foothill woodland, riparian, and meadow communities. For example, the spread of Himalayan blackberry populations into meadow habitat would be halted, as well as the spread of yellow star-thistle into foothill woodland communities. The land area in Yosemite treated for invasive plants would increase over time. Herbicide use is expected to decrease over time. Overall, Alternative 2 would result in a long-term moderate beneficial impact on native vegetation in the park.	The park would meet management objectives for high-, medium-high-, and medium-priority invasive plants. Alternative 3 would control invasive species with the greatest potential to invade natural communities in the park, as well as species that are restricted to disturbed and developed lands in the park. For example, work crews would halt the spread of Himalayan blackberry and yellow star-thistle in meadow and foothill woodland communities, as well as the spread of yellow sweetclover in parking lots. The land area treated for invasive plants would increase over time. Herbicide use is expected to remain the same over time. Overall, Alternative 2 would result in a long-term moderate beneficial impact on native vegetation in the park. Because long-term impacts on vegetation associated with Alternative 3 would be moderate and beneficial,

Table II-7: Summary of Environmental Consequences		
Alternative 1 **No Action**	**Alternative 2** **(Preferred Alternative)** **Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants**	**Alternative 3** **Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants**
		Alternative 3 would not impair the park's vegetation resources for future generations.
Wildlife		
Alternative 1 would have a long-term minor adverse effect on wildlife because the expansion of existing non-native plant populations would continue in native wildlife habitat. This alternative would limit the ability of park staff to detect their arrival and respond with comprehensive and effective eradication actions. Long-term impacts on wildlife associated with Alternative 1 would be minor and adverse.	The judicious use of herbicides would reduce the amount of ground disturbance and increase the area of invasive plant populations that could be treated each year. Alternative 2 would result in a long-term moderate beneficial impact on wildlife in the park. The use of terrestrial or aquatic formulations of glyphosate or aminopyralid (subject to labeling restrictions) without aerial application in terrestrial environments carries little to no risk to amphibians. Alternative 2 would result in a long-term moderate beneficial impact on wildlife in the park.	Under Alternative 3, the increased use of herbicides would allow larger infested areas to be treated. Less time would be dedicated to detecting infestations, because existing non-native populations would be effectively eradicated and new invasions could be permanently removed. The combination of these factors would result in a long-term moderate beneficial impact on wildlife by restoring natural plant communities quickly and effectively.
Special-status Plants		
The level of risk of new invasive plant infestation and spread in special-status habitat would remain high, particularly in low-elevation foothill woodland and meadow communities. Yellow star-thistle populations would remain a threat to the California State Rare Congdon's woolly sunflower. Non-native blackberry and velvet grass would remain a threat to park sensitive plants found in meadow habitat. The use of existing measures to control invasive plants would result in a long-term minor beneficial impact on special-status plants.	The programmatic actions proposed under Alternative 2 (early detection and rapid response, prevention, prioritization, monitoring, research, and education practices) would reduce the risk of new invasive plant infestations in special-status plant habitat. The control methods described for this alternative would have a long-term moderate beneficial impact on special-status species because of the potential to eliminate invasive yellow star-thistle and other invasive plants from special-status species habitat. Overall, the actions prescribed under Alternative 2 would have a long-term moderate beneficial impact on special-status plant habitat.	The programmatic actions proposed under Alternative 3 (early detection and rapid response, prevention, prioritization, monitoring, research, and education practices) would reduce the risk of new invasive plant infestations in special-status plant habitat. The control methods described for this alternative would have a long-term moderate beneficial impact on special-status species because of the potential to eliminate invasive yellow star-thistle and other invasive plants from special-status species habitat. Overall, the actions prescribed under Alternative 3 would have a long-term moderate beneficial impact on special-status plant habitat.
Special-status Wildlife		
There would be a long-term negligible adverse impact on the Yosemite toad, Sierra Nevada yellow-legged frog, peregrine falcon, and bald	There would be a long-term negligible adverse impact on the Yosemite toad, Sierra Nevada yellow-legged frog, peregrine falcon, and bald eagle. There would be a	There would be a long-term negligible adverse impact on the Yosemite toad, Sierra Nevada yellow-legged frog, peregrine falcon, and bald eagle. There

Table II-7: Summary of Environmental Consequences		
Alternative 1 **No Action**	**Alternative 2** **(Preferred Alternative)** **Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants**	**Alternative 3** **Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants**
eagle. There would be a long-term minor adverse impact on the valley elderberry longhorn beetle and the American badger. There would be a short-term minor adverse impact and a long-term minor beneficial impact on the great gray owl. There would be a long-term negligible beneficial impact on willow flycatcher habitat. There would be no effect on the Sierra Nevada red fox, California wolverine, Pacific fisher, or Sierra bighorn sheep. Alternative 1 would not likely affect special-status wildlife species in Yosemite.	long-term negligible beneficial impact on the valley elderberry longhorn beetle and willow flycatcher habitat. There would be a long-term minor beneficial impact on the American badger. There would be a short-term minor adverse impact and a long-term minor beneficial impact on the great gray owl. There would be no effect on the Sierra Nevada red fox, California wolverine, Pacific fisher, or Sierra bighorn sheep. Alternative 2 would not likely affect special-status wildlife species in Yosemite.	would be a long-term negligible beneficial impact on the valley elderberry longhorn beetle and willow flycatcher habitat. There would be a long-term minor beneficial impact on the American badger. There would be a short-term minor adverse impact and a long-term minor beneficial impact on the great gray owl. There would be no effect on the Sierra Nevada red fox, California wolverine, Pacific fisher, or Sierra bighorn sheep. Alternative 3 would not likely affect special-status wildlife species in Yosemite.
Air Quality		
Increased prevention, early detection, and monitoring would have long-term negligible adverse impacts on air quality. Use of motorized equipment for control activities would result in long-term negligible adverse impacts on air quality. Overall, Alternative 1 would result in a long-term negligible adverse impact on air quality.	Increased prevention, early detection, and monitoring would have long-term negligible adverse impacts on air quality. Use of motorized equipment for control activities would result in long-term negligible adverse impacts on air quality. Overall, Alternative 2 would result in a long-term negligible adverse impact on air quality.	Increased prevention, early detection, and monitoring would have long-term negligible adverse impacts on air quality. Use of motorized equipment for control activities would result in long-term negligible adverse impacts on air quality. Overall, Alternative 3 would result in a long-term negligible adverse impact on air quality.
Noise		
Existing noise disturbance regimes would continue during routine operations to control invasive plants. Hand-pulling and use of hand tools would continue to generate small amounts of noise. The mechanical equipment currently used is comparable to mowers and weed trimmers used by the typical homeowner. The noise created by the actions in this alternative is small relative to the existing noise environment of the park. Noise from the activities described in Alternative 1 would result in a negligible	Existing noise disturbance regimes would continue during routine operations to control invasive plants. The use of hand tools would continue to generate small amounts of noise. The mechanical equipment currently used is comparable to mowers and weed trimmers used by the typical homeowner. The noise created by the actions in this alternative is small relative to the existing noise environment of the park. Noise from the activities described in Alternative 2 would result in a negligible long-term adverse impact to the park's sound environment.	Existing noise disturbance regimes would continue during routine operations to control invasive plants. Hand-pulling and use of hand tools would continue to generate small amounts of noise. The mechanical equipment currently used is comparable to mowers and weed trimmers used by the typical homeowner. The noise created by the actions in this alternative is small relative to the existing noise environment of the park. Noise from the activities described in Alternative 3 would result in a negligible long-term adverse impact to the park's sound environment.

Table II-7: Summary of Environmental Consequences		
Alternative 1 **No Action**	**Alternative 2** **(Preferred Alternative)** **Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants**	**Alternative 3** **Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants**
long-term adverse impact to the park's sound environment.		
Wilderness		
Manual control of the invasive plants currently found in Wilderness is likely to control most of the 33 invasive plant species found in Wilderness, with two notable exceptions: velvet grass and Himalayan blackberry. These species have the potential to spread quickly and invade large segments of wetland habitat in Wilderness, beyond the capabilities of extensive manual control. Comprehensive programmatic actions under Alternative 1 would have a long-term moderate beneficial impact on Wilderness values, as they would greatly prevent the invasion of non-native species into areas largely free of invasive plants. Control actions would have a short-term moderate adverse impact and a long-term minor beneficial impact. Overall, Alternative 1 would have a long-term minor beneficial impact on Wilderness character.	Early detection and prevention actions would have a long-term moderate beneficial impact on Wilderness values, as these actions would help prevent the invasion of non-native species into areas largely free of invasive plants. Hand-pulling invasive plants could temporarily create noticeable ground disturbance, resulting in a short-term moderate adverse impact and a long-term minor beneficial impact on Wilderness character. Alternative 2 would allow for the use of herbicides to control two invasive plants with the potential to spread quickly and invade large segments of wetland habitat in Wilderness. Actions considered under Alternative 2 would meet the Wilderness Minimum Tool Requirements Analysis (see Appendix N). Overall, Alternative 2 would have a long-term moderate beneficial impact on Wilderness character.	The impacts of Alternative 3 on Wilderness would be the same as those under Alternative 2. Early detection and prevention actions would have a long-term moderate beneficial impact on Wilderness values, as these actions would help prevent the invasion of non-native species into areas largely free of invasive plants. Hand-pulling of invasive plants could temporarily create noticeable ground disturbance, resulting in a short-term moderate adverse impact and a long-term minor beneficial impact on Wilderness character. Alternative 3 would allow for the use of herbicides to control two invasive plants with the potential to spread quickly and invade large segments of wetland habitat in Wilderness. Alternative 3 would allow the use of herbicides for more invasive species than would Alternative 2, but these additional invasive plants are not expected to thrive in Wilderness areas. Actions considered under Alternative 3 would meet the Wilderness Minimum Tool Requirements Analysis.

Table II-7: Summary of Environmental Consequences		
Alternative 1 **No Action**	**Alternative 2** **(Preferred Alternative)** **Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants**	**Alternative 3** **Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants**
Archeological Resources		
Under Alternative 1, the control of invasive plants would require ground-disturbing activities. Although ground disturbance has the potential to damage or unearth archeological resources, any impacts resulting from these treatment activities would be mitigated in accordance with stipulations outlined in the 1999 Programmatic Agreement. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 1; thus, the park would not treat some invasive plant populations. Impacts related to invasive plant control activities would be mitigated in accordance with the 1999 Programmatic Agreement such that no adverse effects on archeological resources would result.	The control of invasive plants would require treatment measures that involve ground-disturbing activities. Although ground disturbance has the potential to damage or unearth archeological resources, any impacts resulting from these treatment activities would be mitigated in accordance with stipulations outlined in the 1999 Programmatic Agreement. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 2. However, the use of herbicides in areas where ground disturbance is not permitted would allow those invasive plant populations to be controlled (which would not be possible under Alternative 1). There would be no adverse impacts on archeological resources due to control efforts under Alternative 2.	The control of invasive plants would require treatment measures that involve ground-disturbing activities. Although ground disturbance has the potential to damage or unearth archeological resources, any impacts resulting from these treatment activities would be mitigated in accordance with stipulations outlined in the 1999 Programmatic Agreement. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 3. However, the use of herbicides in areas where ground disturbance is not permitted would allow those invasive plant populations to be controlled (which would not be possible under Alternatives 1). There would be no adverse impacts on archeological resources due to control efforts under Alternative 3.
Traditional Cultural Properties		
Under Alternative 1, invasive plant species would be controlled using treatment measures that require ground disturbance; these ground-disturbing treatment measures could damage or displace traditionally gathered plant populations. However, traditionally gathered plant populations could be impacted by the continued spread of invasive plants and generally benefit from the removal of invasive plants. Other traditional properties would not be affected. Potential impacts would be mitigated in accordance with the 1999 Programmatic Agreement. Other mitigations for traditional cultural properties would be developed in consultation with the tribes.	Invasive plant species would be controlled using treatment measures that require ground disturbance; these ground-disturbing treatment measures could damage or displace traditionally gathered plant populations. However, traditionally gathered plant populations can be impacted by the continued spread of invasive plants, and can generally benefit from the removal of invasive plants. Other traditional properties would not be affected. Herbicides would not be used where they could have a negative effect in traditional gathering areas. Potential impacts would be mitigated in accordance with the 1999 Programmatic Agreement. Other mitigations for traditional cultural properties would be developed in consultation with the tribes and with a park historical landscape architect. Overall,	Invasive plant species would be controlled using treatment measures that require ground disturbance; these ground-disturbing treatment measures could damage or displace traditionally gathered plant populations. However, traditionally gathered plant populations can be impacted by the continued spread of invasive plants, and can generally benefit from the removal of invasive plants. Other traditional properties would not be affected. Herbicides would not be used where they could have a negative effect in traditional gathering areas. Potential impacts would be mitigated in accordance with the 1999 Programmatic Agreement. Other mitigations for traditional cultural properties would be developed in consultation with the tribes and with a park historical

Table II-7: Summary of Environmental Consequences		
Alternative 1 **No Action**	**Alternative 2** **(Preferred Alternative)** **Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants**	**Alternative 3** **Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants**
Overall, Alternative 1 would result in no adverse impact.	Alternative 2 would result in no adverse impact.	landscape architect. Overall, Alternative 3 would result in no adverse impact.
Cultural Landscape		
The invasive plant program described under Alternative 1 could reduce the spread of existing invasive plants that have the potential to alter the cultural landscape. Control methods could have a temporary impact on the cultural landscape directly after work crews remove invasive plants. The park would mitigate impacts related to invasive plant control activities in accordance with the 1999 Programmatic Agreement, such that no adverse effects on the cultural landscape would result.	The invasive plant program described under Alternative 2 could reduce the spread of existing invasive plants that have the potential to alter the cultural landscape. Control methods could have a temporary impact on the cultural landscape directly after work crews remove invasive plants. After consultation with a park archeologist and a historical landscape architect, the park would mitigate impacts related to invasive plant control activities in accordance with the 1999 Programmatic Agreement such that no adverse effects on the cultural landscape would result.	The invasive plant program described under Alternative 3 could reduce the spread of existing invasive plants that have the potential to alter the cultural landscape. Control methods could have a temporary impact on the cultural landscape directly after work crews remove invasive plants. After consultation with a park archeologist and a historical landscape architect, the park would mitigate impacts related to invasive plant control activities in accordance with the 1999 Programmatic Agreement such that no adverse effects on the cultural landscape would result.
Scenic Resources		
Control actions described under Alternative 1 would result in a short-term minor adverse impact on scenic resources, and a long-term minor beneficial impact on scenic resources as areas of native vegetation are restored. Overall, there would be a long-term minor beneficial impact on scenic resources under Alternative 1.	Alternative 2 would result in a short-term minor adverse impact on scenic resources due to the impacts of control activities. This alternative would result in a long-term moderate beneficial impact on scenic resources as native vegetation is restored. The use of herbicides under Alternative 2 would increase the area of restored vegetation and allow the park to meet management objectives.	Alternative 3 would result in a short-term minor adverse impact on scenic resources due to the impacts of control activities. This alternative would result in a long-term moderate beneficial impact on scenic resources as native vegetation is restored. The use of herbicides under Alternative 3 would increase the area of restored vegetation and allow the park to meet management objectives.
Visitor Experience and Recreation		
Implementation of a comprehensive invasive plant program would have a long-term minor beneficial impact on the visitor experience in Yosemite. Control activities under Alternative 1 would have a short-term minor adverse impact on the visitor experience. There would be a long-term minor beneficial impact on the visitor	Impacts under Alternative 2 would be similar to those described for Alternative 1, except for those related to the additional use of herbicides. Alternative 2 would result in a short-term minor adverse impact on the visitor experience due to the localized effects of control activities. There would be a long-term minor beneficial impact on the visitor experience, as this alternative	Alternative 3 would result in a short-term minor adverse impact on the visitor experience due to the localized effects of control activities. There would be a long-term minor beneficial impact on the visitor experience in the park, as herbicides use would greatly increase the area of restored vegetation and help ensure that invasive plants do not continue to

Table II-7: Summary of Environmental Consequences

Alternative 1 No Action	Alternative 2 (Preferred Alternative) Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants	Alternative 3 Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants
experience, as this alternative would prevent invasive plants from altering the character of the scenic landscape, limiting access to natural areas in the park, and limiting the visibility of scenic views.	would prevent invasive plants from continuing their adverse effects on the character of the scenic landscape, altering the character of the scenic landscape, limiting access to natural areas in the park, and limiting the visibility of scenic historic views.	adversely affect the character of the scenic landscape, limit access to natural areas in the park, or limit the visibility of scenic historic views.
Park Operations		
There would be a short-term moderate adverse impact on park operations due to increasing staffing needs for prevention, early detection, monitoring, and outreach and education. The divisions of Facilities Management and Project Management, and the concessioner could experience increases in project/contract costs for construction site surveys and invasive plant control. These additional measures would decrease the establishment and spread of invasive plants and the subsequent demand for costly and labor-intensive control efforts over time. Control efforts under this alternative would require long-term labor-intensive efforts that would increase costs to Resources Management. Together, these efforts would result in a long-term, minor, adverse impact on park operations.	As with Alternative 1, there would be a short-term moderate adverse impact on park operations due to increased staffing needs for prevention, early detection, control, monitoring, and outreach and education. With the use of herbicides, high-priority invasive plant populations would be eradicated in less time with fewer resources than under Alternative 1. Invasive plant management efforts would result in a short-term minor adverse impact and a long-term minor beneficial impact on park operations.	Under Alternative 3, staffing demands would remain relatively the same over the long term, resulting in a negligible adverse impact.

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Chapter III: Affected Environment / Environmental Consequences

Introduction

This chapter describes the existing environment that could be affected by actions proposed in the Invasive Plant Management Plan. It also analyzes both beneficial and adverse impacts that could result from implementation of the alternatives described in Chapter II. This chapter lists the resource topics used to describe the existing environment, and then discusses the rationale used for dismissing some of the impact topics. Each selected topic includes a description of the existing conditions (Affected Environment sections), the methods used to determine likely impacts, and the likely impacts of each alternative with respect to the selected topic (Environmental Consequences sections).

This document also evaluates each impact topic in terms of potential cumulative impacts. The Council on Environmental Quality describes a cumulative impact as follows (Regulation 1508.7):

> *. . .a "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

Appendix M describes the cumulative actions considered in the cumulative impacts analysis.

Impairment

Before approving a proposed action, National Park Service decision-makers must determine that the action would not lead to impairment or unacceptable impacts on park resources or values. The meaning of the word "impair" in this context is derived from the fundamental purpose of the National Park System to conserve park resources and values—as established by the Organic Act and reaffirmed by the General Authorities Act, as amended (NPS 2006c). Park managers must always seek ways to avoid, or minimize to the greatest extent practicable, adverse impacts on park resources and values. An impact is more likely to constitute impairment if it affects a resource or value, the conservation of which is: 1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's General Management Plan (NPS 1980) or other relevant National Park Service planning documents.

The impairment of park resources and values is not allowed unless legislation specifically calls for the action. An impact would be less likely to constitute impairment if it is the unavoidable result of an action that is necessary to preserve or restore the integrity of park resources or values, and the impact could not reasonably be further mitigated.

The type and intensity of impacts and the types of resources affected formed the basis for the analysis of impairment of park resources. Overall, beneficial impacts would not constitute impairment. With respect to the intensity of impacts, negligible and minor adverse impacts are not of sufficient magnitude to

constitute impairment. Moderate and major adverse impacts could (but do not automatically) constitute impairment. Moderate and major adverse impacts were analyzed with respect to the three bulleted criteria above. Impairment determinations are provided for each cultural and natural resource topic in the conclusion section under each alternative. Impairment is not assessed for visitor experience and recreation or park operations.

Resource Topics Considered

The resource topics considered in this document were selected based on federal law, regulations, Executive Orders, National Park Service Management Policies (NPS 2006c), National Park Service subject matter expertise, and concerns expressed by other agencies or members of the public during scoping and comment periods.

Natural Resources

The federal and State of California Endangered Species Acts (and associated legislation) as well as the Clean Water Act, Clean Air Act, and NEPA require that the effects of any federal undertaking on natural resources be examined. The Wild and Scenic Rivers Act specifies guidelines for the determination of appropriate actions within the bed and banks of a Wild and Scenic River, and requires managing agencies to determine whether water resource projects would adversely affect the free flow or Outstandingly Remarkable Values (ORVs) of a designated river. In addition, National Park Service management policies and natural resource management guidelines call for the consideration of natural resources in planning proposals. The Invasive Plant Management Plan analyzes the following natural resource topics: soils, hydrology, water quality, wetlands, vegetation, wildlife, special-status species, air quality, Wilderness values, and noise.

Cultural Resources and Historic Properties

The National Historic Preservation Act (NHPA), Archaeological Resources Protection Act, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and NEPA require that the effects of any federal undertaking on historic properties and cultural resources be examined. In addition, National Park Service management policies and cultural resource management guidelines call for the consideration of historic properties and cultural resources in planning proposals. The 1999 Programmatic Agreement between the National Park Service at Yosemite; the California State Historic Preservation Officer; and the Advisory Council on Historic Preservation Regarding Planning, Design, Construction, Operations, and Maintenance, Yosemite National Park, California was developed in consultation with seven American Indian tribes associated with Park lands and the National Trust for Historic Preservation, in compliance with Section 106 of the NHPA. The 1999 Programmatic Agreement is governed by 36 Code of Federal Regulations (CFR) Part 800 implementing regulations that were in place at the time the Programmatic Agreement was executed. Cultural and historic properties exist within the project area and adjacent areas, and could be affected by the alternatives. Therefore, this Environmental Assessment analyzes archeological resources, traditional cultural properties, and the cultural landscape, including historic sites and structures, following the guidelines set forth in the 1999 Programmatic Agreement.

Socio-Cultural Resources

The analysis of socio-cultural resources examines the effects of the Invasive Plant Management Plan on the social environment within the park. Stewardship of Yosemite National Park requires consideration of two integrated purposes: 1) to preserve Yosemite's unique natural and cultural resources and scenic beauty; and 2) to make these resources available to visitors for study, enjoyment, and recreation. The social resources analyzed and addressed in this Environmental Assessment include scenic resources, visitor experience and recreation, and park operations.

Impact Topics Dismissed from Further Analysis

Climate

Future changes in climate are likely to have direct and indirect effects on invasive plant biology. Changes in temperature and carbon dioxide are likely to trigger the expansion of invasive plants into higher latitudes or altitudes. Recent studies indicate that many weeds also show a strong response to increases in atmospheric carbon dioxide (Ziska 2004). Changes in temperature, wind speed, soil moisture, and atmospheric humidity can also influence the effectiveness of herbicide applications (Ziska 2006). For example, drought can result in thicker cuticle development on invasive plant leaves, and reduce herbicide entry into leaf surfaces. Such effects may occur sporadically with local shifts in weather, but they are unlikely to occur within the project lifespan of the Invasive Plant Management Plan (ten to fifteen years). Implementation of the Invasive Plant Management Plan would not result in measurable effects on local or regional climate regimes. Therefore, this resource topic was dismissed from further analysis in this document.

Environmental Justice

Executive Order 12898 requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. This Executive Order does not apply to the subject of this Environmental Assessment. No aspect of the Invasive Plant Management Plan alternatives would result in disproportionately high or adverse human health or environmental effects on minority or low-income populations; the destruction or disruption of community cohesiveness and economic vitality; the displacement of public and private facilities and services; increased traffic congestion; and/or the exclusion or separation of minority or low-income populations from the broader community.

Geology and Geologic Hazards

The actions proposed in this plan would not result in impacts related to geology, and would not increase or decrease the potential for geologic hazards in the project area. Therefore, these topics were dismissed from further analysis in this document.

Prime and Unique Agricultural Lands

No known agricultural lands exist in the project area, and the proposed action would not have any indirect effects on downstream agricultural lands. Therefore, this resource topic was dismissed from further analysis in this document.

Socioeconomics

Implementation of the Invasive Plant Management Plan would not result in measurable effects on the regional or gateway community economies, or cause changes in visitor attendance or visitor spending patterns. Therefore, this resource topic was dismissed from further analysis in this document.

Regional Setting

This section briefly describes how invasive plants within Yosemite fit into a larger statewide context. Some of the most widespread invasive grasses first arrived in California during the 16th century as propagules hitchhiking on explorers, their livestock, and crops; after their introduction, the spread of these non-native species was exacerbated by drought, animal grazing, and the burning practices of American Indians (Hendry 1934). Since the arrival of Europeans, approximately 1,000 plant species from many parts of the globe entered the state's natural areas. The California Exotic Pest Plant Council lists about 140 of the 1,000 non-natives in California on its list of Plants of Greatest Ecological Concern. Yellow star-thistle is the most widespread weed in California's natural areas. It is found in 55 of the state's 58 counties, and infests up to 42 percent of California (Pitcairn, Begley et al. 2003).

The Sierra Nevada is a massive mountain range that divides central California from more arid lands to the east. About two-thirds of the land area of the Sierra Nevada is publicly owned. The Sierra Nevada is home to three national parks (Yosemite, Kings Canyon, and Sequoia National Parks), two national monuments (Devils Postpile and Sequoia National Monument), nine national forests, and numerous smaller state parks. Many invasive plant species occur in the parks of the Sierra Nevada. Despite management efforts, many are spreading and new invasions continue; there are over 180 non-native plant species in Yosemite National Park, 200 in Sequoia and Kings Canyon National Parks, and 8 in Devils Postpile National Monument (Gerlach, Moore et al. 2003). The herbaceous biomass of foothill grasslands in Sequoia National Park is 99 percent invasive species (Parsons and Stohlgren 1989).

Yosemite National Park lies on the western slope of the Sierra Nevada, 150 miles east of San Francisco. The 747,986-acre Park ranges in elevation from approximately 2,000 feet in the western reaches to 13,114 feet along the Pacific crest. This steep elevation gradient drives the distribution of invasive plants, at least in part. While only about 25 percent of the landscape in Yosemite occurs below 7,000 feet, most invasive species populations occur in sites well below 7,000 feet. The remaining landscape above 7,000 feet is free from the impacts of invasive plants, yet highly vulnerable to non-native plant invasion.

Soils

Affected Environment

Soils form over time through complex interactions among the source material, climate, topography, and living organisms. Diverse soil-forming processes have produced about 120 soil types in the Yosemite

region (United States Department of Agriculture 2007). These soils derive primarily from underlying granitic bedrock, and are of similar chemical and mineralogical composition. Metamorphic bedrock, which is found along the western edge of Yosemite and along the eastern edge of the summit area, underlies less than 5 percent of the park area. Most high-country soils developed in glacial material or developed in place from bedrock parent material (NPS 2004).

Soil in Yosemite constitutes a diverse, intact, and functioning ecosystem that is home to a wide range of microbial and animal groups, including bacteria, protozoa, nematodes, and fungi. Invasive plant communities have an impact on soil systems. Invasive plants known to occur in Yosemite can affect nitrogen levels (Evans, Rimer et al. 2001), phosphorus cycling (Zabinski, Quinn et al. 2002), soil biota (Belnap and Phillips 2001), and soil moisture (Enloe, DiTomaso et al. 2004). Changes in nutrient cycling and soil biota can enhance conditions that foster invasive plant invasions and reduce native plant diversity.

Environmental Consequences – Methodology

The capacity of soil to maintain and promote a healthy ecosystem depends on the resistance of the soil to degradation. Resistance to degradation is the ability of a soil system to function without change through a disturbance (Pimm 1984). Disturbances that can lead to soil degradation include trampling, climate change, alterations in hydrologic processes, and the introduction of invasive species. Invasive plant control activities, such as tilling and herbicide use, can have localized effects on soil quality that are similar to those resulting from agricultural disturbance.

This Environmental Assessment considers impacts on three categories of soils: sensitive soils, resilient soils, and other soils. Sensitive soils support or have the potential to support highly valued vegetation communities such as meadows and wetlands. Sensitive soils have an aggregate structure and chemistry that are easily affected by disturbance. Soils that are less affected by disturbance are identified as resilient. Resilient soils are those capable of withstanding alteration and heavier use without permanent deformation, or that recover more easily from alteration and disturbance. Resilient soils are typically well-drained upland sandy soils. Other soils are not considered highly valued or resilient soils. Generally, these soils limit use because of steep slopes or other physical habitats. Other soils are generally more abundant and do not support plant communities that are rare or notably diverse.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Impacts are considered beneficial if implementation of an alternative would protect or restore natural soil conditions, including soil structure and moisture. Impacts are considered adverse if implementation of an alternative would degrade chemical or physical soil components.

Duration of Impact: The duration of an impact is the time required for soil to recover after treatment. This analysis characterizes the duration of soil impacts as short-term or long-term. The impact on soil quality is considered short-term if soil system recovery would take less than 20 years. The impact on soil quality is considered long-term (or permanent) if recovery would take over 20 years. The duration of impact for all actions proposed in this plan is expected to be much less than 20 years.

Intensity of Impact: The intensity of an impact on soils is a measure of the degradation of ecosystem function or soil quality. Impact intensity is characterized as negligible, minor, moderate, or major. Negligible impacts or disturbances to the soil would be detectable but slight (i.e., could be detected when post-treatment conditions are closely compared to existing site conditions). A negligible impact would result, for example, if shovel ridges were left after bull thistle removal, or if slight soil compaction occurred when workers removed blackberry from meadow systems.

Minor impacts or disturbances would involve perceptible alterations in the soil. An example of a minor impact would be the removal of non-native blackberry roots using a small machine such as a bobcat.

Impacts that are readily apparent in less than 50 percent of the treated area would be characterized as moderate. Moderate impacts would have the potential to increase soil degradation on steep slopes or in sensitive areas. An example of a moderate impact would be the use of heavy equipment in an area with steep slopes or along a stream bank with unmitigated runoff. Rills would form in less than 50 percent of the treatment area, and there would be soil compaction.

Major impacts would be readily apparent in over 50 percent of the treated area. More than 25 percent of the treated area would show severe effects of physical disturbance, including extensive compaction. An example of a major impact would be the use of heavy equipment on steep slopes or stream banks where rills and gullies form.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program that employs a variety of manual, mechanical, and other techniques to control invasive plants, without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The comprehensive programmatic actions described in Alternative 1 would reduce the risk of new or larger invasive plant populations becoming well established before populations increase to the point that intensive control efforts are required. Prioritization practices would assist resource managers by ensuring the proper distribution of limited resources (primarily staffing and equipment) for control and eradication efforts. Early detection, response, prevention, prioritization, monitoring, and outreach activities under Alternative 2 would result in a long-term negligible beneficial impact on soils.

Control

Alternative 1 would employ multiple control techniques to treat existing invasive plant populations, without the use of herbicides. Hand tools would continue to be the primary control tool used on sensitive soils. Treatments such as tilling would continue on resilient and other soils. There would be a short-term minor adverse impact on soil quality due to the use of ground-disturbing control techniques. There would be a long-term minor beneficial impact on soil microorganisms, soil chemistry, and hydrologic cycles as invasive plants are controlled.

Cumulative Impacts

Cumulative impacts on soil resources are determined based on analysis of past, present, and reasonably foreseeable future actions in California and the Yosemite region in conjunction with the potential effects of this alternative. During the past 150 years, activities associated with urbanization in California (such as building construction, utility installation, road and bridge building, and stormwater discharge) have contributed to adverse impacts on soils. Impacts range from direct loss of soil ecosystems to indirect losses such as changes in water flows that saturate wetland soils. Agricultural and forestry activities (timber removal and forest re-establishment) activities have also contributed to soil disturbance. The overall effect of statewide activities on soil ecosystems and soil quality has been adverse, long-term, and major.

The magnitude of past impacts on soil resources correlates with the spread of invasive plants in California. This is not surprising because many non-native plants thrive in disturbed soils. California's invasive plant problems are widespread and severe (Bossard, Randall et al. 2000). While fewer than 10 percent of the 1,000-plus (Hickman 1993) non-native plant taxa that have established in California are recognized as serious threats, non-native plants have dramatically changed the landscape of California. Some invasive plants alter soil chemistry, making it difficult for native species to survive and reproduce (Bossard, Randall et al. 2000). Present and future regional activities would have both beneficial and adverse impacts on soils. Some of the regional and local actions listed in Appendix M, such as the Rehabilitation of the Valley Loop Road, would disturb soils. Where soils are disturbed, Yosemite National Park and other agencies mitigate to reduce the risk of importation and spread of invasive plants. For example, Yosemite National Park inspects equipment as it enters the park to ensure it is free from mud and other materials that could import invasive plant seed. Actions such as the El Capitan Meadow Restoration Project and the Visitor Use and Floodplain Restoration Project in East Yosemite Valley would restore native habitat, enhancing the biological quality of native soils. Prescribed fire and managed wildland fire activities would provide long-term minor benefits to local soils by removing heavy litter layers, allowing oxygen to reach the soil surface and returning bound nutrients to the soil.

In addition, the combined actions of State and local programs would address the growing crisis facing the state of California with respect to invasive plant species. Control of invasive plants would have a beneficial impact on soil resources, because invasive plants can alter nutrient cycling and biotic processes in the soil. The Sierra-San Joaquin Noxious Weed Alliance (Weed Management Area) addresses invasive plant issues that cross jurisdictional boundaries. Regional invasive plant control actions sponsored by the California Department of Transportation (Caltrans), Mariposa County, Tuolumne County, Madera County, and the federal agencies adjacent to Yosemite National Park (Sierra National Forest; Stanislaus National Forest; Inyo National Forest; and the Bureau of Land Management [BLM], Merced Canyon) each take a variety of actions to control invasive plants. These invasive plant actions protect or restore native habitat, fostering native soil ecosystems.

Past impacts on soil ecosystems and soil quality have been adverse, long-term, and major. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on soils in California, and would produce long-term moderate beneficial effects on soils. These past, present, and future effects, along with the localized long-term minor beneficial impacts of Alternative 1, would result in long-term adverse minor impacts.

Conclusion

Alternative 1 would result in a short-term minor adverse impact due to the use of ground-disturbing control techniques, and a long-term minor beneficial impact on soils due to the removal of invasive species. Because long-term impacts on soils associated with Alternative 1 would be minor and beneficial, Alternative 1 would not impair the park's soil resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual, mechanical, and other control techniques as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The impacts of the comprehensive programmatic actions described in Alternative 2 would be the same as those under Alternative 1. Early detection, response, prevention, prioritization, monitoring, and outreach activities under Alternative 2 would result in a long-term negligible beneficial impact on soils.

Control

The impacts resulting from the manual and mechanical removal of invasive plants would be similar to those described for Alternative 1. This alternative differs from Alternative 1 in that it would also utilize herbicides (glyphosate and aminopyralid) for specified invasive plants. Glyphosate adsorbs well to soil, and would not be transported through the soil profile or off site (United States Forest Service 2003). Glyphosate has low toxicity to soil biota (Ratcliff 2006) and limited mobilization of trace metals (Barrett and McBride 2006). Aminopyralid quickly degrades in soil and has limited toxicity in the soil (EPA OPP 2005). The limited use of the herbicides glyphosate and aminopyralid, and their associated adjuvants, surfactants, and "inert" ingredients, would have a short-term negligible adverse effect on soil quality (see Appendices F, G, and H).

Herbicide use under Alternative 2 would help to reduce soil disturbance by minimizing the need for manual and mechanical control techniques that can disturb sensitive and other soil types. This would be of particular importance in the control of non-native blackberry, which occurs in wetland soils. There would be a long-term moderate beneficial impact on soil microorganisms, soil chemistry, and hydrologic cycles as invasive plant populations that could not be controlled without the use of herbicides are eradicated. Alternative 2 would meet integrated pest management goals because work crews would use the minimum amount of low-toxicity herbicides necessary to meet management goals.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting soils would be the same as those under Alternative 1. Overall, local and regional present and foreseeable future actions would produce long-term moderate beneficial effects on soils. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on soils in California. These effects, along with the impacts of Alternative 2, would result in long-term adverse minor impacts on soils.

Conclusion

The limited use of the herbicides glyphosate and aminopyralid would have a short-term negligible adverse effect on soil quality. There would be long-term moderate beneficial impacts on soil microorganisms, soil chemistry, and hydrologic cycles as invasive plant populations are controlled and eradicated. Alternative 2 would meet integrated pest management goals because work crews would use the minimum amount of low-toxicity herbicides necessary to meet management goals. Overall, Alternative 2 would result in a short-term minor adverse impact on soils and a long-term moderate beneficial impact on soils. Because long-term impacts on soils under Alternative 2 are expected to be moderate and beneficial, Alternative 2 would not impair the park's soil resources for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). Under Alternative 3, the area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The impacts resulting from early detection, rapid response, and prevention actions under this alternative would be the same as those described for Alternative 2. Comprehensive programmatic actions under Alternative 3 would result in a long-term negligible beneficial impact on soils.

Control

The impacts resulting from the manual and mechanical removal of invasive plants would be similar to those described for Alternative 1. This alternative differs from Alternative 1 in that it would utilize herbicides (glyphosate and aminopyralid) for specified invasive plants. Glyphosate adsorbs well to soil, and would not be transported through the soil profile or off site (United States Forest Service 2003). Glyphosate has low toxicity to soil biota (Ratcliff 2006) and limited mobilization of trace metals (Barrett and McBride 2006). Aminopyralid quickly degrades in soil and has limited toxicity in the soil (EPA OPP 2005). Herbicide use under Alternative 3 would help to reduce soil disturbance by minimizing the need

for manual and mechanical control techniques that can disturb sensitive and other soil types. Limited use of the herbicides glyphosate and aminopyralid would have a short-term negligible adverse effect on soil quality. There would be a long-term moderate beneficial impact on soil microorganisms, soil chemistry, and hydrologic cycles as certain invasive plant populations (i.e., those that could not be controlled without the use of herbicides) are eradicated.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting soils would be the same as those under Alternative 1. Overall, local and regional present and foreseeable future actions would produce long-term moderate beneficial effects on soils. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on soils in California. These effects, along with the impacts of Alternative 4, would result in long-term adverse minor impacts on soils.

Conclusion

Herbicides would be used to prevent infestations in strategic areas such as road corridors and staging areas, and herbicide use would not taper off. Limited use of the herbicides glyphosate and aminopyralid would have short-term negligible adverse effects on soil quality. There would be a long-term moderate beneficial impact on soil microorganisms, soil chemistry, and hydrologic cycles as invasive plant populations are controlled and eradicated. Overall, Alternative 3 would result in a short-term minor adverse impact on soils and a long-term moderate beneficial impact on soils. Because long-term impacts of Alternative 3 would result in moderate and beneficial impacts on soils, Alternative 3 would not impair the park's soil resources for future generations.

Hydrology and Water Quality

Affected Environment

Yosemite has a Mediterranean climate that typically recharges groundwater and surface water during the spring snowmelt. Surface waters include over 3,200 lakes, the Merced River and Tuolumne River headwater basins, and multiple wetlands. Subsurface flow paths and rates and basin groundwater residence times in Yosemite have been little studied, but are likely to play a large role in regional hydrologic cycles. With over 94 percent of the park designated as Wilderness, surface and subsurface flow is largely unaltered.

Water quality throughout Yosemite is generally excellent. Most surface and subsurface waters have low concentrations of minerals and organic contaminants. The direct input of contaminants into Yosemite's water bodies is small and localized to high-use areas (NPS 2000b). The surface water quality throughout most of Yosemite is beneficial to freshwater habitat (California Regional Water Quality Control Board Central Valley Region 1998). Water quality is important to the health of habitats throughout the park.

Surface water in the park exhibits considerable variability in chemical composition, despite the relative homogeneity of bedrock chemistry (Clow 1996). Surface water in most of the Merced River basin is diluted (i.e., lacking in dissolved solids), making the ecosystem sensitive to human disturbances and pollution (Clow 1996).

Environmental Consequences – Methodology

Invasive plant control activities under the three alternatives could result in two types of impacts on water quality: changes in sediment loading due to soil disturbance, and direct inputs of pollutants due to herbicide use. Disturbances to the land surface can increase the quantity of sediment in surface waters, which can adversely affect aquatic habitat and biota. The use of herbicides can have adverse effects on drinking water quality and sensitive wetland habitat.

This analysis considers the environmental consequences of implementing the Invasive Plant Management Plan alternatives based on the potential of each alternative to increase turbidity and chemical contaminants in the park's surface and subsurface waters.

Type of Impact: This analysis identifies impacts as either beneficial or adverse. Impacts are considered beneficial if implementation of an alternative would protect or restore water quality. Impacts are considered adverse if implementation of an alternative would cause water quality in the lakes, rivers, groundwater, or wetlands of the Yosemite region to decline.

Duration of Impact: The duration of an impact is the time required for water quality to return to pre-treatment conditions. The duration of water quality impacts is characterized as short-term or long-term. The impact is considered short-term if water quality would return to pre-treatment conditions in several hours. The impact is considered long-term if it would take longer than several hours for water quality to return to pre-treatment conditions.

Intensity of Impact: The intensity of an impact on water quality is a measure of detectable changes in water quality. Impact intensity is characterized as negligible, minor, moderate, or major. Negligible impacts are those that would cause no detectable changes in water quality. Minor impacts would be slightly detectable and localized without the potential to expand if left alone. Moderate water quality impacts would have an adverse effect on wetland habitat or potable water. Major impacts on water quality would be substantial, highly noticeable, and possibly permanent. Major impacts could cause a die-off of a species or result in the loss of ecosystem function.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The comprehensive programmatic actions described for Alternative 1 would reduce the risk of new invasive plant populations becoming well established, before populations increase to the point that intensive control efforts are required. Prioritization practices would assist resource managers by ensuring the proper distribution of limited resources (primarily staffing and equipment) for control and eradication efforts. Early detection, response, prevention, prioritization, monitoring, and outreach activities under this alternative would result in a long-term negligible beneficial impact on water quality.

Control

Alternative 1 would employ multiple control techniques to treat existing invasive plant populations without the use of herbicides. Ground-disturbing activities would result in negligible increases in sediment loading or turbidity. There would be no herbicides used and no change in potential contaminant inputs from other sources such as weed trimmers and equipment. Control activities under this alternative are expected to result in short- and long-term negligible adverse impacts on water quality.

Cumulative Impacts

Cumulative impacts on hydrology and water quality resources are determined based on analysis of past, present, and reasonably foreseeable future actions in California and the Yosemite region in conjunction with the potential effects of this alternative. Over the past 150 years, activities associated with urbanization in California have contributed to adverse impacts on water flow patterns and water quality. Municipal and industrial activities such as power plants, wastewater treatment facilities, factories, and oil refineries continue to have an adverse affect on water resources due to alteration of water flow and discharge of effluents. Agriculture and silviculture practices can lead to erosion of soils and nonpoint source discharge of nutrients and chemicals into streams, rivers, and coastal waters.

In the Sierra Nevada, chemical water quality may be impaired downstream of urban centers, mines, and extensive land-use zones (Centers for Water and Wildland Resources 1996). Many low- to middle-elevation reservoirs accumulate near-toxic levels of mercury. Water diversions have increased salinity in lakes on the east side of the Sierra Nevada. Dams and diversions have profoundly altered the timing and amount of streamflows. The overall effect of statewide activities on hydrologic flows and water quality has been adverse, long-term, and major.

Present and future regional activities in the Yosemite region would have both beneficial and adverse impacts on hydrology and water quality. Planning efforts regarding large-scale watersheds such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans would protect and enhance Wild and Scenic River values. Hydrologic and ecosystem restoration efforts, such as the Visitor Use and Floodplain Restoration in East Yosemite Valley, would produce localized long-term minor beneficial effects on hydrology, including natural inundation periods.

Past impacts on hydrology and water quality have been adverse, long-term, and major. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on hydrology and water quality in California and the Yosemite region, and would produce long-term minor beneficial effects on hydrology and water quality. These past, present, and future effects, along with the long-term negligible adverse impacts of Alternative 1, would result in long-term adverse minor impacts.

Conclusion

Ground-disturbing activities would result in short-term negligible adverse increases in sediment loading or turbidity. Because no herbicides would be used, and there would be no change in inputs from other potential contaminant sources such as weed trimmers and equipment, the long-term impact on water quality would be negligible and adverse. Because Alternative 1 would be expected to result in negligible

adverse impacts on water quality, Alternative 1 would not impair the park's water quality for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of control techniques as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using these control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as management objectives for specified invasive plant populations are met.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The impacts of the comprehensive programmatic actions described for Alternative 2 would be the same as under Alternative 1. Early detection, response, prevention, prioritization, monitoring, and outreach activities under this alternative would result in a long-term negligible beneficial impact on water quality.

Control Treatments

The impacts resulting from the manual and mechanical removal of invasive plants would be similar to those described for Alternative 1. This alternative differs from Alternative 1 in that it includes the hand application of herbicides (glyphosate and aminopyralid) for specified invasive plants. Glyphosate formulations (such as Rodeo® or Roundup®) would have negligible effects on birds, mammals, fish, and invertebrates, and readily adsorbs to soil using standard application rates and techniques (United States Forest Service 2003; Relyea 2005a; Thompson 2006) (see Appendix F). Aminopyralid has a low-toxicity profile and an aquatic half-life of slightly over half a day (EPA OPP 2005) (see Appendices G and H). Milestone® is the only commercially available formulation of aminopyralid. With low toxicity and a short half-life, Milestone® would have negligible effects on water quality using standard application rates and techniques (see Appendices G and H). Herbicide use is expected to decrease over time. Control efforts under this alternative would result in short-term and long-term negligible adverse impacts on water quality.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting water quality would be the same as those under Alternative 1. Overall, regional present and foreseeable future actions would produce long-term minor beneficial effects on soils. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on soils in California. These effects, along with the impacts of Alternative 2, would result in long-term adverse minor impacts on hydrology and water quality.

Conclusion

Increased prevention, early detection, and monitoring under Alternative 2 would have a negligible beneficial impact on water quality. Proposed ground-disturbing activities would result in a negligible increase in sediment loading. Because there would be limited herbicide use and limited reductions in other sources such as weed trimmers and equipment, the impact on water quality would be long-term, negligible, and adverse. Because Alternative 2 would be expected to result in negligible adverse impacts on water quality, Alternative 2 would not impair the park's water quality for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The impacts resulting from early detection, rapid response, and prevention actions on hydrology and water quality would be the same as those described for Alternative 2. Comprehensive programmatic activities under Alternative 3 would result in a long-term negligible beneficial impact on water quality.

Control Treatments

The impacts resulting from control actions would be similar to those described for Alternative 2, with two exceptions: 1) in addition to utilizing herbicides on selected species that reach specified population sizes, the park would utilize herbicides as a preventive measure on road corridors and staging areas; and 2) herbicide use would not taper off over time. This additional herbicide use would have a short-term negligible adverse effect on water quality.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting water quality would be the same as those under Alternative 1. Overall, regional present and foreseeable future actions would produce long-term minor beneficial effects on soils. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on soils in California. These effects, along with the impacts of Alternative 3, would result in long-term adverse minor impacts on hydrology and water quality.

Conclusion

Ground-disturbing activities would result in short-term negligible adverse increases in sediment loading or turbidity. Limited herbicide use and use of equipment such as weed trimmers and other equipment

would result in long-term negligible and adverse impacts. Because Alternative 3 would be expected to result in negligible, adverse impacts on water quality, Alternative 3 would not impair the park's water quality for future generations.

Wetlands

Affected Environment

Wetlands, as defined by the U.S. Fish and Wildlife Service (USFWS) and adopted by the National Park Service, are lands in transition between terrestrial and aquatic systems, where the water table is usually at or near the surface, or shallow water covers the land (at least seasonally). Three key features characterize wetlands: 1) the presence of standing water throughout part of the growing season; 2) unique wetland soils; and 3) vegetation adapted to or tolerant of saturated soils. Hydrology is considered the primary driver of wetland ecosystems, creating wetland soils and leading to the development of wetland biotic communities.

Wetlands are an important part of Yosemite's landscape, providing major contributions to ecosystem productivity and structural and biological diversity. High numbers of animals and plants in the Sierra Nevada depend entirely on wetlands. Wetlands also perform vital hydrological processes such as flood abatement, sediment retention, groundwater recharge, nutrient capture, and decomposition of organic matter. Wetlands are considered highly valued resources in Yosemite, and are afforded special protection under the Clean Water Act.

The National Park Service uses a system created by the USFWS (Cowardin, Carter et al. 1979) as the standard to define, classify, and inventory wetlands. In 1995, the USFWS mapped over 19,100 acres of wetland habitat in Yosemite as part of the National Wetlands Inventory (USFWS 1995). Yosemite wetlands occur in meadow, riparian, river, marsh, and pond habitats.

Wetlands are particularly vulnerable to invasive plant invasions. Invasive plant infestations can degrade wetland habitat by changing sediment loading, surface and subsurface flows, and water table depth (Gordon 1998). Although wetlands constitute less than 6 percent of the earth's land mass, 24 percent of the world's most invasive plants are wetland species (Zedler and Kercher 2004). Wetlands with a history of hydrological disturbance tend to promote more widespread plant invasions than undisturbed wetlands. This is evident in Yosemite Valley, where non-native perennial grasses dominate many meadows in areas where culverts and ditches alter surface and groundwater flows.

Over 29 percent (52 of 177) of the non-native plants known to occur in Yosemite have the potential to occur in wetlands (USFWS 1996) (see Appendix B). These 52 non-native plants found in wetlands follow the same elevation pattern as infestations in other habitats in Yosemite, and are more widespread at lower elevations and less common at higher elevations. A 2005 Yosemite inventory of non-native plants in riparian habitat, which is typically a wetland community, found non-native plant species in 46 percent of the 156 riparian plots surveyed across the landscape (Kane, Heath et al. 2006). The abundance of plants in each 0.25-acre riparian plot ranged from 1 to 40,000 individual non-native plants per plot.

One relatively recent invader, velvet grass (*Holcus lanatus*), forms the largest invasive plant infestation in Yosemite wetlands. Velvet grass, a prolific seed producer, often forms a monoculture that displaces native wetland plants. Velvet grass is documented on over 285 acres within the park.

Two species of non-native blackberry, *Rubus discolor* and *Rubus laciniatus*, are the prime wetland invaders in Yosemite Valley. Over 30 acres of non-native blackberry occurs in Yosemite Valley. Blackberry is found in many additional wetlands outside of Yosemite Valley in low- to mid-elevation areas. Work crews remove about one acre of non-native blackberry per year from park wetlands. Non-native blackberry and velvet grass are classified as facultative wetland species (i.e., plants that are found in at least 50 percent of wetland habitats) (USFWS 1996). Black locust, perennial pepperweed, and tree-of-heaven are also high-priority invasive plants with the potential to occur in Yosemite wetlands.

Environmental Consequences – Methodology

The National Park Service manages wetlands in compliance with Executive Order 11990 (Wetland Protection), the Clean Water Act, and the Rivers and Harbors Appropriation Act of 1899, and in accordance with the procedures described in National Park Service Director's Order 77-1: Wetland Protection. Executive Order 11990 directs the National Park Service to: 1) provide leadership and take action to minimize the destruction, loss, or degradation of wetlands; 2) preserve and enhance the natural and beneficial values of wetlands; and 3) avoid direct and indirect support of new construction in wetlands unless no practicable alternatives exist. This analysis focuses on the potential for actions to impact the natural and beneficial values of wetlands. Examples of wetland values and functions include:

- Biotic functions (e.g., fish and wildlife habitat, floral and faunal productivity, native species and habitat diversity, special-status species)
- Hydrologic functions (e.g., flood attenuation, streamflow maintenance, groundwater recharge and discharge, water supply, erosion and sediment control, water purification)
- Cultural values (e.g., aesthetics, education, historical values, archeological values, recreation, interpretation)
- Research/scientific values (e.g., reference sites for research on unaffected ecosystems)

Type of Impact: This analysis identifies impacts as either beneficial or adverse. Impacts are considered adverse if implementation of an alternative would degrade the natural values, size, integrity, or connectivity of wetlands. Impacts are considered beneficial if implementation of an alternative would enlarge the size or enhance the natural values, integrity, or connectivity of wetlands.

Duration of Impact: The duration of an impact is the time required for wetlands to return to pre-treatment conditions. The duration of wetland impacts is characterized as short-term or long-term. Short-term impacts are those that would last up to ten years following implementation of an alternative. Long-term impacts would last longer than ten years after implementation of an alternative.

Intensity of Impact: Intensity values focus on direct impacts to the physical attributes of a wetland, the natural values and integrity of the wetland, and the connectivity of the wetland to adjacent habitats. Negligible impacts would be imperceptible or undetectable. Minor impacts would be slightly detectable

and localized within a small area. Moderate impacts would be apparent, with no potential to become major impacts. Major impacts would be substantial and highly noticeable, and could become permanent.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program that employs a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The comprehensive programmatic actions described for Alternative 1 would reduce the risk of new invasive plant populations becoming well established in wetlands. Prioritization practices would assist resource managers by ensuring the proper distribution of limited resources (primarily staffing and equipment) for control and eradication efforts. Early detection, response, prevention, prioritization, monitoring, and outreach activities under this alternative would result in a long-term minor beneficial impact on wetlands.

Control Treatments

Alternative 1 would utilize multiple control techniques to treat existing invasive plant populations, without the use of herbicides. The park would not meet management objectives for seven invasive plants that favor wetland habitats: Himalayan blackberry, cutleaf blackberry, velvet grass, bull thistle, perennial pepperweed, giant reed, tree-of-heaven, and black locust. The use of manual and mechanical treatments could impact wetland soils during removal of belowground portions of plants in wetlands. Manual and mechanical treatments also increase ground disturbance, and could increase the risk of secondary invasive species such as non-native blackberry. The control measures outlined in Alternative 1 represent a short-term minor adverse impact on wetland soils, and an overall long-term minor beneficial impact on wetlands in the park.

Cumulative Impacts

Cumulative impacts on wetland resources are based on analysis of past, present, and reasonably foreseeable future actions in the Yosemite region in conjunction with the potential effects of this alternative. Over half of the wetland area around the globe has been lost, and much of remaining wetland area is degraded (Zedler and Kercher 2004). Drainage for agriculture has been the primary cause of wetland loss to date; as of 1985, an estimated 26 percent of the global wetland area has been drained for intensive agriculture. Wetlands are the most altered and impaired habitat of the Sierra Nevada, and, as a small proportion of the landscape, are relatively rare (Hughes 1934; SNEP 1996). Dams, roads, and diversions in the Sierra Nevada have had a profound effect on streamflow patterns and water temperatures. Broad valleys with wide riparian wetlands were often used as reservoir sites. Much of the flatwater on the western slope of the Sierra Nevada below 5,000 feet in elevation is artificial. These past actions have had long-term adverse effects on regional wetland habitats.

Present and future regional activities would have both beneficial and adverse impacts on wetlands. Some of the regional and local actions listed in Appendix M could take place in the vicinity of wetlands, such as the El Portal Concept Plan or the Utilities Master Plan. Yosemite National Park and other agencies ensure there would be no net loss of wetlands to follow the mandates of the Clean Water Act. Parkwide planning efforts such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans are mandated to protect and enhance river values within each watershed. Actions such as the El Capitan Meadow Restoration Project and Visitor Use and Floodplain Restoration Project in East Yosemite Valley would restore native wetland habitat. Present and future regional actions would have localized long-term moderate beneficial impacts on wetlands.

Past impacts on wetlands have been adverse, long-term, and major. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions in California, and would produce long-term minor beneficial effects on wetlands. These past, present, and future effects, along with the localized long-term negligible adverse impacts of Alternative 1, would result in long-term adverse minor impacts on wetlands.

Conclusion

Under Alternative 1, implementation of comprehensive measures to protect wetlands would have a long-term minor beneficial impact on wetlands. Control actions would have a short-term minor adverse impact and a long-term minor beneficial impact. Overall, Alternative 1 represents a long-term minor beneficial impact. Because long-term impacts on wetlands associated with Alternative 1 would be minor and beneficial, Alternative 1 would not impair the park's wetland resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using these control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as management objectives for specified invasive plant populations are met.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The comprehensive programmatic actions described for Alternative 2 would have the same impacts as Alternative 1. Early detection, response, prevention, prioritization, monitoring, and outreach activities under this alternative would result in a long-term minor beneficial impact on wetlands.

Control

Alternative 2 would utilize multiple control techniques to treat existing invasive plant populations, including the use of herbicides for selected invasive plants. The use of herbicides would allow the park to meet management objectives for nine invasive plants with the potential to invade wetlands: Himalayan blackberry, cutleaf blackberry, velvet grass, perennial pepperweed, giant reed, bull thistle, oxeye daisy, tree-of-heaven, and black locust. One herbicide, glyphosate, would be used in a formulation approved for aquatic application with an R-11 surfactant. Park work teams would use manual and mechanical means to treat the additional 43 non-native plants with the potential to occur in wetlands. With implementation of Alternative 2, the park would meet management objectives for the invasive plants with the highest potential to invade wetlands.

The judicious use of herbicides would increase the number of acres the park could treat each year and reduce the number of follow-up treatments, making it feasible to control many more acres of invasive plants each year. Under Alternative 2, non-native blackberry would be removed at an estimated five acres per year, allowing the park to meet its management goals within six years. Giant reed and black locust populations would require a one- to two-year treatment, and complete eradication would be possible within five years. Although most black locust trees would be removed, the few black locust trees with historical significance would remain in place, thus retaining a source of new seedlings and necessitating periodic treatments of new seedlings. Tree-of-heaven is widespread, and eradication would likely require at least a decade. The park will continue to study the most effective treatments for controlling velvet grass in Yosemite wetlands.

Implementation of control actions under Alternative 2 would improve the functions of degraded wetlands in the park. These control actions would enhance wildlife habitat and biotic functions, such as native floral and faunal productivity, native species habitat diversity, and special-status species habitat. Applications of glyphosate on non-native blackberry and giant reed would have a short-term negligible adverse impact on adjacent vegetation; the impact would be negligible because the targeted species tend to grow in monocultures, making it possible to isolate specific populations during the herbicide applications. The park would apply glyphosate to tree-of-heaven and black locust by cutting down the tree and painting the exposed stump, or by making shallow notches in the tree's bark and squirting small amounts of herbicide into the notches; either method would have short-term negligible adverse effects on surrounding vegetation. Velvet grass and perennial pepperweed populations grow in close proximity to native vegetation, and applications of glyphosate would result in localized short-term impacts on adjacent native vegetation.

Compared with manual and mechanical treatments, the use of herbicides would reduce the extent and intensity of disturbance to wetland soils. Glyphosate would have negligible effects on native amphibians and other wetland wildlife (see Wildlife section in this chapter, and Appendices F, G, and H). Native species abundance and diversity would increase in restored sites, thus enhancing natural habitat for native wildlife. There would be no impacts on hydrologic functions (e.g., flood attenuation, streamflow maintenance, groundwater recharge and discharge, water supply, erosion and sediment control, water purification). Glyphosate is not expected to impact water quality (see Hydrology and Water Quality section in this chapter). Alternative 2 would meet integrated pest management goals because work crews would use the minimum amount of low-toxicity herbicides necessary to meet management goals.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting wetlands would be the same as those under Alternative 1. Overall, local and regional present and foreseeable future actions would produce long-term moderate beneficial effects on wetlands. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on wetlands in California. These effects, along with the impacts of Alternative 2, would result in long-term adverse minor impacts.

Conclusion

Under Alternative 2, early detection and prevention measures would have a long-term minor beneficial impact on wetlands. The use of herbicides would allow the park to meet management objectives for nine invasive plants with the potential to invade wetlands that otherwise would not be controlled using manual and mechanical techniques. The number of wetland acres the park could treat each year would increase, and the number of follow-up treatments would be reduced, resulting in a short-term negligible adverse impact and a long-term moderate beneficial impact on wetlands in the park. Alternative 2 would meet integrated pest management goals because work crews would use the minimum amount of herbicides necessary to meet management goals. Because long-term impacts on wetlands associated with Alternative 2 would be moderate and beneficial, Alternative 2 would not impair the park's wetland resources for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Under Alternative 3, the impacts of comprehensive programmatic actions to manage invasive plants on wetlands would be the same as those for Alternative 2. Implementation of comprehensive measures to protect wetlands would have a long-term minor beneficial impact on wetlands.

Control

Alternative 3 would utilize multiple control techniques to treat existing invasive plant populations, including the use of herbicides for selected invasive plants. Under Alternative 3, park work crews could use herbicides to treat two more invasive plant species with the potential to invade wetlands than under Alternative 2. These invasive plants are sourclover and yellow sweetclover. While these two species have the potential to occur in wetlands, they currently have a low impact on wetlands, and are not considered a

high threat to wetlands. park work teams would use manual and mechanical means to treat the additional 41 non-native plants with the potential to occur in wetlands.

The judicious use of herbicides would increase the number of acres the park could treat each year and reduce the number of follow-up treatments, making it feasible to control many more acres of invasive plants each year. Under Alternative 3, non-native blackberry would be removed at an estimated five acres per year, allowing the park to meet its management goals within six years. Giant reed and black locust populations would require a one- to two-year treatment, and complete eradication would be possible within five years. Though most black locust trees would be removed, the few black locust trees with historical significance would remain in place, thus retaining a source of new seedlings and necessitating periodic treatments of new seedlings. Tree-of-heaven is widespread, and eradication would likely require at least a decade. The park will continue to study the most effective treatments for controlling velvet grass in Yosemite wetlands.

Implementation of control actions under Alternative 3 would improve the functions of degraded wetlands in the park. These control actions would enhance wildlife habitat and biotic functions, such as native floral and faunal productivity, native species habitat diversity, and special-status species habitat. Applications of glyphosate on non-native blackberry and giant reed would have a short-term negligible adverse impact on adjacent vegetation; the impact would be negligible because the targeted species tend to grow in monocultures, making it possible to isolate specific populations during the herbicide applications. The park would apply glyphosate to tree-of-heaven and black locust by cutting down the tree and painting the exposed stump, or by making shallow notches into the tree's bark and squirting small amounts of herbicide into the notches; either method would have short-term negligible adverse effects on surrounding vegetation. Velvet grass and perennial pepperweed populations grow in close proximity to native vegetation, and applications of glyphosate would result in localized short-term impacts on adjacent native vegetation.

Compared with manual and mechanical treatments, the use of herbicides would reduce the extent and intensity of disturbance to wetland soils. Glyphosate would have negligible effects on native amphibians and other wetland wildlife (see Wildlife section in this chapter, and Appendices F, G, and H). Native species abundance and diversity would increase in restored sites, thus enhancing natural habitat for native wildlife. There would be no impacts on hydrologic functions (e.g., flood attenuation, streamflow maintenance, groundwater recharge and discharge, water supply, erosion and sediment control, water purification). Glyphosate is not expected to impact water quality (see Hydrology and Water Quality section in this chapter). Alternative 3 would meet integrated pest management goals because work crews would use the minimum amount of low-toxicity herbicides necessary to meet management goals.

The impacts of control actions on wetlands under Alternative 3 would be similar to the impacts of Alternative 2. Two additional invasive species with the potential to invade wetlands could be controlled with herbicides, but control of these two additional species would have a negligible beneficial impact on wetlands. Control actions would result in a short-term negligible adverse impact and a long-term moderate beneficial impact on wetlands in the park because the proposed actions would increase the area of restored wetlands and allow the park to meet management objectives for invasive plants. Overall, Alternative 3 would result in long-term moderate beneficial impacts on wetlands.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting wetlands would be the same as those under Alternative 1. Overall, local and regional present and foreseeable future actions would produce long-term moderate beneficial effects on wetlands. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on wetlands in California. These effects, along with the impacts of Alternative 3, would result in long-term adverse minor impacts.

Conclusion

The impacts of control actions on wetlands under Alternative 3 would be similar to the impacts of Alternative 2. Two additional invasive species with the potential to invade wetlands could be controlled with herbicides, but control of these two additional species would have a negligible beneficial impact on wetlands. Control actions would result in a short-term negligible adverse impact and a long-term moderate beneficial impact on wetlands in the park because the proposed actions would increase the area of restored wetlands and allow the park to meet management objectives for invasive plants. Overall, Alternative 3 would result in long-term moderate beneficial impacts on wetlands. Because long-term impacts on wetlands associated with Alternative 3 would be moderate and beneficial, Alternative 3 would not impair the park's wetland resources for future generations.

Vegetation

Affected Environment

Over 1,427 vascular plant taxa have been documented in Yosemite National Park, and many species continue to be discovered. Although Yosemite constitutes less than 1 percent of the area of California, nearly 23 percent of all plants in the state are represented within the park. The remarkable floristic diversity over such a relatively small area can be attributed in large part to the steep elevation gradient of the Sierra Nevada and other physical factors such as hydrology and climate.

Non-Native Plant Species

Invasive species are increasingly considered to be important drivers of global ecological change (Mack, Simberloff et al. 2000). Relationships among plants, animals, soil, and water that have taken thousands of years to form are being rapidly altered over a short period of time through the introduction of invasive species. Invasive species have been shown to displace native organisms (Tilman 1999), damage populations of rare species (King 1985), degrade ecosystem structures, alter nutrient cycling and soil chemistry(Vitousek and Walker 1989; Ehrenfeld 2003), and change water availability for native plants and animals (D'Antonio and Mahall 1991).

A total of 177 non-native plant species have been documented within Yosemite National Park and the El Portal Administrative Unit (see Appendices B and O). These non-native plants are not evenly distributed across Yosemite's landscape (see Figure III-1). Vast expanses of the highest elevations of Yosemite National Park remain free of non-native plants, while some low-elevation areas are dominated by non-native plants. Although many areas remain unaffected by non-native species, these areas are highly vulnerable to future plant invasions. Areas that are free of invasive plants are susceptible to future

invasions, as illustrated by the widespread plant invasions in other high-elevation mountain regions in western North America.

Non-native plant invasions occur in three phases: introduction, colonization, and naturalization (Groves 1986; Cousens and Mortimer 1995). For invasive plants to become established, propagules brought into the new environment must successfully establish. Non-native plants can be introduced either intentionally or through accidental means. Intentional introductions occur when plants are brought in for ornamental or other economic reasons and then spread beyond their initial location. The colonization phase of invasion is characterized by exponential population growth.

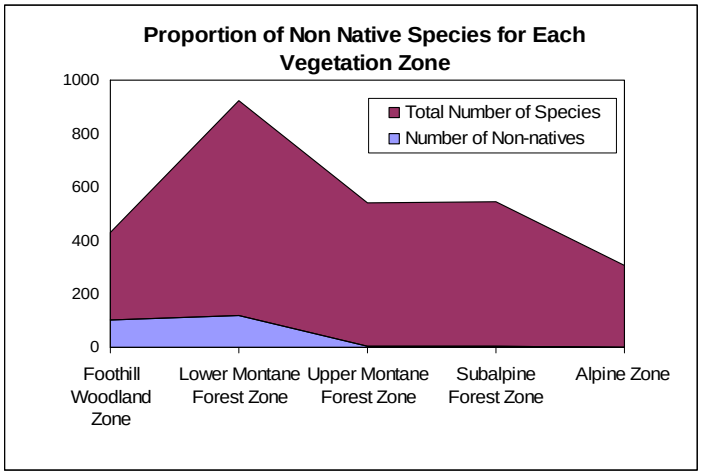


Figure III-1: Proportion of Non-Native Species in Each Elevation Zone in Yosemite National Park

Soil degradation and other types of ecological disturbances can promote the introduction and establishment of invasive plants. In Yosemite, sites such as campgrounds, pack stations, staging areas, road corridors, recent construction sites, and riparian corridors are particularly vulnerable to new infestations of invasive plants. Disturbances due to foot and vehicular traffic off of paved roads can also create suitable habitat for invasive species (Hobbs and Huenneke 1992; D'Antonio, Dudley et al. 1999). The types of environmental changes that promote plant invasion range in scale and intensity—from localized disturbances (such as moderate foot traffic along a trail or within a construction site) to large-scale impacts (such as increased atmospheric nitrogen deposition (Weiss 1999) and climate change). Natural disturbances such as floods or herbivory by native animals can also facilitate the establishment and spread of invasive species.

The National Park Service in Yosemite National Park has long recognized the threat of invasive plants, and has been controlling invasive plants for several decades. More recently, a minimum of 40 non-native species have been treated within Yosemite National Park since 2005 (NPS 2007b). However, over half of the National Park Service staff hours dedicated to invasive plant control were focused on only three of these species: yellow star-thistle, Himalayan blackberry, and spotted knapweed.

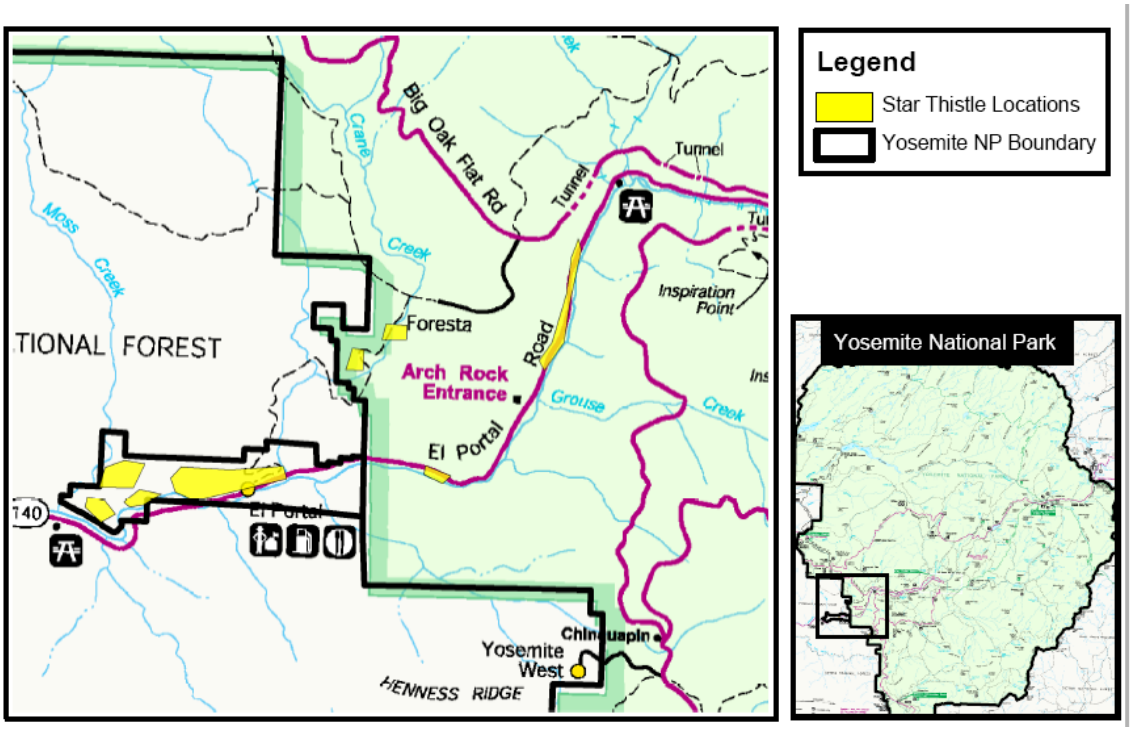


Figure III-2: Yellow Star-thistle Populations in Yosemite National Park

Yellow star-thistle has infested nearly 100 acres of the park, and threatens thousands of additional acres of park land (see Figure III-2). The vast majority of the yellow star-thistle in Yosemite is found on the steep slopes of the Merced Canyon above El Portal. Since 1995, the park has made substantial strides in controlling the spread of yellow star-thistle in the lowest reaches of the park. In these areas, many native plants have returned; monitoring results have shown a twofold increase in native species richness in places where yellow star-thistle has been removed (NPS 2006e). National Park Service staff have effectively treated the densest infestations of yellow star-thistle using hand-held weed trimmers and by hand pulling. However, yellow star-thistle persists in extensive areas throughout the El Portal Administrative Area, and some of the most inaccessible populations remain untreated.

National Park Service staff, Yosemite Institute students, and volunteers have been treating Himalayan blackberry infestations in Yosemite Valley for decades. Primarily, workers have been using hand tools to cut and dig up the extensive belowground root system. This method is slow and difficult, and requires many years of follow-up treatments. The park has slowed the spread of Himalayan blackberry into uninfested areas, but has not been able to substantially reduce the overall impact of this invader (NPS 2006d; NPS 2006e). The current methods also require substantial amount of ground disturbance, and, as a result, other invasive plant species such as velvet grass and bull thistle often rapidly move in to areas where blackberry has been recently removed.

In 1997, spotted knapweed was detected in the initial stages of invasion in Foresta. Since its discovery, the park has been treating the population annually. Although park staff continue to discover and treat new individuals every year since treatment began, the species has not spread beyond its initial area, and its

ecological impact has been minimal thus far. Most of the time and effort spent on this species involves the detection of individuals (because so few individuals remain).

Vegetation Zones

In Yosemite National Park, five broad vegetation zones generally follow the elevation gradient: foothill woodland, lower montane forest, upper montane forest, subalpine forest, and alpine zone (see Figure III-3). Invasive species cause much greater impacts in the lower elevations of the park and the Sierra Nevada (Randall, Rejmanek et al. 1998).

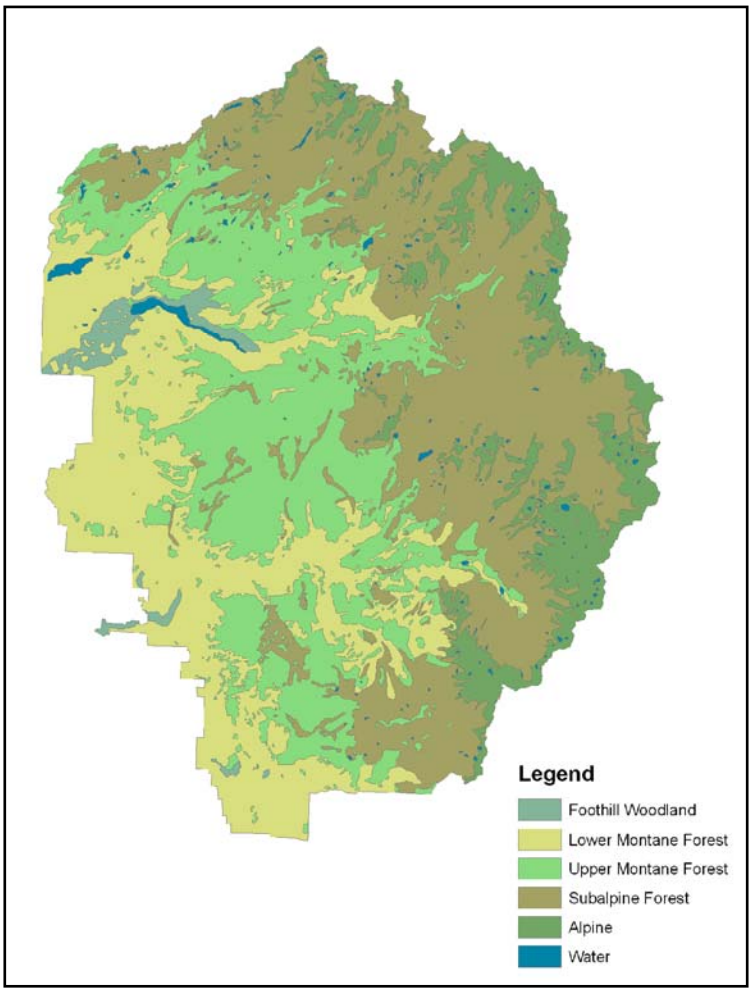


Figure III-3: Vegetation Zones in Yosemite National Park

Foothill Woodland Zone (below 2,000 feet): The lowest elevation zone in Yosemite is found along the western boundary of the park. This zone is characterized by a Mediterranean climate; winters are cool and wet, and summers are hot and dry. Nearly all precipitation occurs within the winter months (generally in the form of rain in the lower elevations and snow at higher elevations). Vegetation communities in this zone range from scattered trees and shrubs with a dense understory of herbaceous annual species to dense, shrub-dominated stands. Plants in this zone must be able to withstand the hot dry

summers. The El Portal Administrative Unit and areas below Hetch Hetchy Reservoir are the only two park locations within this zone.

Non-native species: The foothill woodland zone has substantially more influence from invasive and non-native plants than the other vegetation zones. Non-native species constitute much of the herbaceous vegetation throughout this zone. According to An Illustrated Flora of Yosemite National Park) (Botti 2001), 23 percent of the vascular plant species that occur within this zone are non-native. Annual grasses native to the Mediterranean region are a dominant feature within the woodland areas of this zone.

Some of the lowest elevation areas in the park are located in the El Portal Administrative Unit. El Portal is abundant in non-native species and is highly susceptible to new introductions. Non-native species are not restricted to disturbed areas, and dominate portions of the landscape at locations where no ground-disturbing activities have occurred for decades. Established invasive plant populations in this zone may serve as a primary propagule source for the spread of these species into the park's higher vegetation zones.

Examples of invasive species of concern in this zone include: yellow star-thistle, Himalayan blackberry, black mustard, French broom, tocalote, tree-of-heaven, and giant reed grass.

Lower Montane Forest (3,000 to 6,000 feet): This mid-elevation zone is the lowest zone that regularly receives a majority of its precipitation in the form of snow. The increase in precipitation makes this zone predominantly a forest type, with intermittent riparian areas and meadows. Dominant trees in this zone are incense-cedar, black oak, ponderosa pine, white fir, and sugar pines. Giant sequoia groves also occur in this zone.

Developed areas within the lower montane forest zone include Yosemite Valley, Wawona, Hodgdon Meadows, and the infrastructure around Hetch Hetchy.

Non-native species: This zone contains relatively fewer non-native species than the foothill woodlands zone. Approximately 13 percent of the documented species in this zone are non-native (Botti 2001). However, invasive plants can be found in many of the meadows and open sites within this zone, especially those that are near developed areas and roads. Farming and grazing in many of the meadows within this zone occurred during the late 19th and early 20th centuries (Botti 2001). A majority of the forested areas remain free of non-native plants. In this zone, meadows and riparian areas are the most susceptible to the impacts of invasive plants. Many of the non-native species that are abundant in the foothill woodland zone reach their upper limits in this zone.

Many invasive plant species have the potential to invade this zone, but have not yet spread into Yosemite. If given the opportunity, these species could rapidly spread throughout this zone. Examples of invasive species of concern in this zone include: Himalayan blackberry, velvet grass, black locust, bull thistle, spotted knapweed, and cheatgrass.

Upper Montane Forest (6,000 to 8,000 feet): The climate in this zone is characterized by short cool summers and cold winters. Nearly all precipitation in this zone is in the form of snow. Upper montane

forest is a forest-dominated zone interspersed with biologically diverse meadows. The dominant trees in this zone include lodgepole pine, Jeffrey pine, and red fir. Upper montane forest encompasses 216,000 acres (87,000 hectares). Developed areas within the upper montane forest zone include Crane Flat, Tioga Road, and Glacier Point Road.

> ***Non-native species:*** A small number of established non-native plant populations occur in natural areas within this zone. Less than 1 percent of the plant species documented in this zone are non-native. Scattered populations of non-natives are found along road corridors, trails, and developed areas, but these populations diminish rapidly away from disturbed sites. Examples of invasive species of concern in this zone include bull thistle, cheatgrass, and dandelion.

Subalpine Forest (8,000 to 9,500 feet): This zone encompasses 297,000 acres in the park, and has a shorter growing season due to the long cold snowy winters. This zone typically accumulates 3 to 10 feet of snow during the winter. Forests of western white pine, mountain hemlock, and lodgepole pine are interspersed with numerous subalpine meadows throughout this zone.

> ***Non-native species:*** Nearly all of the non-native plant populations in the subalpine zone are restricted to frequently disturbed sites such as road corridors and campgrounds. Even in these areas, non-native species are uncommon. Scattered non-natives grow infrequently along trails and meadow edges in Wilderness areas throughout the zone. No known persistent populations of non-native plant species exist outside the Tuolumne Meadows area. This zone may be highly susceptible to invasion in the future due to changes in climate and non-native species that thrive in this environment.

Alpine Zone: This zone is easily distinguished from the lower elevation zones by its lack of forests. Herbaceous plants found in this zone tend to be low in stature due to the harsh environment. This zone covers 54,362 acres (22,000 hectares) in the park.

> ***Non-native species:*** No known persistent populations of non-native plants exist within this zone (Botti 2001). The short growing season and the limited human disturbances have likely slowed the spread of non-native plants into this zone. The alpine zone contains no developed areas. No invasive species are species of concern in this zone.

Environmental Consequences – Methodology

Changes in the size, continuity, and integrity of native vegetation community structure were used to evaluate impacts on vegetation due to invasive plant control activities. Impacts on these communities were assessed in terms of type, duration, and intensity of impact, as discussed below.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Impacts are considered adverse if implementation of an alternative would reduce the size, continuity, or integrity of a native plant community. Impacts are considered beneficial if implementation of an alternative would increase the size, continuity, or integrity of a native plant community.

Duration of Impact: The duration of an impact is the time required for native plant communities to recover to pre-treatment conditions. The duration of impact is characterized as short-term or long-term.

Short-term impacts on vegetation are those that would last up to 20 years following implementation of an alternative. Long-term impacts would last longer than 20 years after implementation of an alternative.

Intensity of Impact: The intensity of an impact on vegetation is a measure of perceptible changes in native plant community size, continuity, or integrity. Impact intensity is characterized as negligible, minor, moderate, or major. Negligible impacts are those that would have no measurable or perceptible changes in native plant community size, continuity, or integrity. Minor impacts would be measurable or perceptible, but would be localized within an isolated area, and the overall viability of the native plant community would not be affected. Moderate impacts would cause a measurable and perceptible change in the native plant community (e.g., size, continuity, or integrity); however, the impact would remain localized and could be reversed. Major impacts would be substantial and highly noticeable and could be permanent in their effects on native plant community size, diversity, continuity, or integrity.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Under Alternative 1, early detection and rapid response would continue to reduce the risk that new invasive plant populations would become well established in the park. Detecting species early in the invasion process and executing the appropriate response would also reduce the intensity and extent of invasive plant control efforts in diverse vegetative communities.

Prevention practices would keep invasive plant species that already exist within park boundaries from establishing elsewhere in the park, and would prevent new invasive species from entering the park and threatening native vegetation. These prevention techniques would also reduce the extent and intensity of measures needed to control or eradicate invasive plant populations.

Prioritization practices under Alternative 1 would assist resource managers by ensuring that limited resources (primarily staffing and equipment) for control and eradication efforts are properly distributed. These practices would continue to increase the efficiency and success of invasive plant management in the park.

Monitoring would continue to be implemented to determine whether management objectives have been met, and to evaluate the effectiveness of control techniques. Under Alternative 1, park staff would work with outside researchers, and would conduct applied research to improve their understanding of invasive plants in the park.

The outreach and education component of Alternative 1 would continue to inform visitors, employees, and residents of the importance of preventing new invasions in the park. For example, visitors and employees would continue to be educated not to bring items into the park that could be infested with

non-native propagules. Under this alternative, the National Park Service would provide information on the need to control existing populations and prevent new infestations of invasive plant species.

The early detection and rapid response, prevention, prioritization, monitoring, outreach, and education components of the comprehensive program under Alternative 1 would have a long-term minor beneficial impact on vegetation communities in the park.

Control

Under Alternative 1, the park would continue to utilize multiple control techniques to treat existing invasive plant populations without the use of herbicides. With the existing range of manual and mechanical control techniques, it is likely that the park would not meet management objectives for high-priority species, including yellow star-thistle, Himalayan blackberry, common velvet grass, cutleaf blackberry, oxeye daisy, perennial sweet pea, giant reed, Bermuda grass, rose clover, black locust, and tree-of-heaven. The park would continue to focus energy and resources on limited species, restricting time and attention on other high-priority species, and reducing the likelihood that the park could meet management objectives for remaining priority species.

The treatment of invasive plants with manual and mechanical control methods can cause large amounts of soil disturbance when belowground portions of the plant are required to be removed. The viability of invasive plant seed may be increased when seed is pushed farther into the soil with a shovel. Additionally, invasive species are often highly adapted to ground disturbance, and can become established in sites where invasive species have been removed. In Yosemite Valley, for example, bull thistle can form dense populations in sites where Himalayan blackberry has been removed. For many invasive species, multiple visits to the site are required, over several years, to control the population effectively. Without appropriate follow-up efforts, populations can fully recover to the condition that existed before the initial treatment. Some species, such as Himalayan blackberry, can actually return with more vigor than the original population if work crews do not conduct follow-up work.

Invasive plants would continue to spread into diverse vegetation communities. The largest populations of yellow star-thistle would continue to reduce in extent and density, but outlying populations of yellow star-thistle would continue to spread into foothill grassland communities. Manual and mechanical treatment of yellow star-thistle is most effective when two percent of the flowers on each plant are open, and the rest are in bud. In a typical year, yellow star-thistle would be effectively treated for a total of two to three weeks in the late spring or early summer. Velvet grass would continue to spread into wetland and riparian communities. Non-native blackberry would continue to spread into meadow and riparian habitats. Other priority invasive plants could spread into diverse native habitats. As a result, there would be a long-term moderate adverse impact on vegetation communities in Yosemite under Alternative 1.

Cumulative Impacts

Cumulative impacts on vegetation are based on analysis of past, present, and reasonably foreseeable future actions in California and the Yosemite region in conjunction with the potential effects of this alternative. In the past 150 years, activities associated with urbanization in California (e.g., building construction, utility installation, road and bridge building, stormwater discharge), livestock, and agriculture contributed to adverse impacts on vegetation (D'Antonio 2004). Impacts range from direct

loss of ecosystems to indirect losses such as changes in water flows that sustain vegetative habitat. The overall effect of statewide trends on vegetation has been adverse, long-term, and major. In addition, climate change and resultant changes in vegetation should increase in intensity or rate as the climate continues to change (D'Antonio 2004; Mutch 2007).

The magnitude of past impacts on vegetation correlates with the spread of invasive plants in California. While fewer than ten percent of the 1,000-plus (Hickman 1993) non-native plant taxa that have established in California are recognized as serious threats, non-native plants have dramatically changed the landscape of California.

Parkwide activities would have both beneficial and adverse impacts on vegetation. Some of the regional and local actions listed in Appendix M, such as the Yosemite Lodge Area Redevelopment, involve soil and vegetation disturbance. These activities would disturb ground, creating conditions that encourage the growth of invasive plants. Where vegetation is disturbed, Yosemite National Park and other agencies prescribe mitigations to preserve the genetic integrity of native plants and reduce the risk of importation and spread of invasive plants. For example, developed areas in Yosemite National Park are landscaped with native plants propagated from site-specific local seeds and cuttings.

Actions such as the El Capitan Meadow Restoration Project and the Visitor Use and Floodplain Restoration Project in East Yosemite Valley restore plant communities. Parkwide planning efforts such as the Wilderness Management Plan and the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans would provide large-scale watershed protection to plant communities. Prescribed fire and managed wildland fire activities would greatly reduce the threat of large high-severity catastrophic fires, and would reduce the potential for vegetation type conversion.

The combined actions of State and local programs to control invasive plant species would have a long-term beneficial impact on vegetation. The Sierra-San Joaquin Noxious Weed Alliance (Weed Management Area) addresses invasive plant issues that cross jurisdictional boundaries. Regional invasive plant control actions sponsored by Caltrans, Mariposa County, Tuolumne County, Madera County, and the federal agencies that abut Yosemite National Park (Sierra National Forest; Stanislaus National Forest; Inyo National Forest; and the BML, Merced Canyon) support invasive plant actions to control invasive plants. These invasive plant actions protect or restore native habitat, fostering native plant communities. Present and future regional actions would have localized long-term moderate beneficial impacts on vegetation.

Past impacts on vegetation have been adverse, long-term, and major. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on vegetation in California, and would produce long-term moderate beneficial effects on vegetation. These past, present, and future effects, along with the long-term minor adverse impacts of Alternative 1, would result in a long-term moderate adverse impact on vegetation.

Conclusion

Under Alternative 1, the park is not likely to meet management objectives for high- and medium-high-priority invasive species (see Appendix A). These are species with a high potential to invade natural plant

communities in the park. For example, Himalayan blackberry populations would continue to invade meadow habitat, and yellow star-thistle would continue to invade foothill woodland communities. Invasive plant work crews would continue to keep invasive plants from spreading from areas that have received treatments over the past two decades. Actions would reduce the density of invasive plants in treated areas. The area of treatment is expected to remain approximately the same size. While the continuation of comprehensive early detection, prevention, and control measures would continue to reduce the risk of new infestations and reduce the rate of spread of invasive plants into uninfested areas, the National Park Service would be unable to keep up with the rate of spread of high-priority invasive populations into a diverse set of native plant communities. Overall, Alternative 1 would result in a long-term minor adverse impact on native vegetation in the park. Alternative 1 would not impair the park's vegetation resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using these control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as the park attains management objectives for specified invasive plant populations.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Impacts on vegetation under Alternative 2 would be the same as those described for Alternative 1.

Control Treatments

Under Alternative 2, work crews would utilize multiple control techniques to treat existing invasive plant populations, including the use of glyphosate or aminopyralid herbicide to control up to 22 invasive plant species. As more invasive plant populations are eradicated or controlled, work crews would expand their treatment areas throughout native plant communities in the park.

There would be less soil disturbance under Alternative 2 than under Alternative 1, as belowground portions of invasive plants such as Himalayan blackberry would not be removed. With reduced ground disturbance, there would be a reduced risk of secondary invasive plant invasion (a situation where new invasive plants establish in sites where invasive species have been removed).

The targeted application of herbicides to invasive plants could result in a short-term minor adverse impact on adjacent native vegetation. For example, the application of aminopyralid to yellow star-thistle populations could infrequently harm some native plant species that are growing within large yellow star-thistle populations.

The spread of invasive plants into diverse vegetation communities would be substantially limited. Increases of yellow star-thistle from outlying populations would be halted, protecting foothill grassland communities. Work crews would be able to treat yellow star-thistle when the plant is green, rather than waiting until two percent of the flowers are open and the rest are in bud (the time when manual and mechanical treatments are most effective). Work crews would halt the spread of non-native blackberry into meadow and riparian habitats. Other priority invasive plants would be controlled in diverse native habitats.

The judicious use of herbicides would substantially increase the number of acres the park could treat each year, making it feasible to control many more acres of invasive plants each year than if herbicides were not used. In addition, the use of herbicides would substantially reduce the extent and intensity of ground disturbance that occurs with many types of manual and mechanical treatments. The control techniques proposed under this alternative would result in a long-term major beneficial impact on native vegetation by preventing invasions into uninfested areas.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting vegetation would be the same as those under Alternative 1. Overall, local and regional present and foreseeable future actions would produce long-term moderate beneficial effects on vegetation. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on vegetation in California. These effects, along with the beneficial long-term moderate impacts of Alternative 2, would result in long-term adverse minor impacts on vegetation.

Conclusion

Under Alternative 2, the park would meet management objectives for high- and medium-high-priority invasive plants, species with the highest potential to invade natural communities. This would protect a variety of native plant communities, including foothill woodland, riparian, and meadow communities. For example, the spread of Himalayan blackberry populations into meadow habitat would be halted, as would the spread of yellow star-thistle into foothill woodland communities. The judicious use of herbicides would greatly reduce the amount of ground disturbance and increase the treatment area each year. Overall, Alternative 2 would result in a long-term moderate beneficial impact on native vegetation in the park. Because long-term impacts on vegetation associated with Alternative 2 would be moderate and beneficial, Alternative 2 would not impair the park's vegetation resources for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-

priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Impacts under Alternative 3 would be similar to those under Alternative 2. These practices would keep species of invasive plants that already exist in the park from becoming established elsewhere in the park, and would prevent new species from entering the park and threatening native vegetation. These prevention techniques would also reduce the extent and intensity of measures needed to control or eradicate invasive plant populations that become established in the park.

Control

Under Alternative 3, work crews would utilize multiple control techniques to treat existing invasive plant populations, including the use of glyphosate or aminopyralid herbicide to control up to 35 invasive plant species. As more invasive plant populations are eradicated or controlled, work crews would expand their treatment areas throughout the park.

The impacts of control activities on vegetation under Alternative 3 would be similar to Alternative 2. However, there would be less soil disturbance and a reduced risk of secondary invasive plant invasion. The targeted application of herbicides could result in a short-term minor adverse impact on adjacent native vegetation. The control of high- and medium-high-priority invasive species would halt the spread of invasive species with the most potential to invade natural communities of the park. The spread of yellow star-thistle from outlying populations would be halted, protecting foothill grassland communities. Work crews would be able to treat yellow star-thistle when the plant is green, rather than waiting until two percent of the flowers are open and the rest are in bud (the time when manual and mechanical treatments are most effective). Work crews would halt the spread of non-native blackberry into meadow and riparian habitats. Other priority invasive plants would be controlled in diverse native habitats.

Alternative 3 would also achieve management objectives for medium-priority species. Medium-priority species are found in disturbed and developed areas of the park such as roadsides, parking lots, and construction staging areas. While medium-priority species are found in areas that are prime vectors for the spread of invasive plants throughout the park, medium-priority species do not have a high potential to spread into natural communities. Overall, the control techniques proposed under this alternative would result in a long-term major beneficial impact on native vegetation, as well as disturbed and developed lands in the park.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting vegetation would be the same as those under Alternative 1. Overall, local and regional present and foreseeable future actions would produce long-term moderate beneficial effects on vegetation. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on vegetation in California. These effects, along with the beneficial long-term moderate impacts of Alternative 3, would result in long-term adverse minor impacts on vegetation.

Conclusion

Under Alternative 3, the park would meet management objectives for high-, medium-high-, and medium-priority invasive plants. Alternative 3 would control invasive species with the highest potential to invade natural communities in the park, as well as species that are restricted to disturbed and developed lands in the park. For example, work crews would halt the spread of Himalayan blackberry and yellow star-thistle in meadow and foothill woodland communities, as well as the spread of yellow sweetclover in parking lots. The land area treated for invasive plants would increase over time. Herbicide use is expected to remain the same over time. Overall, Alternative 3 would result in a long-term moderate beneficial impact on native vegetation in the park. Because long-term impacts on vegetation associated with Alternative 3 would be moderate and beneficial, Alternative 3 would not impair the park's vegetation resources for future generations.

Wildlife

Affected Environment

Yosemite contains over 270 species of native vertebrates, including, fish, amphibians, reptiles, birds, and mammals. The park also contains thousands of species of invertebrates. This diversity is due to the wide elevational span of park habitat types, which range from foothills to alpine. For wildlife populations to be viable, resources and environmental conditions must be sufficient for animals to forage, hide, nest or den, and disperse. The distribution, type, and amounts of territory, shelter, water, and food must be sufficient for the basic needs of self-sustaining wildlife populations on a daily, seasonal, annual, and multi-year basis. Habitat must be well distributed over a broad geographic area to allow breeding individuals to interact spatially and temporally within and among populations.

Yosemite is not exempt from well-documented global decline in amphibian population numbers (Drost 1996). Extensive speculation exists regarding the cause of this global decline (Alford and Richards 1999). Toxicity of herbicides and other chemicals are possible reasons (Blaustein, Romansic et al. 2003; Collins and Storfer 2003). More recently, the spread of a fungus fatal to many amphibian species, *Batrachochytrium dendrobatitus*, has been identified as a significant factor in the global decline of amphibians, including the federal candidate species Sierra Nevada yellow-legged frog (*Rana sierrae*) and Yosemite toad (*Bufo canous*) (Rachowicz, Roland et al. 2006).

The ecology of native habitats, and, therefore, the assortment of wildlife species they support, can be altered if non-native plants become established and displace native plants. Non-native plants can change the habitat qualities needed to support the park's wildlife species. Such changes are most prevalent at lower elevations of the park, where the majority of invasive plant species are found. These effects include alterations in vegetation type and structure, reductions in natural food and cover plant species, and changes in natural fire regime.

In very rare situations, certain wildlife species may actually benefit from the presence of non-native species. For example, lesser and American goldfinches (*Carduelis psaltria* and *C. tristis,* respectively) may benefit from feeding on yellow star-thistle fruits. Black bears (*Ursus americanus*) feed heavily on Himalayan blackberries, which provide an unnatural food source. While the presence of the blackberries

may allow a given area to support more black bears, this non-native plant alters the natural ecology of the bears. In addition, the greatest concentrations of blackberries occur in Yosemite Valley, where conflicts between humans and black bears are common. The presence of blackberries likely exacerbates these conflicts by increasing the abundance of black bears above natural levels. A wide variety of bird and small mammal species also feed on blackberries, but with fewer detrimental effects. Invasive plants may be beneficial to individual animals, but they cause perturbations in the relationship between wildlife and their habitats. In a national park, where the mission is to protect and restore natural ecosystems, such effects are not acceptable. Where non-native plants become abundant, they alter natural habitats and result in highly detrimental effects on native wildlife species.

Environmental Consequences – Methodology

Controlling invasive plants would affect certain wildlife by removing non-native plants that may be providing food and cover in place of native plants. Control activities would also result in the unavoidable removal or disturbance of native plants. Direct effects on wildlife are also possible if manual, mechanical, or chemical controls disturb reproducing wildlife, such as ground- or shrub-nesting birds.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Impacts are considered adverse if implementation of an alternative would reduce the population size of any wildlife species. Impacts are considered beneficial if implementation of an alternative would maintain the population size of any wildlife species that is of natural abundance and/or increase the population size of any species that has been unnaturally reduced.

Duration of Impact: The duration of an impact is the time required for wildlife to recover after treatment. Short-term impacts are those that would last up to five years following implementation of an alternative, while long-term impacts would last longer than five years after implementation of an alternative.

Intensity of Impact: Negligible impacts on wildlife are those that would cause no measurable or perceptible changes in any native wildlife populations. Minor impacts would be measurable or perceptible, but would be localized within an isolated area, and the overall viability of wildlife populations would not be affected. Moderate impacts would cause a measurable and perceptible change in wildlife populations; however, the impact would remain localized and could be reversed. Major impacts would be substantial and highly noticeable and could be permanent in their effects on the size, diversity, or integrity of wildlife populations.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Alternative 1 would improve the ability of park staff to detect the arrival of new non-native plant species, as well as the spread of established species, which would allow proactive control of invasive species and provide a greater benefit to wildlife and habitat. Detecting species early in the invasion process and executing the appropriate response would also reduce the intensity and extent of invasive plant control efforts.

Control

Alternative 1 would employ multiple control techniques to treat existing invasive plant populations without the use of herbicides. While the continuation of comprehensive protection and control measures would continue to reduce the risk of new infestations and reduce the rate of spread of invasive plants into uninfested areas, the National Park Service would be unable to keep up with the rate of spread of invasive populations into native wildlife habitat.

Cumulative Impacts

Cumulative impacts on wildlife are based on analysis of past, present, and reasonably foreseeable future actions in California and the Yosemite region in conjunction with the potential effects of this alternative. Past and present effects to wildlife include fire suppression history, deposition of chemical compounds from outside the park, non-native species (including pathogens), and land management practices outside Yosemite. In the foreseeable future, climate change has the potential to cause large-scale major adverse impacts on wildlife. Climate change could accelerate the arrival and spread of non-native plant species by making higher elevations of the park more suitable for these species through warming. These past, present, and foreseeable future impacts are long-term, adverse, and major.

Local past and present actions would have both beneficial and adverse impacts on wildlife. Parkwide planning efforts such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans and the Wilderness Management Plan would provide large-scale watershed protection to plant communities. Prescribed fire and managed wildland fire activities would greatly reduce the threat of large high-severity catastrophic fires, and would reduce the potential for habitat conversion. Actions such as the El Capitan Meadow Restoration Project and the Visitor Use and Floodplain Restoration Project in East Yosemite Valley restore wildlife habitat.

Past impacts on wildlife have been adverse, long-term, and major. Local present actions would contribute to reversing the major adverse impacts of past actions on wildlife, and would produce long-term moderate beneficial effects. In the context of the multiple, spatially massive, and potentially catastrophic past and present effects, the impacts of Alternative 1 are negligible. The past, present, and future effects, along with the localized long-term minor adverse impacts of Alternative 1, would result in long-term adverse moderate impacts on wildlife.

Conclusion

Alternative 1 would have a long-term minor adverse effect on wildlife because the expansion of existing invasive plant populations would continue in native wildlife habitat, and the ability of park staff to respond with comprehensive eradication actions would be compromised. Long-term impacts on wildlife

associated with Alternative 1 would be minor and adverse, and continued spread of invasive plants into the natural areas of the park would potentially affect large tracts of wildlife habitat, although not enough to impair the park's wildlife resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using these control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as the park attains management objectives for invasive plant populations.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Impacts resulting from programmatic actions under Alternative 2 would be the same as those described for Alternative 1.

Control Treatments

Alternative 2 adds herbicide use to the increased early detection and the manual and mechanical removal activities proposed under Alternative 1. As the toxicity of herbicides and other chemicals has been suggested as one possible reason for the well-documented global decline of amphibians (Blaustein, Romansic et al. 2003; Collins and Storfer 2003), this section begins with a focus on potential impacts to amphibians.

A surfactant is an additive used with the active ingredient in an herbicide, used to increase the amount of active ingredient of the herbicide delivered to the target plant. The impact of specific surfactants on amphibians, known as polyethoxylated tallowamine (POEA) surfactants, is widely documented and acknowledged (Mann and Bidwell 1999; Smith 2001; Relyea 2005a; Relyea 2005b). PEOA surfactant is found in the commercial glyphosate formulation Roundup®, as well as many other terrestrial glyphosate formulations marketed for home and garden use. It is not present in commercial aquatic glyphosate formulations such as Rodeo® (Dow 2006) and Aquamaster® (Monsanto 2006b).

When applied to water, terrestrial (PEOA-containing) glyphosate formulations can rapidly kill amphibians present in the water (Relyea 2005a; Relyea 2005b). When applied in wildland situations, glyphosate appears to come out of solution quickly; the herbicide binds to soil and organic particles and is no longer dissolved in the water (Feng and Thompson 1990; Feng, Thompson et al. 1990). The key factors that appear to determine amphibian mortality are the type of surfactant used, the length of time surfactants and herbicides remain dissolved in water before being brought out of solution or degrading, and the concentration of the chemicals in water. The relationship between the concentration of the dissolved chemicals and the length of time they remain at that concentration is also an important

consideration (SERA 2003; Relyea 2004; Trumbo 2005; Relyea 2005b; Relyea 2005c), with at least one study indicating that glyphosate may remain in solution long enough to cause significant mortality (Trumbo 2005). In Yosemite, work crews would not use terrestrial glyphosate formulations (those containing PEOA surfactants) in or near water, wetlands, or within the bed and banks of Wild and Scenic Rivers.

Glyphosate alone is substantially less toxic to amphibians (SERA 2003); however, debate exists over the amount of toxicity. The source of contention appears to be discrepancies between *en vitro* studies (experiments outside a living system in an environment such as a test tube) and *en vivo* studies (experiments conducted in or on the tissue of a living organism or system). Also, it is difficult to conduct realistic large-scale control/treatment studies in actual wildland situations (Trumbo 2005; Relyea 2005b).

Recently, a number of studies (funded by National Science Foundation grants) assessed the danger of wildland applications of different glyphosate formulations on amphibians. Relyea (2005c and 2004) reported that Roundup® is extremely toxic to amphibians when applied at rates consistent with the label. Trumbo (2005) (funded by California Department of Fish and Game) countered with an analysis of Relyea's methods, indicating that Relyea's application methods were not consistent with labeling restrictions (Relyea mimicked the application of terrestrial-use herbicides to plants growing in standing water).

Trumbo (2005) conducted a study of his own, applying aquatic glyphosate formulations directly to open water (instead of on plants growing in water) in ponds, applied at the maximum rate allowed for according to labeling restrictions. This resulted in a greater concentration of herbicide entering the water than would be expected under actual application conditions. Trumbo noted little invertebrate mortality in the water, documenting also that the concentration of glyphosate in the water only briefly approached a level that would be expected to induce 50 percent mortality in larval frogs exposed for longer durations, compared with the 95 percent mortality documented by Relyea. Trumbo concluded that the R-11 surfactant used in the aquatic mix was likely more toxic than the glyphosate itself.

A large difference between the two studies is that Relyea studied Roundup®, a terrestrial-use herbicide, while Trumbo used a mixture of Rodeo® (an aquatic-use herbicide) and R-11 (a surfactant registered for aquatic use in California). Relyea stayed close to recommended application rates, except that terrestrial herbicides were used over water, which is specifically prohibited on the herbicide label. Trumbo deliberately maximized the amount of herbicide that entered the water (by spraying onto the water, instead of onto plants growing in the water, as the label requires), while not quite exceeding the recommended application rates. The two studies effectively contrast the difference between terrestrial and aquatic glyphosate formulations.

In reply to a rebuttal by Monsanto, Relyea (2005c) documented multiple cases where terrestrial glyphosate formulations were unintentionally applied to water via aerial applications by helicopters and other means (Monsanto 2006b). Feng et al. (1990) documented wetlands receiving concentrations of terrestrial-use glyphosate at rates comparable to that used in Relyea's studies; the concentrations Feng documented were also achieved via aerial application.

The R-11 surfactant approved for use in aquatic situations has been found to be more toxic to amphibians than glyphosate itself, but still of very low risk if applied in a manner consistent with labeling restrictions (SERA 1997; SERA 2003; Trumbo 2005). The presence of R-11 doubles the toxicity to aquatic organisms of glyphosate itself, presumably by enhanced absorption into the animals' bloodstreams (Trumbo 2005).

In Yosemite, two of the most invasive plants are found in seasonally flooded wetlands: velvet grass and Himalayan blackberry. To control these invasive plants, **work crews would use aquatic-approved formulations of glyphosate with an R-11 surfactant. This formulation would only be used in seasonally flooded wetlands, during the dry phase. Work crews would never apply herbicides within six feet of standing or flowing water, within the bed and banks of Wild and Scenic Rivers, or (intentionally) to plants growing in water.** All applications would take place using manually applied applications from backpack sprayers, hand-held wands extending from truck-mounted tanks, or individual containers of herbicide and a wiper tool (such as a paintbrush) to minimize the potential for drift into flooded areas. Work crews would not use aerial applications such as from an airplane or helicopter or from truck-mounted tanks with boom attachments.

Aminopyralid is considered to be a terrestrial-use herbicide; however, limited testing has indicated that the product is nearly non-toxic to amphibians (SERA 2007). Non-ionic surfactants such as R-11 may enhance effectiveness (DowAgroSciences 2005).

In summary, the key factors that influence amphibian mortality due to herbicide use are the type of herbicide mix used (terrestrial or aquatic), the application rate (above or below labeling restrictions), and the application method (aerial, ground, broadcast, or spot spray). Used alone, glyphosate and aminopyralid are functionally non-toxic to amphibians except at very high doses. Current literature indicates that aquatic glyphosate formulations used correctly pose little to no risk to amphibians. However, the surfactants used in terrestrial glyphosate formulations such as Roundup® are very toxic to amphibians, which is why such formulations cannot be used in or over water. R-11 aquatic surfactant is moderately toxic to aquatic organisms, but only at concentrations far above the label-approved application methods. Aerial applications, which would not occur in Yosemite, carry a significant risk of depositing terrestrial-use herbicides (such as Roundup®) into aquatic environments.

Under Alternative 2, the park would use aquatic formulations of glyphosate during the dry portions of seasonally flooded wetlands and near water, and would only use terrestrial glyphosate formulations outside of wetlands or water. This would reduce the use of terrestrial surfactants, and eliminate the risk of accidentally applying terrestrial formulations to water. Aerial spraying would not be acceptable and would not occur in Yosemite. Herbicides would not be used within six feet of standing water. The appropriate use of terrestrial or aquatic formulations of glyphosate or aminopyralid, subject to labeling restrictions, without aerial application, in terrestrial environments carries little to no risk to amphibians.

The actions proposed under Alternative 2 would result in a long-term moderate beneficial effect on wildlife by providing another effective tool for controlling non-native plant species and their adverse effects on wildlife and habitat. While there may be some concern regarding the effects of herbicides on wildlife, such effects are considered negligible as long as the herbicides are used in compliance with the manufacturer's and the EPA's guidelines and limits. Manual and mechanical treatments supplemented by herbicide use would increase the infected area that could be treated, and possibly reduce the disturbance

of wildlife caused by mechanical removal. The combination of these actions would result in a long-term moderate beneficial impact on wildlife by more effectively removing the non-native plant species that adversely affect wildlife and habitat.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting wildlife would be the same as those under Alternative 1. Past impacts on wildlife have been adverse, long-term, and major. Local present actions would contribute to reversing the major adverse impacts of past actions on wildlife, and would produce long-term moderate beneficial effects. In the context of the multiple, spatially massive, and potentially catastrophic past and present effects, the impacts of Alternative 2 are negligible. The past, present, and future effects, along with the localized long-term moderate beneficial impacts of Alternative 2, would result in long-term adverse moderate impacts on wildlife.

Conclusion

The judicious use of herbicides would reduce the amount of ground disturbance and increase the area of invasive plant populations that could be treated each year. The use of terrestrial or aquatic formulations of glyphosate or aminopyralid, subject to labeling restrictions, without aerial application, in terrestrial environments carries little to no risk to amphibians. Alternative 2 would result in a long-term moderate beneficial impact on wildlife in the park. Because long-term impacts on wildlife associated with Alternative 2 would be moderate and beneficial, Alternative 2 would not impair the park's vegetation resources for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Impacts resulting from Alternative 3 would be similar to those described for Alternative 2, except that herbicides would also be used to prevent new populations from occurring in areas of frequent disturbance or recent earthmoving activities such as road corridors and staging areas. These prevention practices would keep species that already exist in the park from becoming established elsewhere in the park, as well as prevent new species of invasive plants from entering the park and threatening wildlife habitat. These prevention techniques would also reduce the extent and intensity of measures needed to control or eradicate invasive plant populations that become established in the park.

Control Treatments

The impacts of control actions on wildlife under Alternative 3 would be the same as under Alternative 2. Actions would result in a long-term moderate beneficial impact on wildlife by more effectively removing the non-native plant species that adversely affect wildlife and habitat.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting wildlife would be the same as those under Alternative 1. Past impacts on wildlife have been adverse, long-term, and major. Local present actions would contribute to reversing the major adverse impacts of past actions on wildlife, and would produce long-term moderate beneficial effects. In the context of the multiple, spatially massive, and potentially catastrophic past and present effects, the impacts of Alternative 3 are negligible. The past, present, and future effects, along with the localized long-term moderate beneficial impacts of Alternative 3, would result in long-term adverse moderate impacts on wildlife.

Conclusion

Under Alternative 3, the increased use of herbicides would allow larger infested areas to be treated. Less time would be dedicated to detecting infestations, because existing non-native populations would be effectively eradicated and new invasions could be permanently removed. The combination of these factors would result in a long-term moderate beneficial impact on wildlife by restoring natural plant communities quickly and effectively. Because long-term impacts on wildlife associated with Alternative 3 would be moderate and beneficial, Alternative 3 would not impair the park's vegetation resources for future generations.

Special-Status Plants

Affected Environment

Special-status plants in Yosemite reflect the complex geologic substrate, diverse topography, and wide elevation range found in the park. Over 150 special-status plant taxa (including vascular plant species, subspecies, and varieties) are known to occur in Yosemite National Park and the El Portal Administrative Site (USGS 2005). Special-status plants in Yosemite include species listed under the federal Endangered Species Act of 1973, as amended; species listed under the State Endangered Species Act; and sensitive plant species designated by park staff.

No federally listed plants are documented within Yosemite National Park or the El Portal Administrative Site. Four plant species listed as Rare by the State of California are found in the park or administrative site: Yosemite onion (*Allium yosemitense*), Tompkin's sedge (*Carex tompkinsii*), Congdon's woolly-sunflower (*Eriophyllum congdonii*), and Congdon's lewisia (*Lewisia congdonii*) (see Table III-1). An additional 146 special-status plants found within park boundaries are designated Park Sensitive.

Table III-1: State of California Rare Plants Known to Occur in Yosemite National Park and the El Portal Administrative Site

Common Name and Scientific Name	Habitat Type/Occurrence
Yosemite onion *Allium yosemitense*	Confined to open metamorphic slabs, talus slopes, and scree. Restricted to the Merced River watershed in foothill woodland and lower montane zones.
Tompkin's sedge *Carex tompkinsii*	Limited to foothill oak woodland and chaparral areas and along low talus slopes. Found sporadically from Arch Rock to El Portal in the Merced River canyon.
Congdon's woolly-sunflower *Eriophyllum congdonii*	Restricted to dry, mostly south-facing metamorphic and metasedimentary outcrops. Occurs on dry ridges on rocks, scree, and talus in foothill woodland and lower montane zones.
Congdon's lewisia *Lewisia congdonii*	Restricted to moist, shady, mostly north-facing slopes and metamorphic rock faces in foothill woodland and lower montane zones.

The National Park Service Management Policies (NPS 2006c), in particular, prescribes the management of special-status species in conformance with the federal and State Endangered Species Acts. This policy states:

> [The National Park Service will] undertake active management programs to inventory, monitor, restore, and maintain listed species' habitats, *control detrimental non-native species*, control detrimental visitor access, and re-establish extirpated populations as necessary to maintain the species and the habitats upon which they depend. (emphasis added)
>
> The National Park Service will inventory, monitor, and manage State and locally listed species in a manner similar to its treatment of federally listed species, to the greatest extent possible.

Invasive plant infestations can affect special-status plants in several ways. Aggressive invasive plants intercept light, moisture, and nutrients, and can directly out-compete special-status plants. Invasive plants can indirectly cause the decline or extirpation of special-status plants by altering their habitat to a degree that affects the interactions of predators, pollinators, and other elements of a functioning ecosystem (Gordon 1998). Invasive plants in Yosemite threaten special-status plants in a number of habitats, particularly low-elevation foothill woodland, meadow, and forested habitats.

The four California State Rare species known to occur in Yosemite are all found in the foothill habitats of El Portal, the site of large populations of the invasive yellow star-thistle. In low-elevation meadow habitat, non-native perennial grasses and herbs alter native plant communities. Intact meadow habitat supports Park Sensitive plants such as round-leaved sundew (*Drosera rotundifolia*), northern bedstraw (*Galium boreale* ssp. *septentrionale*), false pimpernel (*Lindernia dubia* var. *anagallidea*), and ladies' tresses (*Spiranthes porrifolia*). Special-status plants found at higher elevations are currently free from non-native plant invasion, although invasive plants such as velvet grass have the potential to spread into high-elevation habitat for special-status plants.

Environmental Consequences – Methodology

This analysis considers the effects of the alternatives on special-status species and their habitats. Each special-status species was evaluated to determine its known or likely occurrence or preferred habitat in the vicinity of invasive plants. The analysis also evaluates the potential for direct physical loss or fragmentation of special-status species habitat.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Impacts are considered adverse if implementation of an alternative would degrade the natural size or integrity of special-status species populations. Impacts are considered beneficial if implementation of an alternative would decrease the size or integrity of special-status species populations.

Duration of Impact: The duration of an impact is the time required for special-status plants to recover after invasive plant control treatments. Short-term impacts are those that would immediately affect a special-status plant species, but would not cause long-term declines in population or species viability. Long-term impacts would lead to a loss in population or species viability, as exhibited by a decline in overall species abundance, viability, and/or survival.

Intensity of Impact: Impact intensity is a measure of the integrity of special-status species habitat, and potential changes in the size or distribution of special-status species populations. Negligible impacts are those that would be imperceptible or undetectable. Minor impacts would be slightly detectable and localized within a small area, but would not expand if left alone. Minor impacts would not affect the overall viability of special-status species in the park; without further impacts, minor adverse effects would reverse and the species would recover. Moderate impacts would be apparent and sufficient to cause a change in the abundance, distribution, quantity, or integrity of special-status populations, but the effect would remain localized. Major impacts would be substantial and highly noticeable, with the potential for landscape-scale changes in species populations or habitat.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The programmatic actions described for Alternative 1 would reduce the risk of new invasive plant populations from establishing in special-status plant habitat. Early detection, rapid response, and prevention practices would help keep species that already exist within park boundaries from becoming established elsewhere in the park. These practices would also reduce the number of new species of invasive plants entering the park. Furthermore, if work crews discover invasive plant populations before they are well established, the prevention techniques would reduce the extent and intensity of measures needed to control or eradicate invasive plant populations. The prioritization practices outlined for this alternative would assist resource managers by ensuring the proper distribution of limited resources

(primarily staffing and equipment) for control and eradication efforts. Implementation of research actions under Alternative 1 would help improve all components of the invasive plant program by helping park staff to understand the most efficient and effective approach to invasive plant management. Monitoring activities would allow resource managers to determine the effectiveness of management actions and the success of these actions in achieving objectives, thus improving the efficiency of resource allocation. Implementation of comprehensive early detection and rapid response, prevention, prioritization, monitoring, research, and education practices would have a long-term minor beneficial impact on special-status plants in Yosemite.

Control

Under Alternative 1, the park would continue to utilize multiple control techniques to treat existing invasive plant populations without the use of herbicides. For over a decade, park staff and volunteers have been treating yellow star-thistle located near populations of Congdon's woolly sunflower without the use of herbicides. These treatments have resulted in a substantial reduction of yellow star-thistle per year. Because of the extent of yellow star-thistle (over 110 acres), and the narrow window of opportunity to manually or mechanically treat this species (when two to five percent of the plant is in bloom), it is not possible to treat the entire population every year; thus, outlying populations would continue to grow and spread.

Special-status plants in low-elevation meadows that compete with historical populations of non-native grasses and forbs have a different challenge. These invasive plants, most of which are deep-rooted perennials, would be extremely difficult to remove without first implementing a large-scale restoration of the hydrologic and other processes that sustain the meadow.

With the existing slate of manual and mechanical control techniques, it is likely that the park would not meet management objectives for high-priority species. The level of risk of new invasive plant infestation and spread in special-status habitat would remain high, particularly in low-elevation foothill woodland and meadow communities. Yellow star-thistle populations would remain a threat to the California State Rare Congdon's woolly sunflower and other special-status plant species. Non-native blackberry and velvet grass would remain a threat to Park Sensitive plants found in meadow habitat. The use of existing measures to control invasive plants would result in a long-term minor beneficial impact on special-status plants.

Cumulative Impacts

Cumulative impacts on special-status plant species are based on analysis of past, present, and reasonably foreseeable future actions in California and the Yosemite region in conjunction with the potential effects of this alternative. Past impacts threaten special-status plant habitat throughout California, including urbanization and agricultural conversion, alteration of natural processes that sustain plant habitat, and introduction of non-native plants and animals. Special-status plants are often dependent on specialized habitats that are fragmented, degraded, or completely eliminated (CNPS 2001) . The overall loss of native plant and special-status plant habitat in California has been adverse, long-term, and major.

Some of the regional and local actions listed in Appendix M, such as the El Portal Road Improvements Project, involve soil and vegetation disturbance. Where vegetation is disturbed, Yosemite National Park

and other agencies ensure that mitigation is included to protect special-status plants. Parkwide planning efforts such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans and the Wilderness Management Plan would provide large-scale watershed protection to plant habitat. Prescribed fire and managed wildland fire activities would greatly reduce the threat of large high-severity catastrophic fires, and would reduce the potential for vegetation type conversion. Actions such as the El Capitan Meadow Restoration Project and the Visitor Use and Floodplain Restoration Project in East Yosemite Valley restore native plant habitat that could sustain special-status species.

The combined actions of State and local programs to control invasive plant species would have a long-term beneficial impact on special-status plant species. The Sierra-San Joaquin Noxious Weed Alliance (Weed Management Area) addresses invasive plant issues that cross jurisdictional boundaries. Regional invasive plant control actions sponsored by Caltrans, Mariposa County, Tuolumne County, Madera County, and the federal agencies that abut Yosemite National Park (Sierra National Forest; Stanislaus National Forest; Inyo National Forest; and the BLM, Merced Canyon) support invasive plant actions to control invasive plants. These invasive plant actions protect or restore native plant communities that often sustain special-status plants. Present and future regional actions would have localized long-term moderate beneficial impacts on special-status plant habitat.

Past impacts on special-status plants have been adverse, long-term, and major. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on special-status plants, and would produce long-term minor beneficial effects on special-status plants. These past, present, and future effects, along with the localized long-term minor beneficial impacts of Alternative 1, would result in long-term adverse minor impacts on vegetation.

Conclusion

Under Alternative 1, implementation of prevention and control practices would have a long-term minor beneficial impact on special-status plants in Yosemite. Alternative 1 would not likely affect special-status vegetation species in Yosemite. Because long-term impacts on special-status plants associated with Alternative 1 would be minor and beneficial, Alternative 1 would not impair the park's special-status plant resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts of comprehensive programmatic actions on special-status plant species would be the same as under Alternative 1. Implementation of comprehensive early detection and rapid response, prevention, prioritization, monitoring, research, and education practices would have a long-term minor beneficial impact on special-status plants in Yosemite.

Control

Alternative 2 would utilize multiple control techniques to treat existing invasive plant populations, including the use of herbicides. The judicious use of herbicides would increase the number of acres of yellow star-thistle that work crews could treat in the vicinity of Congdon's woolly sunflower habitat, making it feasible for the park to control many more acres each year than if herbicides were not used. Work crews would be able to treat yellow star-thistle when the plant is green, rather than waiting until two percent of the flowers are open and the rest are in bud (the time when manual and mechanical treatments are most effective). Herbicides would not be used in proximity to special-status plant populations. It may be possible to control yellow star-thistle in three to five years, with only occasional hand-pulling necessary in the future. This control strategy would remove the threat of yellow star-thistle invasion into Congdon's woolly sunflower habitat. There would be a negligible impact on special-status plants in low-elevation meadows, because this plan would not address the non-native grasses and sedges in the meadow that compete with special-status plants in low-elevation meadows. Alternative 2 would result in a long-term moderate beneficial impact on special-status plants in low-elevation foothill woodlands due to its potential to eliminate invasive yellow star-thistle from special-status species habitat. Overall, control actions under Alternative 2 would result in a long-term moderate beneficial impact on special-status plants.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting special-status plants would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce long-term minor beneficial effects on special-status plants. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on special-status plants in California. These effects, along with the beneficial long-term moderate impacts of Alternative 2, would result in long-term adverse minor impacts.

Conclusion

The programmatic actions proposed under Alternative 2 (early detection and rapid response, prevention, prioritization, monitoring, research, and education practices) would reduce the risk of new invasive plant infestations in special-status plant habitat. The control methods described for this alternative would have a long-term moderate beneficial impact on special-status species due to the potential to eliminate invasive yellow star-thistle and other invasive plants from special-status species habitat. Overall, the actions prescribed under Alternative 2 would have a long-term moderate beneficial impact on special-status plant habitat. Alternative 2 would not likely affect special-status vegetation species in Yosemite. Because long-term impacts on special-status plants under Alternative 2 would be moderate and beneficial, Alternative 2 would not impair the park's special-status plant resources for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

Implementation of the early detection and rapid response, prevention, prioritization, monitoring, research, and outreach and education actions prescribed under Alternative 3 would be expected to result in the same impacts on special-status species as those described for Alternative 2.

Control

The impacts of control activities on special-status plant species would be the same as those under Alternative 2. Control actions would result in a long-term moderate beneficial impact on special-status plants.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting special-status plants would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce long-term minor beneficial effects on special-status plants. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on special-status plants in California. These effects, along with the beneficial long-term moderate impacts of Alternative 3, would result in long-term adverse minor impacts.

Conclusion

The programmatic actions proposed under Alternative 3 (early detection and rapid response, prevention, prioritization, monitoring, research, and education practices) would reduce the risk of new invasive plant infestations in special-status plant habitat. The control methods described for Alternative 3 would have a long-term moderate beneficial impact on special-status species due to the potential to eliminate invasive yellow star-thistle and other invasive plants from special-status species habitat. Overall, the actions prescribed under Alternative 3 would have a long-term moderate beneficial impact on special-status plant habitat. Alternative 1 would not likely affect special-status vegetation species in Yosemite. Because long-term impacts on special-status plants under Alternative 3 would be moderate and beneficial, Alternative 3 would not impair the park's special-status plant resources for future generations.

Special-Status Wildlife

Affected Environment

This section focuses on special-status wildlife species that have declined to the point where further declines could result in their extinction. As such, these species are sensitive to even small changes in their populations, and require separate evaluation of possible adverse effects under the context of this plan's alternatives. This analysis considers special-status wildlife species at the State and federal listing level, as shown in Table III-2. Section 7 (a) (2) of the federal Endangered Species Act of 1973, as amended, requires all federal agencies to consult with the USFWS to ensure that actions taken by the agencies do not jeopardize the continued existence of federally listed or proposed threatened or endangered species, or result in the destruction of adverse modification of designated critical or proposed critical habitat.

Table III-2: Yosemite Special-Status Wildlife Species

Special-Status Wildlife Species	Federal Status	State Status	Habitat
Invertebrates			
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)	FT		Occurs below 3,000 feet in elevation. Entire life cycle revolves around elderberry plants (*Sambucus* spp.). Adult beetles lay eggs in the bark of the elderberry shrubs where they hatch. The larvae feed on plant tissues under the bark, and eventually emerge as adults through distinctive exit holes. Elderberry plants with probable valley elderberry longhorn beetle exit holes have been found in El Portal.
Amphibians			
Yosemite toad (*Bufo canorus*)	FC	CSC	Found at elevations above approximately 6,400 feet. Breeds in shallow ponds and wet meadows. After breeding, adults disperse into the surrounding landscape, but are most likely found in meadow habitat.
California red-legged frog (*Rana aurora draytonii*)*	FT	CSC	Believed to be extirpated from Yosemite National Park. Formerly found in quiet pools and permanent streams in mixed conifer zones and foothill woodlands. Prefers deciduous riparian habitat.
Sierra Nevada yellow-legged frog (*Rana sierrae*)	FC	CSC	As with the Yosemite toad, the Sierra Nevada yellow-legged frog has a high elevation distribution, and is found above 4,600 feet. Occurs in streams, lakes, and ponds in a variety of vegetation types.
Birds			
Bald Eagle (*Haliaeetus leucocephalus*)		SE	Found in very low density in the park, usually around rivers and large lakes where it subsists primarily on fish.
American peregrine falcon (*Falco peregrinus anatum*)		SE	Nests on high cliffs in a few locations in Yosemite, and preys primarily on birds that inhabit the cliffs or the habitats below.

Table III-2: Yosemite Special-Status Wildlife Species			
Special-Status Wildlife Species	**Federal Status**	**State Status**	**Habitat**
Great gray owl (*Strix nebulosa*)		SE	Nests in forests, and forages nearby in large meadows at 4,000 to 8,000 feet in elevation. In winter, the owls move downslope to lower elevation meadows (as low as 2,000 feet).
Willow flycatcher (*Empidonax trailii*)		SE	A recent study suggests that this species no longer breeds in Yosemite (Siegel, Pyle et al. 2006). Nesting habitat of this species is shrubby willows in wet meadows, mostly at 4,000 to 5,000 feet in elevation. This habitat was once common in the park, including Yosemite Valley. Its disappearance from Yosemite follows a Sierrawide change in the species' abundance.
Mammals			
Sierra Nevada red fox (*Vulpes vulpes necator*)		ST	This enigmatic species is easily confused with the introduced Eastern red fox. As such, the ability to confirm its existence and distribution in the Sierra Nevada is problematic. Early accounts of the species indicate that it was restricted to high elevations of the park (Grinnell and Irwin 1924).
California wolverine (*Gulo gulo*)		ST	It is uncertain whether this species is still present in Yosemite (Garcelon 2006). Historical documentation of this species indicates that it occurred at high elevations in the park.
Pacific fisher (*Martes pennanti*)	FC	CSC	The most recent data on this species (Chow, Wagtendonk et al. 1994) indicate that it is very rare in Yosemite, but occurs at lower elevations than formerly believed, extending into oak and mixed confer habitats. Crucial habitat attributes of this species include dense canopy closure and complex understory structure.
American badger (*Taxidea taxus*)		CSC	Records of this species are fragmentary, but indicate that badgers can occur over a wide range of elevations and habitat types. Its distribution is dependent on its prey—burrowing rodents such as California ground squirrel (*Spermophilus beecheyi*), Belding's ground squirrel (*Spemophilus beldingi*), and yellow-bellied marmot (*Marmota flaviventris*). These prey species occur in open meadow habitats (squirrels) and rocky areas (marmot).
Sierra bighorn sheep (*Ovis canadensis californiana*	SE	FE	Found in very small numbers in high-elevation alpine habitat.

FE – Federal Endangered
FT – Federal Threatened
FC – Federal Candidate
SE – State Endangered
ST – State Threatened
CSC – California Species of Concern

Environmental Consequences – Methodology

Control of invasive plants would affect certain special-status wildlife by removing non-native plants that may be providing food and cover in place of native plants; control activities would also result in the unavoidable removal or disturbance of native plants. Direct effects on wildlife are also possible if manual, mechanical, or chemical controls disturbed reproducing wildlife, such as ground- or shrub-nesting birds.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Impacts are considered adverse if implementation of an alternative would reduce the population size of any special-status wildlife species. Impacts are considered beneficial if implementation of an alternative would maintain the population size of any wildlife species that is of natural abundance, and/or increase the population size of any species that has been unnaturally reduced.

Duration of Impact: The duration of an impact is the time required for special-status wildlife to recover after treatment. Short-term impacts are those that would last up to five years following implementation of an alternative. Long-term impacts would last longer than five years after implementation of an alternative.

Intensity of Impact: Negligible impacts on special-status wildlife are those that would cause no measurable or perceptible changes in any native wildlife populations. Minor impacts would be measurable or perceptible, but would be localized within an isolated area, and the overall viability of wildlife populations would not be affected. Moderate impacts would cause a measurable and perceptible change in wildlife populations; however, the impact would remain localized and could be reversed. Major impacts would be substantial and highly noticeable and could be permanent in their effects on the size, diversity, or integrity of special-status wildlife populations.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, Education, and Control

Under this alternative, the park would manage high-priority non-native plants at current levels. This level of management is inadequate to prevent the spread of invasive species already found in the park and to keep other invasive species from becoming established. There could be an adverse effect on the valley elderberry longhorn beetle if non-native plants out-compete elderberry plants or inhibit reproduction of elderberry plants. Altered fire regimes supported by non-native plants could adversely affect elderberry plants. There would be a long-term minor adverse impact on the valley elderberry longhorn beetle.

Yosemite toads are unlikely to be affected by current invasive plant control efforts due to the high-elevation distribution of the species. In yellow-legged frog habitat, invasive plant managers would consult with wildlife biologists during the planning phase for control activities. If invasive plant control work would be conducted in likely special-status wildlife habitat, surveys would be performed before the park conducted invasive plant control measures. In the event that special-status wildlife occupy areas slated for

treatment with herbicides, chemical treatments would not occur, and managers would develop site-specific mitigations to ensure that manual or mechanical control actions would not adversely affect special-status wildlife (see Table II-5). It is unlikely that control measures would have an appreciable effect on the Sierra Nevada yellow-legged frog with these measures in place. There would be a long-term negligible adverse impact on the Yosemite toad and the Sierra Nevada yellow-legged frog.

Effects on bald eagle and peregrine falcon populations would only occur if invasive plant control resulted in a radical change in the vegetation type and structure over which it forages. This would not occur under Alternative 1. The estimated effects on the peregrine falcon and bald eagle would be long-term negligible and adverse.

Current locations of invasive plants overlap very little with active great gray owl breeding habitat, but may adversely affect the species on its lower-elevation wintering grounds. Removal of invasive meadow plant species by manual and mechanical techniques where great gray owls are present could disrupt feeding activity. To mitigate this potential effect, the park would schedule plant removal during periods when the birds are least susceptible to disturbance. Over the long term, restoration of a natural assemblage of meadow plants could improve prey forage. Under Alternative 1, there would be a short-term adverse minor impact and a long-term minor beneficial impact on the great gray owl.

Increased suppression of invasive plants would have a positive effect on willow flycatcher habitat by returning native plants to habitats in which willow flycatcher historically nested and foraged. The benefit, however, would be long-term negligible and beneficial, because the suspected cause of the disappearance of the willow flycatcher from Yosemite likely has a more regional cause (other than habitat degradation in Yosemite) (Siegel, Pyle et al. 2006).

Early accounts of the Sierra Nevada red fox indicate that it was restricted to high elevations of the park (Grinnell and Irwin 1924). Because the vast majority of the non-native plants would be controlled occur at the lower elevations of Yosemite, the Sierra Nevada red fox would not be affected.

It is uncertain whether the California wolverine still occurs in Yosemite (Garcelon 2006). Historical documentation of this species indicates that it occurred at high elevations of the park, where non-native plant control would be unlikely to take place. There would be no effect on the California wolverine.

The Pacific fisher is very rare in Yosemite, but occurs at lower elevations than formerly believed, extending into oak and mixed-conifer habitats. Crucial habitat attributes of this species include dense canopy closure and complex understory structure. Alternative 1 is unlikely to affect these crucial habitat attributes. There would be no effect on the Pacific fisher.

The American badger can occur over a wide range of elevations and habitat types. Its distribution is dependent upon its prey, which includes burrowing rodents and yellow-bellied marmot. These prey species occur in open meadow habitats (squirrels) and rocky areas (marmot). At low elevations, invasive plants may affect habitat quality by altering food availability for prey species. Current levels of non-native plant control may not be adequate to reduce invasive species populations, leading to further spread of invasive plants. Under Alternative 1, there would be a long-term minor adverse effect on the American badger.

Alternative 1 is not expected to have an appreciable effect on Sierra bighorn sheep, either positive or negative, because of the absence of non-native plant species in its habitat.

Cumulative Impacts

Cumulative impacts on special-status wildlife are based on analysis of past, present, and reasonably foreseeable future actions in California and the Yosemite region in conjunction with the potential effects of this alternative. Past and present effects to special-status wildlife include fire suppression history, deposition of chemical compounds from outside the park, non-native species (including pathogens), and land management practices outside Yosemite. In the foreseeable future, climate change has the potential for large-scale major adverse impacts on wildlife. Climate change could accelerate the arrival and spread of non-native plant species by making higher elevations of the park more suitable for these species through warming. These past, present, and foreseeable future impacts are long-term, adverse, and major.

Local past and present actions would have both beneficial and adverse impacts on special-status wildlife. Parkwide planning efforts such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans and the Wilderness Management Plan would provide large-scale watershed protection to plant communities. Prescribed fire and managed wildland fire activities would greatly reduce the threat of large high-severity catastrophic fires, and would reduce the potential for habitat conversion. Actions such as the El Capitan Meadow Restoration Project and the Visitor Use and Floodplain Restoration Project in East Yosemite Valley restore wildlife habitat.

Past impacts on special-status wildlife have been adverse, long-term, and major. Local present actions would contribute to reversing the major adverse impacts of past actions on special-status wildlife, and would produce long-term moderate beneficial effects. In the context of the multiple, spatially massive, and potentially catastrophic past and present effects, the impacts of Alternative 1 are negligible. The past, present, and future effects, along with impacts of Alternative 1, would result in long-term adverse moderate impacts on special-status wildlife.

Conclusion

There would be a long-term negligible adverse impact on the Yosemite toad, Sierra Nevada yellow-legged frog, peregrine falcon, and bald eagle. There would be a long-term minor adverse impact on the valley elderberry longhorn beetle and the American badger. There would be a short-term minor adverse impact and a long-term minor beneficial impact on the great gray owl. There would be a long-term negligible beneficial impact on willow flycatcher habitat. There would be no effect on the Sierra Nevada red fox, California wolverine, Pacific fisher, or Sierra bighorn sheep. Alternative 1 would not likely affect special-status wildlife species in Yosemite. Alternative 1 would not impair special-status wildlife for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of control techniques as described under Actions Common to

All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using these control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as management objectives for specified invasive plant populations are met.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, Education, and Control

Alternative 2 adds herbicide use to the increased detection and removal activities proposed under Alternative 1. Together, these actions would result in a long-term moderate beneficial effect on special-status wildlife by providing another effective tool for controlling non-native plant species and their adverse effects on wildlife and habitat. The effects of the specified herbicide use are considered negligible as long as the herbicides are used according to the guidelines and limits of the manufacturer and the EPA (see Appendices E, F, G, and H). Herbicide use, in addition to manual and mechanical removal of non-native plants, would increase the infected area that could be treated, and possibly reduce the disturbance of special-status wildlife caused by manual and mechanical removal. The combination of these actions would result in a long-term moderate beneficial impact on wildlife by more effectively removing the non-native plant species that adversely affect special-status wildlife and habitat.

Under Alternative 2, the area of invasive plants treated in valley elderberry longhorn beetle habitat would increase. There would be a long-term negligible beneficial impact on the valley elderberry longhorn beetle.

High-priority invasive plants slated for herbicide treatments are not currently known in the high-elevation habitats of the Yosemite toad, or at the elevation and type of habitat of the Sierra Nevada yellow-legged frog. Biologists would determine whether special-status amphibians are present before any type of invasive plant control measure occurs in likely habitat. In the unlikely event that high-priority invasive plants slated for treatment with herbicides are discovered in habitat occupied by special-status amphibians, chemical treatments would not occur and control measures would be restricted to manual and mechanical means. Under Alternative 2, there would be a negligible adverse impact on the Yosemite toad and the Sierra Nevada yellow-legged frog.

Effects on the bald eagle and peregrine falcon would occur only if invasive plant control resulted in a radical change in the vegetation type and structure over which they forage, which is not anticipated under Alternative 2. The estimated effects on the peregrine falcon and bald eagle under Alternative 2 would be long-term negligible.

Current locations of invasive plants overlap very little with active great gray owl breeding habitat, but may adversely affect the species on its lower-elevation wintering grounds. Removal of invasive meadow plant species by manual and mechanical techniques where great gray owls are present could disrupt feeding activity. To mitigate this potential effect, the park would schedule plant removal during periods when the birds are least susceptible to disturbance. Over the long term, restoration of a natural assemblage of meadow plants could improve prey forage. Under Alternative 2, there would be a short-term adverse minor impact and a long-term minor beneficial impact on the great gray owl.

Increased suppression of non-native plants using a full range of tools would have a positive effect on the willow flycatcher by returning native plants to willow flycatcher nesting and foraging habitat. The benefit, however, would be minor, because the suspected cause of the disappearance of the willow flycatcher from Yosemite likely has a more regional in cause (other than habitat degradation in Yosemite) (Siegel, Pyle et al. 2006). There would be a long-term minor beneficial impact on willow flycatcher habitat.

Early accounts of the Sierra Nevada red fox indicate that it was restricted to high elevations of the park (Grinnell and Irwin 1924). The vast majority of invasive plants would be controlled at lower elevations of Yosemite. There would be no effect on the Sierra Nevada red fox.

It is uncertain whether the California wolverine still occurs in Yosemite (Garcelon 2006). Historical documentation of this species indicates that it occurred at high elevations of the park, where non-native plant control would be unlikely to take place. There would be no effect on the California wolverine.

The Pacific fisher is very rare in Yosemite, but occurs at lower elevations than formerly believed, extending into oak, mixed- conifer habitats. Crucial habitat attributes of this species include dense canopy closure and complex understory structure. Alternative 2 is unlikely to affect these crucial habitat attributes. There would be no effect on the Pacific fisher.

The American badger can occur over a wide range of elevations and habitat types. Its distribution is dependent upon its prey, which includes burrowing rodents and yellow-bellied marmot. These prey species occur in open meadow habitats (squirrels) and rocky areas (marmot). At low elevations, invasive plants may affect habitat quality by altering food availability for prey species. More aggressive suppression of invasive plants under Alternative 2 would have a better chance of restoring natural plant assemblages in badger habitat. Under Alternative 2, there would be a long-term minor beneficial effect on the American badger.

Alternative 2 is not expected to have an appreciable effect on Sierra bighorn sheep, either positive or negative, because of the absence of non-native plant species in its habitat.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting special-status wildlife would be the same as those under Alternative 1. Past impacts on special-status wildlife have been adverse, long-term, and major. Local present actions would contribute to reversing the major adverse impacts of past actions on wildlife, and would produce long-term moderate beneficial effects. In the context of the multiple, spatially massive, and potentially catastrophic past and present effects, the impacts of Alternative 2 are negligible. The past, present, and future effects, along with the impacts of Alternative 2, would result in long-term adverse moderate impacts on wildlife.

Conclusion

There would be a long-term negligible adverse impact on the Yosemite toad and the Sierra Nevada yellow-legged frog. There would be negligible impacts on the peregrine falcon and bald eagle. There would be a long-term negligible beneficial impact on the valley elderberry longhorn beetle and willow flycatcher habitat. There would be a long-term minor beneficial impact on the American badger. There

would be a short-term minor adverse impact and a long-term minor beneficial impact on the great gray owl. There would be no effect on the Sierra Nevada red fox, California wolverine, Pacific fisher, or Sierra bighorn sheep. Alternative 2 would not likely affect special-status wildlife species in Yosemite. Alternative 2 would not impair special-status wildlife for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, Education, and Control

Under Alternative 3, the area of invasive plant treatment would increase, with a full range of tools for invasive plant control. Although the acreage of invasive plants treated would increase, the relative benefits would be essentially the same as under Alternative 2.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting special-status wildlife would be the same as those under Alternative 1. Past impacts on wildlife have been adverse, long-term, and major. Local present actions would contribute to reversing the major adverse impacts of past actions on wildlife, and would produce long-term moderate beneficial effects. In the context of the multiple, spatially massive, and potentially catastrophic past and present effects, the impacts of Alternative 3 are negligible. The past, present, and future effects, along with impacts of Alternative 3, would result in long-term adverse moderate impacts on wildlife.

Conclusion

There would be a long-term negligible adverse impact on the Yosemite toad, Sierra Nevada yellow-legged frog, peregrine falcon, and bald eagle. There would be a long-term negligible beneficial impact on the valley elderberry longhorn beetle and willow flycatcher habitat. There would be a long-term minor beneficial impact on the American badger. There would be a short-term minor adverse impact and a long-term minor beneficial impact on the great gray owl. There would be no effect on the Sierra Nevada red fox, California wolverine, Pacific fisher, or Sierra bighorn sheep. Alternative 3 would not likely affect special-status wildlife species in Yosemite. Alternative 3 would not impair special-status wildlife for future generations.

Air Quality

Affected Environment

Yosemite National Park is classified as a mandatory Class I area under the Clean Air Act (42 United States Code [USC] 7401 et seq.). This air quality classification aims to protect national parks and Wilderness areas from air quality degradation. The Clean Air Act gives federal land managers the responsibility of protecting air quality and related values— including visibility, plants, animals, soils, water quality, cultural resources, and public health—from adverse air pollution impacts. The EPA has set national standards for six pollutants: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter less than 10 microns in diameter (PM_{10}). In addition, California has set ambient air quality standards that are stricter than the national standards.

Air pollutants can affect both human health and the ecology of Sierra Nevada landscapes, but human exposure is currently most aggressively protected by federal and State law. From a human health perspective, air quality throughout Yosemite is generally good, with the exception of: 1) spatially localized nighttime smoke accumulation due to prescribed fires, wildland fires, and camp fires; and 2) regionally high ozone in the front-country during hot stagnant summer days when upslope winds bring ozone precursors (i.e., nitrogen oxides [NO_x] and volatile organic compounds [VOCs]) into the park from urban sources to Yosemite's west. Asthmatics, people with cardiovascular problems, the elderly, children, and actively exercising individuals are the most vulnerable to these pollutants.

Less is known about ecological impacts of air pollutants in Yosemite, but damage to Jeffrey Pine (*Pinus jeffreyii*), generally at elevations below 6,000 to 7,000 feet on the western slopes of the park, has been well documented for several decades. From other parks (i.e., Great Smokies National Park), evidence also exists that elevated levels of ozone can reduce the ability of a forested watershed to retain moisture, which may have implications for Yosemite's fire regime as climate change in the park continues and water availability during lengthening dry seasons decreases. NO_x, which are the precursors that lead to elevated ozone levels, can also deposit into Sierra Nevada landscapes, facilitating the invasion of landscapes by nitrophilous weedy invasive plants. Although no direct link has been established for Yosemite's landscape, this facilitation of invasive plants is likely to be occurring to some degree, given the amount of nitrogen thought to deposit on Yosemite's landscape.

Because Yosemite National Park spans three counties (Tuolumne, Mariposa, and Madera), three air pollution control districts (San Joaquin Unified Air pollution Control District, Mariposa County Air Pollution Control District, and Tuolumne County Air Pollution Control District) regulate the park's air pollution. In concert with the California Air Resources Board, the Mariposa County Air Pollution Control District is responsible for developing and implementing a State Implementation Plan, which define control measures to bring areas into attainment with federal and State air quality standards.. These regulations currently focus on human health (the secondary standards protecting ecology are identical to the primary standards protecting human health). Currently, Mariposa and Tuolumne Counties are in attainment, or are unclassified, for all national ambient air quality standards; however, Mariposa County exceeds two California ambient standards: ozone (throughout the county) and PM_{10} (in Yosemite Valley). A very small portion of Yosemite's southernmost extent (Madera County) is under the jurisdiction of the San Joaquin Unified Air pollution Control District, which is also in nonattainment for ozone and PM_{10}.

Environmental Consequences - Methodology

Because of the time required for precursors to produce ozone and particulate matter (PM), the localized nature of other sources in the park, and the magnitude of the regional source impacting Yosemite's air quality, the impact of any given park activity on the concentration of air pollutants is usually localized in space and time, and relatively small in magnitude. The type, extent, and intensity of air quality impacts are determined by comparison of the emissions from a given activity to the overall emission inventory of Yosemite National Park, and an elevation of its potential to affect the 8-hour ozone and/or the 24-hour PM standards that are enforced by the air pollution control districts that have jurisdiction in Yosemite National Park.

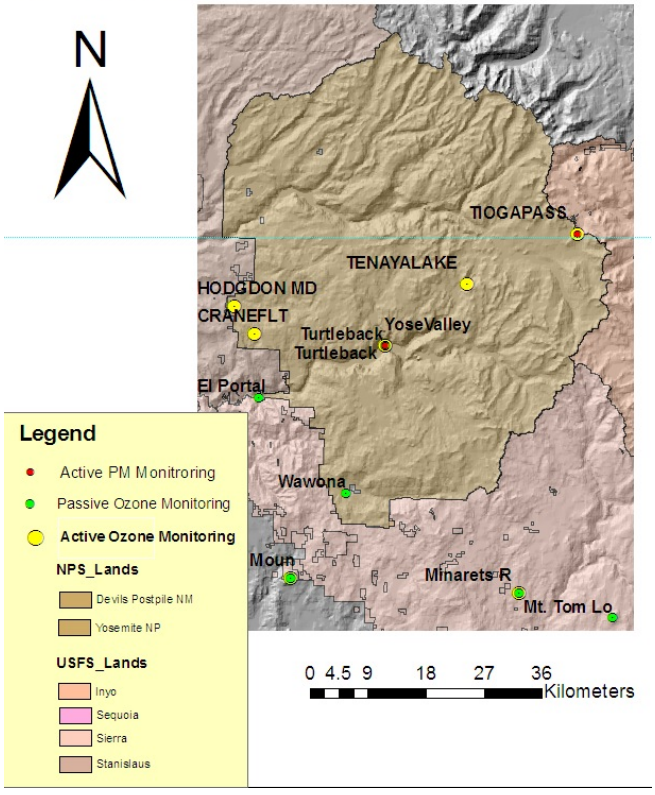
Type of Impact: Types of impact are evaluated as either beneficial or adverse. Beneficial impacts to air quality protect or restore air quality; however, most activities do not "clean" the air, but rather they reduce the degree to which it is polluted by reducing emissions. Adverse impacts result in increases in ozone and PM levels to the point that they exceed federal and State standards.

Duration of Impact: The duration of impact is critical in determining air quality impacts, because the air quality standards are an average (8-hour for ozone; 24-hour for PM) of the 1-hour values for both PM and ozone.

Intensity of Impact: The intensity of an impact on air quality is based on changes in 8- and 24-hour averages of ozone and PM. Negligible impacts would have no detectable in 8- and 24-hour averages of ozone and PM. Minor impacts would be at the lowest level detectable—a slight "bump up" in hourly ozone or PM concentrations. Moderate air quality impacts would have a detectible increase in concentrations of PM and/or ozone over the relevant 8- or 24-hour period. Major impacts on air quality would cause an exceedance of federal and/or State standards, over the appropriate averaging period.

Monitoring: Both PM and ozone are monitored in several places throughout Yosemite (see Figure III-4), and the assumptions stated in the consequences section below can be periodically compared to these data to ensure that the project is having the predicted impact (or lack thereof) on air quality in Yosemite.

Figure III-4:
Air Quality Monitoring Sites in Yosemite (2007)



Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The comprehensive programmatic actions described in Alternative 1 would reduce the risk of new or larger invasive plant populations becoming well established, and would be implemented before populations increase to the point that intensive control efforts are required. Prioritization practices would assist resource managers by ensuring the proper distribution of limited resources (primarily staffing and equipment) for control and eradication efforts.

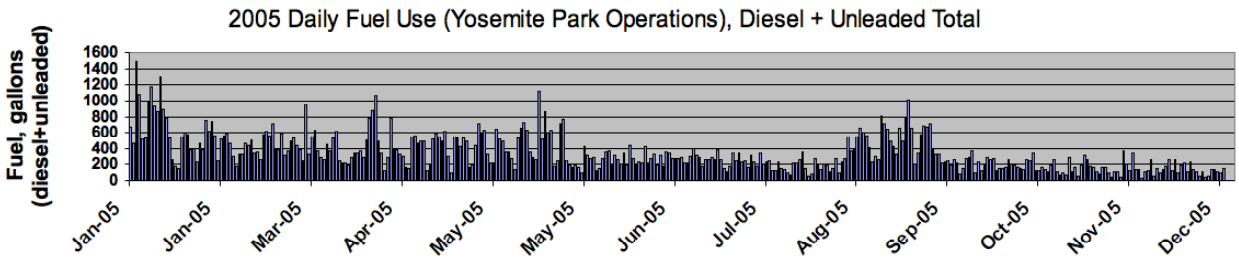


Figure III-5: 2005 Daily Fuel Use in Yosemite National Park

Control

Alternative 1 would employ multiple control techniques to treat existing invasive plant populations, but would not involve the use of herbicides. This alternative proposes to use similar (i.e., less than 85 gallons) amounts of fuel in two- or four-stroke weed trimmers every year. Given that a single automobile in the Yosemite inventory can use more fuel than that in a week, and given that usage for the entire park exceeds that amount on any given day (see Figure III-5), it is reasonable to conclude that the impact of Alternative 1 would be negligible with respect to park air quality.

Cumulative Impacts

Since 1950, the population of California has tripled, and the rate of increase in vehicle-miles-traveled has increased six-fold. Air quality conditions within the park have been influenced by this surge in population growth and associated emissions from industrial, commercial, and vehicular sources in upwind areas. Since the 1970s, emissions sources operating within the park, as well as California as a whole, have been subject to local stationary-source controls and State and federal mobile-source controls. With the passage of time, such controls have been applied to an increasing number of sources, and the associated requirements have become dramatically more stringent and complex. In the 1980s, a Restricted Access Plan was developed for use when traffic and parking conditions in Yosemite Valley become congested. The plan has the effect of reducing the number of incoming vehicles and their related emissions until the

traffic volume and parking demand in Yosemite Valley decrease sufficiently (as visitors leave the Valley) to stabilize traffic conditions.

The Yosemite Area Regional Transportation System is a multi-agency effort to provide transportation options, reduce reliance on automobiles, and improve regional air quality. Efforts being conducted under this project are expected to result in long-term beneficial impacts on air quality throughout the region.

The Yosemite Valley Plan proposes to enhance the quality of the visitor experience in Yosemite Valley by reducing automobile congestion and limiting crowding. It also proposes traffic management systems and options for the size and placement of parking lots, both within and outside of Yosemite Valley. Parking lot(s) outside the Valley could be used to intercept day visitors and shift those visitors to Valley-bound shuttle buses. The Yosemite Valley Plan would have a long-term moderate adverse impact on NO_x emissions from the use of diesel buses through 2015, but long-term minor to major beneficial impacts to VOCs, carbon monoxide, and PM emissions.

The purpose of the Merced River Plan is to protect and enhance the ORVs and free-flowing condition of the river for the benefit and enjoyment of present and future generations. The protection of natural resources under this plan would benefit air quality.

Reasonably foreseeable future actions proposed for Yosemite Valley could have beneficial or adverse impacts on air quality. For example, the National Park Service's Shuttle Bus Replacement Project could have a net beneficial effect on air quality by improving the attractiveness of alternative modes of transportation, thereby reducing private automobile trips. Although the Shuttle Bus Replacement Project would have localized short-term adverse air quality effects, the general goal of the project is to relieve congestion and provide for alternative means of transportation. As such, this project would encourage travel to the park by alternative (non-private vehicle) modes, and would have a long-term beneficial effect on air quality.

Other reasonably foreseeable future National Park Service projects are not anticipated to have a net adverse or beneficial effect on air quality, except for short-term localized impacts during construction.

Although cumulative growth in the region would tend to adversely affect air quality, implementation of ongoing State and federal mobile-source control programs would somewhat ameliorate this effect. With respect to PM, conditions in the Valley would be determined by both regional sources and local sources and could be beneficial or adverse. Considered with the adverse impacts associated with regional air quality influences, the cumulative projects would have a local long-term moderate adverse impact on air quality in Yosemite.

Alternative 1 and the cumulative projects would result in local long-term moderate adverse impacts on local and regional air quality. The long-term adverse negligible effects associated with invasive plant control activities would not change the long-term adverse effects of the cumulative projects.

Conclusion

Increased prevention, early detection, and monitoring would have long-term negligible adverse impacts on air quality. The proposed use of motorized equipment and under Alternative 1 would result in long-

term negligible adverse impacts on air quality. Overall, Alternative 1 would have a long-term negligible adverse impact on air quality. Alternative 1 would not impact air quality for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The comprehensive programmatic actions described in Alternative 2 would reduce the risk of new or larger invasive plant populations becoming well established, and would be implemented before populations increase to the point that intensive control efforts are required. Prioritization practices would assist resource managers by ensuring the proper distribution of limited resources (primarily staffing and equipment) for control and eradication efforts.

Control

The impacts resulting from the manual and mechanical removal of invasive plants would be similar to those described for Alternative 1. This alternative differs from Alternative 1 in that it would utilize herbicides for specified invasive plants. The proposed herbicide formulations under Alternative 2 are not considered volatile (DowAgroSciences 2006; Monsanto 2006b). The amount of herbicide proposed to be used (less than ten gallons a year) would also have negligible adverse impacts on air quality, even if all of it were volatilized as a hydrocarbon.

Cumulative Impacts

Overall past, present, and reasonably foreseeable cumulative actions in conjunction with the actions called for under Alternative 2 would be generally the same as those described for Alternative 1, resulting in local long-term moderate adverse impacts on local and regional air quality.

Conclusion

Increased prevention, early detection, and monitoring would have long-term negligible adverse impacts on air quality. The proposed use of motorized equipment and herbicides under Alternative 2 would result in long-term negligible adverse impacts on air quality. Because long-term impacts would be negligible and adverse, Alternative 2 would not impair air quality resources of the park for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The impacts resulting from early detection, rapid response, and prevention actions would be the same as those described for Alternative 2.

Control

The impacts resulting from early detection, rapid response, and prevention actions would be similar to those described for Alternative 2, with two exceptions: 1) in addition to utilizing herbicides on selected species that reach specified population sizes, the park would utilize herbicides as a preventive measure on road corridors and staging areas; and 2) the proposed herbicide formulations under Alternative 3 are not considered volatile (EPA OPP 2005; DowAgroSciences 2006). The amount of herbicide proposed to be used (less than ten gallons a year) would also have negligible adverse impacts on air quality, even if all of it were volatilized as a hydrocarbon.

Cumulative Impacts

Overall past, present, and reasonably foreseeable cumulative actions in conjunction with the actions called for under Alternative 3 would be generally the same as those described for Alternative 1, resulting in local long-term moderate beneficial impacts on local and regional air quality.

Conclusion

Increased prevention, early detection, and monitoring would have long-term negligible adverse impacts on air quality. The proposed use of motorized equipment and herbicides under Alternative 3 would result in long-term negligible adverse impacts on air quality. Because long-term impacts would be negligible and adverse, Alternative 3 would not impair air quality resources of the park for future generations.

Noise

Affected Environment

Natural sounds are an important value at Yosemite National Park for visitors enjoying the booming of the waterfalls or the view of Half Dome. Sounds near the Yosemite Pioneer History Center and other historic or archeological districts in the park help transport visitors to earlier times. Many species of wildlife

depend on sound to find mates, to hunt, to defend territories, or to warn (or be warned) of danger. Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. Examples of such natural sounds include:

- Sounds produced by birds, frogs, or insects to define territories or attract mates
- Sounds produced by bats and owls to locate prey or navigate
- Sounds received by mice or deer to detect and avoid predators or other danger
- Sounds produced by physical processes, such as wind in the trees, claps of thunder, or falling water

Noise is defined as a human-caused sound that is considered unpleasant and unwanted—for example, a motorcycle heard above sound of Yosemite Falls, a cell phone ringing on the top of Half Dome, and a chainsaw in the Yosemite Pioneer History Center. Whether a noise is considered pleasant or unpleasant depends on the individual listening to the sound, the setting, and what the individual is doing when the sound is heard (e.g., working, playing, resting, or sleeping). Natural sounds within Yosemite are not considered to be noise, nor are human-caused sounds associated with traditional cultural practices.

Sound levels in Yosemite National Park vary by location and also by season. The sound environment of alpine (i.e., above treeline) areas of the park is very different from deep canyons such as Yosemite Valley, which is very different from old growth red fir forests with large widely spaced trees. The sound environment in spring of many areas of the park, particularly in Yosemite Valley, is dominated by the sound of running water and waterfalls, which is very different from early fall when water levels are at their lowest and many of the streams have dried up. Noise levels are also influenced by the number of visitors and park operations, which are strongly correlated, and by atmospheric effects such as wind, temperature, humidity, topography, rain, fog, and snow.

Sound and noise levels are measured in units known as decibels (dB). For the purpose of this analysis, sound and noise levels are expressed in decibels on the A-weighted scale (dBA). This scale most closely approximates the response characteristics of the human ear to low-level sound. Human hearing ranges from the threshold of hearing (0 dBA) to the threshold of pain (140 dBA). Environmental sound or noise levels typically fluctuate over time, and different types of noise descriptors are used to account for this variability. One of these descriptors is the day-night average noise level, which reflects the noise level averaged over a 24-hour period.

Existing Noise Sources: The primary sources of noise in the park are vehicles, aircraft, park operations, and park visitors. These sources are not intended to be exhaustive, and are not mutually exclusive.

Vehicle noise is most noticeable at locations with a concentration of park visitors, heavy vehicle traffic, and topography that either places visitors in close proximity to roads or allows sound to travel long distances. The existing noise environment changes dramatically throughout the year directly in proportion to the level of use (i.e., the number of cars, buses, motorcycles, and other vehicles that travel the various roadways in the park); therefore, noise levels are generally lower during the winter than during the busy summer months. Vehicle noise is very noticeable in Yosemite Valley and along road corridors such as the Big Oak Flat Road and Tioga Road.

Aircraft is a substantial source of noise in the park, particularly high-altitude commercial jet traffic. Aircraft noise is not as noticeable in Yosemite Valley, where vehicle noise dominates, but it is far more noticeable in Wilderness areas and in the higher elevations of the park. Two major commercial jet "highways" cross over Yosemite: one east-west route and one north-south route. Other types of aircraft include military planes (some of which are very loud), commercial air tours, recreational flights, and helicopters that provide operational support to the park.

Park operations, including visitor services provided by concessioners, generate a myriad of activities that produce noise. Many facilities provide visitor services, ranging from hotels and restaurants to sewer plants and roads. Constructing, rebuilding, or maintaining these facilities can generate noise through service vehicles, generators, chain saws, vacuums, garbage trucks, etc. park operations not related to facilities include shuttle bus service, emergency medical services, search and rescue, law enforcement patrol, hazard tree management, fire management, interpretive walks, wildlife management, invasive plant management, and research activities.

Some noise can be directly attributed to visitors, as opposed to indirectly attributed to visitors via the services provided to them. Notwithstanding the previously mentioned noise sources, additional sources of noise include visitors using their voices, riding their bikes, barbecuing at campsites, listening to music at picnic areas, calling to each other while climbing El Capitan, and accidentally setting off car alarms.

Sound data were collected in 2005 and 2006 in various areas of the park, generally in areas where road noise could not be heard, but also in a few developed areas such as Yosemite Village. The results of the analysis of these data show that human-caused sounds were audible 89.3 percent of the time in Yosemite Village, the noisiest sampling location, but only 12.3 percent of the time at Harden Lake near White Wolf, the quietest sampling location. At Yosemite Village, aircraft could be heard only 2.4 percent of the time, compared to 12.1 percent of the time at Harden Lake (Formichella, Fritstrup et al. 2006).

Environmental Consequences – Methodology

Impacts related to noise were assessed in terms of duration, type, and intensity of impact, as discussed below. Unless otherwise noted, local impacts were considered to be those that occur in the immediate vicinity of an action or in a nearby area indirectly affected by the action.

Duration of Impact: Short-term impacts would be temporary impacts that typically occur during construction activities. Long-term impacts would be impacts that continue to occur after construction, typically last ten years or more, and would be considered permanent changes.

Intensity of Impact: The level of impact (negligible, minor, moderate, or major) of sound changes from the No Action alternative to the Action alternatives was evaluated using the following definitions. A negligible impact indicates that the change in sound levels would not be perceptible. A minor impact indicates that the change in sound levels would be perceptible, but not likely to have a substantial annoyance effect on visitors or residents in the area. A moderate impact indicates that the change in sound levels would be easily perceptible and likely to result in annoyance to some park visitors and residents. A major impact indicates that the change in sound levels would be very perceptible and likely to annoy most park visitors and residents who experience it.

Type of Impact: Beneficial impacts are those impacts that result in less noise; adverse impacts are those impacts that result in more noise.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Under Alternative 1, minor noises would be associated with scientific data collection (e.g., associated with early detection and research activities), outreach and education, and fire management activities. Overall, these activities would produce a long-term negligible adverse amount of noise.

Control

Under Alternative 1, existing noise disturbance regimes would continue during routine operations to control invasive plants. Hand-pulling and use of hand tools would continue to generate small amounts of noise. The mechanical equipment currently used is comparable to mowers and weed trimmers used by the typical homeowner. Operations would continue to occur during daylight hours, between 7:00 a.m. and 6:00 p.m. The noise created by the actions in this alternative is small relative to the existing noise environment of developed areas of the park described in the Affected Environment. Noise from the activities described in Alternative 1 would result in a negligible long-term adverse impact to the park's sound environment.

Cumulative Impacts

The cumulative effects to the ambient noise environment are based on analysis of past, present, and reasonably foreseeable future actions in the Yosemite region in conjunction with the potential effects of this alternative. Parkwide planning efforts such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans and the Wilderness Management Plan potentially provide large-scale reductions in or protection of ambient noise levels. Some of the regional and local actions listed in Appendix M are sources of short-term noise disturbance, such as the El Portal Road Improvements Project. Some past impacts on noise levels such as fire suppression and noise associated with helicopters, chain saws, and water pumps have been short-term moderate adverse impacts. Past, present, and future impacts on ambient noise levels in the Yosemite region range from long-term adverse to beneficial. This variety of impacts, along with the negligible long-term adverse impact of Alternative 1, would result in long-term adverse minor impacts on noise.

Conclusion

Noise from the control activities described in Alternative 1 would result in a negligible long-term adverse impact to the park's sound environment. Because long-term impacts would be negligible, there would be no impairment of natural sound in Yosemite.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, Alternative 2 would accept the use of herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Under Alternative 2, minor noises would be associated with scientific data collection (e.g., associated with early detection and research activities), outreach and education, and fire management activities. Overall, these activities would produce a long-term negligible adverse amount of noise.

Control

Noise from control activities under Alternative 2 would be similar to Alternative 1. The noise created by the actions under this alternative is small relative to the existing noise environment of the park described in the Affected Environment. Noise from the increased activities described in Alternative 1 would result in a negligible long-term adverse impact to the park's sound environment.

Cumulative

Overall past, present, and reasonably foreseeable cumulative actions in conjunction with the actions called for under Alternative 2 would be generally the same as those described for Alternative 1, resulting in long-term negligible adverse impacts on ambient noise levels.

Conclusion

Noise from the increased activities described in Alternative 2 would result in a negligible long-term adverse impact to the park's sound environment. Because long-term impacts would be negligible, there would be no impairment of natural sound in Yosemite.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-

priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Under Alternative 3, minor noises would be associated with scientific data collection (e.g., associated with early detection and research activities), outreach and education, and fire management activities. Overall, these activities would produce a long-term negligible adverse amount of noise.

Control

Noise from control activities under Alternative 3 would be similar to Alternative 1. The noise created by the actions under this alternative is small relative to the existing noise environment of the park described in the Affected Environment. Noise from the increased activities described in Alternative 3 would result in a negligible long-term adverse impact to the park's sound environment.

Cumulative

Overall past, present and reasonably foreseeable cumulative actions in conjunction with the actions called for under Alternative 3 would be generally the same as those described for Alternative 1, resulting in long-term negligible adverse impacts on ambient noise levels.

Conclusion

Noise from the increased activities described in Alternative 3 would result in a negligible long-term adverse impact to the park's sound environment. Because long-term impacts would be negligible, there would be no impairment of natural sound in Yosemite.

Wilderness

Affected Environment

In 1984, the California Wilderness Act designated about 94 percent (704,624 acres) of Yosemite National Park as Wilderness. An additional 1.5 percent of the park was designated as potential Wilderness additions. Aside from road corridors, developed areas, and the southwestern edge of the park, most of Yosemite is designated Wilderness.

The National Park Service is required to manage Wilderness in accordance with the Wilderness Act of 1964. The Wilderness Act directs managers to preserve Wilderness character, and mandates that both wildness and naturalness be preserved. Congress defined Wilderness as an area "...in contrast with those areas where man and his works dominate the landscape, . . . as an area where the earth and its community of life are untrammeled by man." Untrammeled, as mentioned in the Wilderness Act, is often defined as unmanipulated, self-willed, autonomous, and wild, or that which "retains its primeval character and influence, without permanent improvements." Congress further defined Wilderness as an area that is "protected and managed so as to preserve its natural conditions. . . with the imprint of man's work substantially unnoticeable" and that Wilderness "has outstanding opportunities for solitude or a primitive

and unconfined type of recreation" (Public Law 88-577 [16 USC 1131-1136]). Wilderness character is considered to have four general components: untrammeled, natural, undeveloped, and experiential.

The Wilderness Act also prohibits certain activities such as the use of motorized equipment, mechanical transport, structures or installations, and aircraft landing, unless considered the minimum requirement to administer the area for the purpose of preserving Wilderness character. In addition, National Park Service policies mandate that management decisions affecting Wilderness are consistent with the minimum requirement concept (see Appendix N).

Although non-native plants are present in Wilderness areas, they do not currently affect vast expanses of Yosemite's Wilderness. As a result, prevention and early detection practices play a primary role. A total of 33 non-native plant species have been documented in the park's Wilderness, 22 of which are high- and medium-high-priority species (NPS 2006f). In general, these invasive plants grow at elevations of 7,000 feet or lower in the immediate footprints of developed sites such as trails, corrals, and cabins. Non-native plant species found outside developments are most often associated with areas that sustained large fires in proximity to trails. Wet areas and sites where trails and streams intersect are especially likely to contain non-native species. The areas with the greatest density and diversity of invasive species include the Merced River corridor from Little Yosemite Valley to Merced Lake, the trail from Hetch Hetchy Reservoir to Beehive Spring, Pate Valley, Tiltill Valley, Miguel Meadows, and Rancheria Falls. Currently, most invasive plants in Wilderness are hand-pulled, although shovels and trowels are occasionally used for control.

Invasive plants enter the Wilderness through a variety of means—from transport on shoes and socks to transport on the feet of birds. Stock operations in Wilderness areas can also introduce non-native plants into the park through feed and hay products. The two main operators of stock in the park—the National Park Service and the park concessioner, account for 59 percent of overnight stock use and 90 percent of day stock use in the park. These entities voluntarily use only certified weed-free feed. The National Park Service encourages the use of weed-free feed in the Commercial Use Authorizations it issues to pack stations and private stock users, and compliance with clean or certified feed is generally very high. A statewide memorandum of understanding is in place to help ease difficulties in obtaining weed-free feed due to quality, supply, and/or price. This agreement would bring together land management agencies, the California Agricultural Commissioners and Sealers Association, and the CDFA to address issues that prevent full compliance with the use of weed-free feed on public lands.

Environmental Consequences – Methodology

In an effort to reduce soil disturbance in Wilderness areas, invasive plant control methods typically involve hand-pulling or using a shovel to slice below the root crown. Ground disturbance and the loss of vegetation are the most apparent impacts on Wilderness character, which represents both tangible and intangible components of the idea of Wilderness. Impacts on Wilderness character were assessed in terms of duration, type, and intensity of impact, as discussed below.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Adverse impacts are those that would degrade Wilderness character or interfere with the public's use and enjoyment of

Wilderness. Beneficial impacts would improve Wilderness character or enhance the public's use and enjoyment of Wilderness.

Duration of Impact: The duration of an impact is the time required for Wilderness character to recover after treatment. Impacts are considered short-term if evidence of human activity would last no more than five years following implementation of an alternative. Impacts are considered long-term if evidence of human activity would persist for more than five years following implementation of an alternative.

Intensity of Impact: The intensity of an impact on Wilderness is a measure of change in Wilderness character. Negligible impacts would not cause perceptible or detectable changes in Wilderness character. Minor impacts would be slightly perceptible but localized within an isolated area. Moderate impacts would result in apparent effects on Wilderness character. Major impacts on Wilderness character would be substantial and highly noticeable.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual and mechanical techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

Alternative 1 would continue a comprehensive and prioritized program to prevent, detect, prioritize, and monitor invasive plants without the use of herbicides. The early detection and rapid response actions under this alternative would reduce the risk of new invasive plant populations becoming well established in Wilderness, resulting in a long-term moderate beneficial impact on Wilderness character. Comprehensive prevention measures would have a long-term moderate beneficial impact on Wilderness character. Prioritization actions would assist resource managers by ensuring the proper distribution of limited resources for control efforts, resulting in a long-term moderate beneficial impact on Wilderness character.

Monitoring under this alternative would allow resource managers to determine the effectiveness of management actions and to improve their efficiency, resulting in a long-term moderate beneficial impact on Wilderness character. Research activities would enhance all of the above actions and provide for more efficient and effective control of invasive plants, resulting in a long-term moderate beneficial impact on Wilderness character. This alternative would promote awareness of the invasive plant program among Wilderness users, thus reducing the accidental spread of invasive plants and resulting in a long-term moderate beneficial impact on Wilderness character.

Cumulative Impacts

Cumulative impacts on Wilderness are based on analysis of past, present, and reasonably foreseeable future actions in Yosemite's Wilderness in conjunction with the potential effects of this alternative. Past impacts include prevention of Native American burning, grazing during the 19th and 20th centuries, fish stocking, killing of predators (such as the California grizzly), spraying of insects (such as the needle-miner

moth), and attempted eradication of plant species (such as gooseberries and poison oak). Large areas of the western part of Yosemite were logged in the early part of the 20th century. Structures in Wilderness such as trails, bridges, and campsites enhance and diminish Wilderness character. These facilities have the potential to diminish the Wilderness quality to some visitors, but most visitors depend on many of these features and tolerate their presence.

Local actions listed in Appendix M that could affect Wilderness in Yosemite include the Wilderness Management Plan, the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans, the Tuolumne Meadows Concept Plan, the Fire Management Plan, and the Comprehensive Transportation Plan. Parkwide planning efforts would provide large-scale protection in Wilderness. Prescribed fire and managed wildland fire activities would greatly reduce the threat of large high-severity catastrophic fires, and would reduce the potential for vegetation type conversion. The Comprehensive Management Plan would include alternatives to manage transportation in the Tioga Road corridor.

Past impacts on Wilderness have been adverse, long-term, and moderate. Present and foreseeable future actions would contribute to reversing the moderate adverse impacts of past actions on Wilderness, and would produce long-term minor beneficial effects. Past, present, and future effects, along with the long-term minor beneficial impacts of Alternative 1, would result in long-term adverse moderate cumulative impacts on Wilderness.

Control

Continued manual control of the invasive plants currently found in Wilderness is likely to control most of the 33 invasive plant species found in Wilderness, with two notable exceptions: velvet grass and Himalayan blackberry. These species have the potential to spread quickly and invade large segments of wetland habitat in Wilderness, beyond the capabilities of extensive manual control. Extensive hand-pulling of large invasive plant populations could temporarily create noticeable ground disturbance, resulting in a short-term moderate adverse impact and a long-term minor beneficial impact. In contrast, the disturbance created from control of smaller, less dense infestations would have little to no impact on Wilderness character.

Conclusion

Continued manual control of the invasive plants currently found in Wilderness is likely to control most of the 33 invasive plant species found in Wilderness, with two notable exceptions: velvet grass and Himalayan blackberry. These species have the potential to spread quickly and invade large segments of wetland habitat in Wilderness, beyond the capabilities of extensive manual control. Comprehensive programmatic actions under Alternative 1 would have a long-term moderate beneficial impact on Wilderness values, as they would greatly prevent the invasion of non-native species into areas largely free of invasive plants. Control actions would have a short-term moderate adverse impact and a long-term minor beneficial impact. Overall, Alternative 1 would have a long-term minor beneficial impact on Wilderness character. Because long-term impacts on Wilderness character associated with Alternative 1 would be minor and beneficial, Alternative 1 would not impair the park's Wilderness resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts of comprehensive programmatic actions under Alternative 2 on Wilderness values would be similar to Alternative 1. Comprehensive programmatic actions would have a long-term moderate beneficial impact on Wilderness values.

Control

Currently, manual control of the invasive plants currently found in Wilderness is likely to control most of the 33 invasive plant species found in Wilderness, with two notable exceptions: velvet grass and Himalayan blackberry. These species have the potential to spread quickly and invade large segments of wetland habitat in Wilderness, beyond the capabilities of extensive manual control. Alternative 2 would allow for the use of herbicides to control these invasive plants, if they are an ecosystem-level threat to Wilderness character and resources, herbicides are determined to be the minimum tool for control, and populations meet the location and size thresholds.

Early detection and prevention actions would have a long-term moderate beneficial impact on Wilderness values, because these actions would help prevent the invasion of non-native species into areas largely free of invasive plants. Extensive hand-pulling of invasive plants could temporarily create noticeable ground disturbance, resulting in a short-term moderate adverse impact and a long-term minor beneficial impact on Wilderness character. Actions considered under Alternative 2 would meet the Wilderness Minimum Tool Requirements Analysis (see Appendix N). Overall, Alternative 2 would have a long-term minor beneficial impact on Wilderness character.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting Wilderness would be the same as those under Alternative 1. Past impacts on Wilderness have been adverse, long-term, and moderate. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on Wilderness, and would produce long-term minor beneficial effects. Past, present, and future effects, along with the long-term moderate beneficial impacts of Alternative 2, would result in long-term beneficial minor cumulative impacts on Wilderness.

Conclusion

Early detection and prevention actions would have a long-term moderate beneficial impact on Wilderness values, because these actions would help prevent the invasion of non-native species into areas largely free of invasive plants. Hand-pulling invasive plants could temporarily create noticeable ground disturbance, resulting in a short-term moderate adverse impact and a long-term minor beneficial impact on Wilderness character. Alternative 2 would allow for the use of herbicides to control two invasive plants with the potential to spread quickly and invade large segments of wetland habitat in Wilderness. Actions considered under Alternative 2 would meet the Wilderness Minimum Tool Requirements Analysis (see Appendix N). Overall, Alternative 2 would have a long-term moderate beneficial impact on Wilderness character. Because long-term impacts on Wilderness character associated with Alternative 2 would be moderate and beneficial, Alternative 2 would not impair the park's Wilderness resources for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts resulting from the early detection and rapid response, prevention, prioritization, monitoring, research, and outreach and education activities under Alternatives 3 would be the same as those described for Alternative 2. The enhanced prevention and early detection actions would greatly reduce the risk of new infestations. Comprehensive programmatic actions would have a long-term moderate beneficial impact on Wilderness values.

Control

Control of invasive plants under Alternative 3 would have the same effects as those of Alternative 2. Manual control of the invasive plants currently found in Wilderness is likely to control most of the 33 invasive plant species found in Wilderness, with two notable exceptions: velvet grass and Himalayan blackberry. These species have the potential to spread quickly and invade large segments of wetland habitat in Wilderness, beyond the capabilities of extensive manual control. Alternative 3 would allow for the use of herbicides to control these invasive plants, if they are an ecosystem-level threat to Wilderness character and resources, herbicides are determined to be the minimum tool for control, and populations meet the location and size thresholds. Alternative 3 would allow for the use of herbicides on additional

invasive plant species known from the park, but these plant species are not expected to impact Wilderness areas.

Early detection and prevention actions would have a long-term moderate beneficial impact on Wilderness values, because these actions would help prevent the invasion of non-native species into areas largely free of invasive plants. Extensive hand-pulling of invasive plants could temporarily create noticeable ground disturbance, resulting in a short-term moderate adverse impact and a long-term minor beneficial impact on Wilderness character. Actions considered under Alternative 3 would meet the Wilderness Minimum Tool Requirements Analysis (see Appendix N). Overall, Alternative 3 would have a long-term minor beneficial impact on Wilderness character

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting Wilderness would be the same as those under Alternative 1. Past impacts on Wilderness have been adverse, long-term, and moderate. Present and foreseeable future actions would contribute to reversing the major adverse impacts of past actions on Wilderness, and would produce long-term minor beneficial effects. Past, present, and future effects, along with the long-term moderate beneficial impacts of Alternative 3, would result in long-term beneficial minor cumulative impacts on Wilderness.

Conclusion

The impacts of Alternative 3 on Wilderness would be the same as under Alternative 2. Early detection and prevention actions would have a long-term moderate beneficial impact on Wilderness values, because these actions would help prevent the invasion of non-native species into areas largely free of invasive plants. Hand-pulling invasive plants could temporarily create noticeable ground disturbance, resulting in a short-term moderate adverse impact and a long-term minor beneficial impact on Wilderness character. Alternative 3 would allow for the use of herbicides to control two invasive plants with the potential to spread quickly and invade large segments of wetland habitat in Wilderness. Alternative 3 would allow the use of herbicides for more invasive species than Alternative 2, but these additional invasive are not expected to thrive in Wilderness areas. Actions considered under Alternative 3 would meet the Wilderness Minimum Tool Requirements Analysis (see Appendix N). Overall, Alternative 3 would have a long-term moderate beneficial impact on Wilderness character. Because long-term impacts on Wilderness character associated with Alternative 3 would be moderate and beneficial, Alternative 3 would not impair the park's Wilderness resources for future generations.

Archeological Resources

Affected Environment

Archeological sites are important because they provide information on prehistoric and historic lifeways, as well as a tangible link with the past. Prehistoric sites in Yosemite generally contain flaked and ground stone tools, waste from tool manufacture, food processing features, fire hearths, structural remains, human burials, and rock art. Historic archeological sites provide important information that is not available in written records—e.g., cultural patterns typically omitted from historical literature (related to gender and ethnic groups), early building construction techniques, lifestyles of early settlers, trade and

procurement of goods and materials, and interactions with native peoples. Historic sites can include structural remains, waste dumps, work camps, and the remains of logging, hydrological manipulation, and mining activities.

In most cases, archeological inventories are initiated in conjunction with park development projects. Most of this work has focused on lower elevation developed areas and road corridors. The archeological database is therefore not a representative sample of the park (Hull and Moratto 1999).

Environmental Consequences – Methodology

Type and Duration of Impact: A change in the physical attributes of an archeological site that affects the information contained in that site is irreparable, and any such change due to implementation of an alternative would be considered adverse and of permanent duration. Adverse impacts on archeological resources could result from the manual or mechanical removal of plant material due to ground disturbance. Because archeological resources are non-renewable and irreplaceable resources, the effects from actions ranging from preservation to destruction are long term.

When the impact of an action results in an alteration to the characteristics of an archeological site that qualify it for inclusion in the National Register of Historic Places (NRHP), the action is considered to have an adverse effect under Section 106 of the NHPA. However, effects are not considered adverse under the 1999 Programmatic Agreement, which stipulates that archeological investigations guided by the Yosemite Research Design and Archeological Synthesis are conducted to sufficiently minimize the effect. If the 1999 Programmatic Agreement cannot be implemented to avoid or minimize the effect, and the National Park Service, the California State Historic Preservation Officer, and the Advisory Council on Historic Preservation cannot agree on measures to avoid or minimize adverse impacts and are unable to negotiate and execute an alternate MOU in accordance with 36 CFR 800.6(b), the effect remains adverse.

Intensity of Impact: A beneficial type of effect as measured by NEPA is folded in the "No Adverse Effect" finding under the NHPA. An adverse type of effect and the intensity or degree of the effect on historic properties is measured by the Criteria of Adverse Effect in 36 CFR Part 800.5 (a) (1):

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.*

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

With implementation of an effective early detection and prevention program, the park could detect and eradicate invasive plant species before they become established, thus decreasing the possibility that ground-disturbing activities would be required to control new populations. As a result, prevention and early detection efforts would not result in adverse impacts on archeological resources.

Control

Under Alternative 1, the control of invasive plants would require ground-disturbing activities. Although ground disturbance has the potential to damage or unearth archeological resources, any impacts resulting from these treatment activities would be mitigated in accordance with stipulations outlined in the 1999 Programmatic Agreement. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 1; thus, some invasive plant populations would not be treated under this alternative.

Cumulative Impacts

Cumulative impacts on archeological resources are based on analysis of past, present, and reasonably foreseeable future actions in the Yosemite region in conjunction with the potential effects of this alternative. In the past, archeological resources in the Yosemite region have been subject to damage from urbanization, vandalism, visitor access, and natural processes, including fire. Regional and local present and foreseeable future activities would have both beneficial and adverse impacts on archeological resources. Some of local actions listed in Appendix M, such as the Yosemite Lodge in Yosemite Valley Area Redevelopment, involve soil and vegetation disturbance. While prescribed fire and managed wildland fire activities would greatly reduce the threat of large high-severity catastrophic fires, fire activities would also contribute to the damage and/or loss of some regional archeological resources through burning and post-burn landscape processes. In Yosemite, actions to control invasive plant species are pre-approved by cultural resource specialists to ensure no adverse effect on archeological resources. Overall, projects that could have an adverse cumulative impact on archeological resources could be mitigated by implementing the 1999 Programmatic Agreement. These projects, when combined with Alternative 1, are expected to have no adverse effect on archeological resources.

Conclusion

The prevention and control activities under Alternative 1 would not cause adverse impacts on archeological resources. Impacts related to invasive plant control activities would be mitigated in accordance with the 1999 Programmatic Agreement such that no adverse effects on archeological resources would result. This alternative would not impair the park's archeological resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, herbicides would be used to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

With implementation of an effective early detection and prevention program, the park could detect and eradicate invasive plant species before they become established, thus decreasing the possibility that ground-disturbing activities would be required to control new populations. As a result, prevention and early detection efforts would not result in adverse impacts on archeological resources.

Control

Under Alternative 2, the control of invasive plants would require treatment measures that involve ground-disturbing activities. Although ground disturbance has the potential to damage or unearth archeological resources, any impacts resulting from these treatment activities would be mitigated in accordance with stipulations outlined in the 1999 Programmatic Agreement. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 2. However, the use of herbicides in areas where ground disturbance is not permitted would allow the control of invasive plant populations that would not be controlled under Alternative 1. There would be no adverse impacts on archeological resources due to control efforts under Alternative 2.

Cumulative

The past, present, and reasonably foreseeable projects affecting archeological resources would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce no adverse effect on archeological resources when mitigated with the 1999 Programmatic Agreement. These effects, when combined with Alternative 2, would result in no adverse impacts on archeological resources.

Conclusion

The prevention and control activities under Alternative 2 would not cause any adverse impacts on archeological resources. Impacts due to invasive plant control activities would be mitigated in accordance with the 1999 Programmatic Agreement such that no adverse effects on archeological resources would result. This alternative would not impair the park's archeological resources for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The impacts of early detection, rapid response, and prevention actions on archeological resources would be the same as those described for Alternative 2. There would be no adverse impacts on archeological resources due to prioritization, monitoring, research, and outreach and education activities.

Control

The impacts of control actions to remove invasive plants on archeological resources would be the same as those described for Alternative 2. There would be no adverse impacts on archeological resources due to control efforts under Alternative 3.

Cumulative

The past, present, and reasonably foreseeable projects affecting archeological resources would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce no adverse effect on archeological resources when mitigated with the 1999 Programmatic Agreement. These effects, when combined with Alternative 3, would result in no adverse impacts on archeological resources.

Conclusion

The prevention and control activities under Alternative 3 would not cause any adverse impacts on archeological resources. Impacts due to invasive plant control activities would be mitigated in accordance with the 1999 Programmatic Agreement such that no adverse effects on archeological resources would result. However, the use of herbicides in some situations where ground disturbance is not permitted would allow control of invasive plant populations that would not be controlled under Alternatives 1 or 2. This alternative would not impair the park's archeological resources for future generations.

Traditional Cultural Properties

Affected Environment

Traditional cultural properties (TCPs) are any "site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence, or other significance in the cultural system

of a group traditionally associated with it" (NPS 1998). A traditional cultural property is an ethnographic resource that is eligible for listing in the NRHP. Two places in Yosemite Valley are managed as traditional cultural properties.

American Indian people and groups continue their traditional cultural association with park lands and resources. Seven federally recognized and unrecognized tribal groups claim ancestral cultural association with park lands. These park-associated tribes and groups include the American Indian Council of Mariposa County, Inc. (Southern Sierra Miwuk Nation); the North Fork Mono Rancheria; the Tuolumne Band of Me-Wuk Indians; the Picayune Rancheria of Chuchansi Indians; the Mono Lake Kutzadika'a Tribe; the Bridgeport Paiute Indian Colony; and the Bishop Paiute Tribe.

American Indians have intensively managed biotic resources in the Sierra Nevada for thousands of years. Resource management practices were widespread, producing ecological and evolutionary consequences in ecosystems of the region (Anderson and Moratto 1996). To meet requirements for firewood, fish and game, plant foods, craft supplies, and building materials, American Indian peoples shaped the distribution, structure, composition, and extent of certain plant and animal communities. This was accomplished using proto-agricultural techniques such as pruning, sowing, weeding, tilling, selective harvesting, and burning.

Environmental Consequences – Methodology

Type and Duration of Impact: Changes in the physical attributes of traditional cultural properties that affects the information contained in that site is considered irreparable, and irreparable changes due to implementation of an alternative would be considered adverse and of permanent duration. Because traditional cultural properties are nonrenewable and irreplaceable resources, the effects from a range of actions from preservation to destruction is long term.

When the impact of an action results in an alteration to the characteristics of an archeological site that qualify it for inclusion in the NRHP, the action is considered to have an adverse effect under Section 106 of the NHPA. However, for archeological sites that are traditional cultural properties, effects are not considered adverse under the 1999 Programmatic Agreement, which stipulates that archeological investigations guided by the Yosemite Research Design and Archeological Synthesis are conducted to sufficiently minimize the effect. If the 1999 Programmatic Agreement cannot be implemented to avoid or minimize the effect, and the National Park Service, the California State Historic Preservation Officer, and the Advisory Council on Historic Preservation cannot agree on measures to avoid or minimize adverse impacts and are unable to negotiate and execute an alternate MOU in accordance with 36 CFR 800.6(b), the effect remains adverse. For burial sites, any disturbance would be considered an adverse effect.

Intensity of Impact: A beneficial type of effect as measured in NEPA is folded into the "No Adverse Effect" finding under the NHPA. An adverse type of effect and the intensity or degree effect on historic properties is measured by the Criteria of Adverse Effect in 36 CFR Part 800.5 (a) (1):

> *An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association. Adverse effects may include reasonably foreseeable*

> *effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.*

Type of Impact: Adverse impacts on TCPs can occur as a result of manual, mechanical, or chemical control efforts. For example, traditionally used plants can be damaged or destroyed if they are trampled or removed during invasive plant control. However, the removal of invasive plants can be beneficial to traditionally gathered plant populations that have been displaced by invasive plants.

Duration of Impact: Impacts are considered short-term if implementation of an alternative would cause a temporary change in important vegetation or temporarily restrict access to an important resource, but would not disrupt the cultural traditions associated with that resource for a noticeable period. Impacts are considered long-term if implementation of an alternative would cause a change in culturally important vegetation or a cultural feature for a noticeable period; this period would vary by resource type and traditional practitioners. Long-term changes would disrupt cultural traditions associated with the affected resource, but the disruption would not alter traditional activities to the extent that the important cultural traditions associated with the resource are lost. A permanent impact on TCPs would involve irreversible changes in important resources such that the ongoing cultural traditions associated with those resources are lost.

Intensity of Impact: Under the NHPA, impacts on traditional cultural properties are characterized as having either an adverse effect or no adverse effect. The proposed action is considered to have no impact when no traditional cultural properties are present or when the action would not affect any traditional cultural properties. When an action would not alter the characteristics of a traditional cultural property that qualify it for inclusion in the NRHP, the action is considered to have no adverse effect. When an action would alter the characteristics of a traditional cultural property that qualify it for inclusion in the NRHP, the action is considered to have an adverse effect.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual, mechanical, and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

With implementation of an effective early detection and prevention program, the park could detect and eradicate invasive plant species before they become established. This alternative would therefore decrease the risk of invasive plants damaging or displacing traditional cultural properties. As a result, a comprehensive invasive plant program would have no adverse impact on traditional cultural properties.

Control

Under Alternative 1, invasive plant species would be controlled using treatment measures that require ground disturbance; these ground-disturbing treatment measures could damage or displace traditionally gathered plant populations. However, traditionally gathered plant populations can be impacted by the

continued spread of invasive plants and generally benefit from the removal of invasive plants. Other traditional properties would not be affected under Alternative 1. Control activities under Alternative 1 would not cause any adverse direct impacts on traditional cultural properties. Potential impacts from invasive plant control activities on traditional cultural properties that are archeological sites would be mitigated in accordance with the 1999 Programmatic Agreement such that no direct adverse effects on archeological resources would result. Other mitigations for traditional cultural properties would be developed in consultation with the tribes.

Cumulative Impacts

Cumulative impacts on traditional cultural properties are based on analysis of past, present, and reasonably foreseeable future actions in the Yosemite region in conjunction with the potential effects of this alternative. In the past, traditional cultural properties have been lost or damaged through disruption of cultural traditions and disenfranchisement due to government policies and actions, larger societal trends, as well as past development, visitor use, and natural events such as fire. Nevertheless, Yosemite retains many sites and resources of importance to local and culturally affiliated American Indians. Regional and local present and foreseeable future activities would have both beneficial and adverse impacts on traditional cultural properties. Invasive plant actions would not take place in areas that sustain intact traditional cultural properties. Invasive plant control actions that would enhance or protect traditional cultural properties would talk place, after consultation with local and culturally affiliated American Indians. These projects, when combined with Alternative 1, are expected to have no adverse effect on traditional cultural properties.

Conclusion

There would be no direct impacts on traditional cultural properties as a result of comprehensive programmatic actions under Alternative 1. Control activities under Alternative 1 would not cause any adverse direct impacts on traditional cultural properties. Potential impacts from invasive plant control activities on traditional cultural properties that are archeological sites would be mitigated in accordance with the 1999 Programmatic Agreement such that no direct adverse effects on archeological resources would result. Other mitigations for traditional cultural properties would be developed in consultation with the tribes. The intent of Alternative 1 is to reduce the impacts of invasive plants in the park; thus, this alternative is not expected to result in impairment of the traditional cultural properties in the park.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

With implementation of an effective early detection and prevention program, the park could detect and eradicate invasive plant species before they become established. This alternative would therefore decrease the risk of invasive plants damaging or displacing traditional cultural properties. As a result, a comprehensive invasive plant program would have no adverse impact on traditional cultural properties.

Control

Control measures under Alternative 2 would have impacts to traditional cultural properties that are similar to those under Alternative 1. Thus, there would be no adverse impacts from control measures.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting traditional cultural properties would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce no adverse effect on traditional cultural properties. These effects, along with Alternative 2, would result in no adverse impacts.

Conclusion

The prevention and control activities under Alternative 2 would not cause any adverse impacts on traditional cultural properties. Impacts due to invasive plant control activities would be mitigated in accordance with the 1999 Programmatic Agreement such that no adverse effects on archeological resources would result. The intent of Alternative 2 is to reduce the impacts of invasive plants in the park; thus, this alternative is not expected to result in impairment of the traditional cultural properties in the park.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

Impacts under Alternative 3 would be the same as those described for Alternative 1.

Control

Under this alternative, impacts would be the same as those described for Alternative 1. Although herbicides use is proposed under this alternative, they would not be used in areas that have been identified as traditional gathering sites for plants.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting traditional cultural properties would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce no adverse effect on traditional cultural properties. These effects, along with Alternative 3, would result in no adverse impacts.

Conclusion

Impacts on traditional cultural properties—of both American Indian and early Euro-American settlers—would be similar to those described for Alternative 2. Herbicides would not be used on invasive plant populations that are located in traditional gathering areas. Overall, Alternative 3 would result in no adverse impact. The intent of Alternative 3 is to reduce the impacts of invasive plants in the park; thus, this alternative is not expected to result in impairment of the traditional cultural properties in the park.

Cultural Landscape

Affected Environment

Cultural landscapes are the result of the long interaction between humans and the land. They reflect human adaptation and use of natural resources, and the influence of beliefs, values, traditions, and actions over time upon the natural landscape. They are shaped over time by historical land use and management practices, as well as by politics and property laws, levels of technology, and economic conditions. Cultural landscapes provide a living record of an area's past, and act as a visual chronicle of its history. There are 65 recognized cultural landscapes within the larger context of Yosemite National Park (NPS 1991; NPS 2000a).

Yosemite's cultural landscapes are defined to a large degree by their vegetation. The original American Indian inhabitants extensively modified the natural environment to suit their way of life, creating the distinctive pattern of meadows and open woodland that is a hallmark of Yosemite Valley. European Americans continued to alter the environment during the 19th and 20th centuries while converting Yosemite into a national park. They deliberately and accidentally introduced many non-native species during the course of farming, grazing, construction, landscaping, and visitor use activities. Some non-native trees—in particular, the American elm (*Ulmus americana*), sugar maple (*Acer saccharum*), black locust (*Robinia pseudoacacia*), and various apple varieties—are elements of the cultural landscape. Most of these are represented by mature specimens that survived from the original plantings and have not spread into natural areas; however, black locusts now reproduce, have spread beyond their original location, and are considered invasive. None of these non-native trees that are considered invasive were part of the historic planting palette. The proliferation of non-native plants beyond established historical limits is

changing the essential character of Yosemite's cultural landscape by forcing out or reducing the types and patterns of vegetation, as well as the biological diversity, that has long been associated with the park.

Environmental Consequences – Methodology

Type of Impact: Impacts on historic cultural landscapes are considered adverse if implementation of an alternative diminished the overall integrity of the landscape by irreparably altering its distinctive features or patterns. Unlike impact analyses performed under NEPA, NHPA analyses do not consider beneficial impacts.

Duration of Impact: Any change in the physical attributes of a cultural landscape feature is considered long-term and of permanent duration.

Intensity of Impact: Under the NHPA, impacts on cultural landscapes are characterized as having either an adverse effect or no adverse effect. The proposed action is considered to have no impact when no historic cultural landscapes are present or when the action would not affect historic cultural landscapes. When an action would not alter the characteristics of a historic cultural landscape that qualify it for inclusion in the NRHP, the action is considered to have no adverse effect. When an action would alter the characteristics of a historic cultural landscape that qualify it for inclusion in the NRHP, the action is considered to have an adverse effect. However, effects on features and/or patterns of a cultural landscape are not considered adverse if standard mitigation measures identified in the 1999 Programmatic Agreement are implemented in consultation with the California State Historic Preservation Officer, and if data recovery and reconstruction is carried out in accordance with A Sense of Place: Design Guidelines for Yosemite Valley (NPS 2005b). If the National Park Service, the State Historic Preservation Officer, and the Advisory Council on Historic Preservation cannot agree on implementation of standard mitigation measures to avoid or minimize adverse impacts and are unable to negotiate alternative measures in accordance with 36 CFR 800.6(b), the effect remains adverse.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual and mechanical to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

Comprehensive programmatic actions would reduce the risk of new or larger invasive plant populations becoming well established, and would be implemented before populations increase to the point that intensive control efforts are required. An effective early detection and prevention program would reduce the need for more intensive control efforts within cultural landscapes, thus reducing the risk to cultural landscapes. As a result, prevention and early detection efforts would have no adverse impacts on cultural landscapes.

Control

Control measures under Alternative 1 could temporarily alter the landscape where plants have been removed. Activities would be mitigated in accordance with stipulations outlined in the 1999 Programmatic Agreement. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 1; thus, some invasive plant populations would not be treated under this alternative.

Cumulative Impacts

Cumulative impacts on the cultural landscape are based on analysis of past, present, and reasonably foreseeable future actions in the Yosemite region in conjunction with the potential effects of this alternative. Past development, visitor use, and natural events have resulted in adverse cumulative impacts to historic resources and the cultural landscape. Over time, structures and sites such as homestead cabins, barns, road and trail segments, bridges, mining complexes, railroad and logging facilities, historic tourist facilities, blazes, and campsites have been affected. These resources are reminders of Yosemite's ranching, grazing, lumbering, and mining history, as well as early tourism.

Reasonably foreseeable future actions that could affect historic and cultural landscape resources include the Yosemite Valley Plan, which would remove, relocate, or modify historic buildings and structures. This plan would also restore native vegetation to a pattern that is closer to the cultural landscape and historic setting of Yosemite. Parkwide plans such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans provide a framework for decision-making on future management actions within the river corridors. These plans would have no adverse effect on historic structures and cultural landscape resources.

The impacts of cumulative projects in Yosemite would be mitigated to have no adverse effect on the cultural landscape. These effects, along with Alternative 1, would result in no adverse impacts on the cultural landscape.

Conclusion

The invasive plant program described under Alternative 1 could reduce the spread of existing invasive plants that have the potential to alter the cultural landscape. Control methods could have a temporary impact on the cultural landscape directly after work crews remove invasive plants. Impacts related to invasive plant control activities would be mitigated in accordance with the 1999 Programmatic Agreement such that no adverse effects on the cultural landscape would result. Alternative 1 would not impair the park's cultural landscape for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and

invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The comprehensive programmatic actions described in Alternative 2 would reduce the risk of new or larger invasive plant populations becoming well established, and would be implemented before populations increase to the point that intensive control efforts are required. An effective early detection and prevention program would reduce the need for more intensive control efforts within cultural landscapes, thus reducing the risk to cultural landscapes. As a result, prevention and early detection efforts would have no adverse impacts on cultural landscapes.

Control

The invasive plant program described under Alternative 2 could reduce the spread of existing invasive plants that have the potential to alter the cultural landscape. Control methods could have a temporary impact on the cultural landscape directly after work crews remove invasive plants. The park would mitigate impacts related to invasive plant control activities in accordance with the 1999 Programmatic Agreement such that no adverse effects on the cultural landscape would result. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 2; thus, some invasive plant populations would not be treated under this alternative.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting the cultural landscape would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce no adverse effect. These effects, along with Alternative 2, would result in no adverse impacts on the cultural landscape.

Conclusion

Alternative 2 would not have an adverse impact on cultural landscapes due to the mitigation of impacts related to control efforts and the implementation of a comprehensive prevention and early detection program. Alternative 2 would not impair the park's cultural landscape for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-

priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

Impacts resulting from early detection and rapid response, prevention, prioritization, monitoring, outreach, and education activities under Alternative 3 would be the same as those described for Alternative 2.

Control

Control measures under this alternative could temporarily alter the landscape in areas where invasive plants have been removed. However, mitigation of impacts related to these activities would occur in accordance with the 1999 Programmatic Agreement. In some cases, this agreement could preclude the use of the control techniques proposed under Alternative 2; thus, some invasive plant populations would not be treated under this alternative.

Cumulative Impacts

The past, present, and reasonably foreseeable projects effecting the cultural landscape would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce no adverse effect. These effects, along with Alternative 3, would result in no adverse impacts on the cultural landscape.

Conclusion

Alternative 3 would not have an adverse impact on cultural landscapes due to the mitigation of impacts related to control efforts and the implementation of a comprehensive prevention and early detection program. Alternative 3 would not impair the park's cultural landscape for future generations.

Scenic Resources

Affected Environment

The scenic resources of Yosemite include not only the iconic views within Yosemite Valley, but also the expansive views in the Yosemite Wilderness, views seen along the major roads, and views within other major destinations.

Yosemite Valley. Scenic resources have been studied and analyzed in Yosemite National Park since at least 1865, when a board of commissioners appointed by the governor of the State of California commissioned three artists to study and document the scenery of Yosemite. The 1865 board identified the 11 most important features in Yosemite Valley as Half Dome, Yosemite Falls, El Capitan, Bridalveil Fall, Three Brothers, Cathedral Rocks and Spires, Sentinel Rock, Glacier Point, North Dome, Washington Column, and Royal Arches (NPS 1980). Other important scenic resources that can be viewed in Yosemite Valley include: Nevada, Illilouette, and Ribbon Falls; the cliffs at Yosemite Point/Lost Arrow Spine; and the scenic interface of river, rock, meadow, and forest throughout the Valley.

Many of these important scenic features are in Wilderness. Some visual resources in Wilderness are less well known. The Merced and Tuolumne River watersheds and their many lakes, falls, and valleys; granite domes; and the peaks of the Sierra crest dominate the scenery of Yosemite's Wilderness. Only a small fraction of the visitors to the park ever directly experience the scenic resources beyond the views from roads and highways, but the lack of people and modern cultural artifacts enhances the beauty of Wilderness areas as well as the opportunity to enjoy these landscapes.

Major Thoroughfares. Tioga Road offers broad alpine views of meadows, domes, distant peaks, and Tenaya Lake. Exfoliating granite surfaces along Tioga Road provide a unique view of the geologic processes at work in Yosemite. Visitors encounter dramatic views of Yosemite Valley as they approach from the north and south. Dense vegetation obscures many historic views and vistas.

Wawona Area. Scenery in the Wawona area includes the South Fork of the Merced River, forests, granite features such as Wawona Dome, and the Wawona Hotel and its historic landscape.

El Portal. Scenery in El Portal includes the V-shaped Merced River gorge with its steep unglaciated terrain and woodland and grassland cover, and the rocky boulder-strewn riverbed.

Invasive plants have the ability to quickly spread and displace native vegetation in scenic areas. This invasive process can alter the visual character, traditional vegetation patterns, and visitor perception of the park's scenic resources. Non-native plant species can have elements such as color, texture, form, patterning, massing, and spacing that create an undesirable contrast with native vegetation. In addition, some non-native plant species have characteristics such as thorns or growth patterns that may be visually undesirable. These characteristics may be perceived as unkempt, weedy, or overgrown in appearance (Nassauer 1997).

Environmental Consequences – Methodology

Impacts on scenic resources consist of substantial changes that would alter important viewpoints in terms of: 1) existing landscape character, whether foreground, intermediate ground, or background; 2) access to historically important viewpoints or sequences of viewpoints; or 3) the visibility of a viewpoint or sequence of viewpoints. The visual character of the landscape includes the color, contextual scale, and formal attributes of landscape components and features. Experiential factors include whether a given action would result in a visible change, the duration of any change in the visual character, the distance and viewing conditions under which the change would be visible, and the number of viewers that would be affected.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Impacts are considered beneficial if implementation of an alternative would enhance the existing landscape character, access to historically important viewpoints or sequences of viewpoints, or the visibility of a viewpoint or sequence of viewpoints. Impacts are considered adverse if implementation of an alternative would diminish the existing landscape character, access to historically important viewpoints or sequences of viewpoints, or the visibility of a viewpoint or sequence of viewpoints.

Duration of Impact: The duration of an impact is the time required for the integrity of scenic resources to recover after invasive plant control treatments. The duration of scenic resources impacts is characterized as short-term or long-term. A short-term impact would be temporary (less than two years), and a long-term impact would be permanent and continual.

Intensity of Impact: The intensity of an impact on scenic values is a measure of perceptible changes to scenic views from specific vantage points and to specific scenic features. The magnitude of impacts on scenic values is described as negligible, minor, moderate, or major. Negligible impacts would be imperceptible or not detectable. Minor impacts would be slightly detectable or localized within a relatively small area. Moderate impacts are those that would be readily apparent. Major impacts would be substantial and highly noticeable and/or would change the character of the landscape.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual and mechanical techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Outreach, and Education

The comprehensive programmatic actions described for Alternative 1 would reduce the risk of new invasive plant populations in scenic areas. Early detection, rapid response, and prevention practices would help keep species that already exist within park boundaries from becoming established elsewhere in the park, as well as prevent new species of invasive plants from entering the park. Prevention techniques would allow workers to discover invasive plant populations before they become established, which would reduce the extent and intensity of measures needed to control or eradicate invasive plant populations. Prioritization practices under Alternative 1 would assist resource managers by ensuring the proper distribution of limited resources (primarily staffing and equipment) for control and eradication efforts. Implementation of research actions under Alternative 1 would improve all components of the invasive plant program by helping park staff understand the most efficient and effective techniques and priorities for the invasive plant program. Monitoring activities would allow resource managers to determine the effectiveness of management actions and improve the efficiency of resource allocation. Implementation of a comprehensive program would have a long-term minor beneficial impact on scenic resources in Yosemite.

Control

Alternative 1 would implement multiple control techniques to treat existing invasive plant populations without the use of herbicides. Mowing, brushing, weed-eating, and flaming techniques could have a negative impact on park viewsheds. Workers could leave slash and other residual material on the ground to dry as mulch; these materials could contrast visually with the untreated areas in terms of texture and color. Manual and mechanical treatments could also increase ground disturbance. As a result, manual and mechanical treatments would have a short-term moderate adverse impact on scenic resources. Another technique—using mulch and other chipped vegetation to smother vegetation—could also temporarily

impact the scenic resources of the park by creating undesirable variations in texture and color when compared to the surrounding vegetation.

The risk of new infestations would remain moderate for invasive plants in favorable habitats, because park staff would be unable to substantially control or eradicate some species without the use of herbicides. Invasive plants at a high risk of remaining and spreading into scenic viewsheds include non-native blackberry, yellow star-thistle, black locust, and tree-of-heaven. Non-native blackberry has the potential to overtake low- to mid-elevation meadows. Yellow star-thistle forms a monoculture in low-elevation grasslands. Black locust and tree-of-heaven can quickly overtake upland sites. The presence of these species could impact landscape character, access to important viewpoints, or the visibility of scenic views.

Control activities would have a short-term minor adverse impact on scenic resources. In the long term, there would be a minor beneficial impact on scenic resources, as removal activities would restore native vegetation.

Cumulative Impacts

Cumulative impacts on scenic resources are based on analysis of past, present, and reasonably foreseeable future actions in the Yosemite region. These actions include urban development that would interrupt the natural scene and fire management activities (CNPS 2001). Local and regional actions, listed in Appendix M, would have beneficial and adverse impacts on scenic resources. Parkwide planning efforts such as the Merced and Tuolumne Wild and Scenic Comprehensive Management Plans and the Wilderness Management Plan would protect and enhance scenic values on a watershed scale. Prescribed fire and managed wildland fire activities would greatly reduce the threat of large high-severity catastrophic fires, and would reduce the potential for vegetation type conversion. Actions such as the El Capitan Meadow Restoration Project and the Visitor Use and Floodplain Restoration Project in East Yosemite Valley would restore the natural scenery in impacted sites. California State and local programs to control invasive plant species would restore the composition of natural vegetation and restore scenic values.

Present and future regional actions would have long-term negligible beneficial impacts on scenic resources. These impacts, in conjunction with the long-term minor beneficial impacts on scenic resources from Alternative 1, would result in long-term negligible beneficial impacts.

Conclusion

Control actions described under Alternative 1 would result in a short-term minor adverse impact on scenic resources, and a long-term minor beneficial impact on scenic resources as areas of native vegetation are restored. Overall, there would be a long-term minor beneficial impact on scenic resources under Alternative 1. Because long-term impacts under Alternative 1 would be minor and beneficial, scenic resources would not be impaired for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts of comprehensive programmatic actions described for Alternative 2 would be the same as those under Alternative 1. Implementation of a comprehensive program would have a long-term minor beneficial impact on scenic resources in Yosemite.

Control

Alternative 2 proposes multiple control techniques to treat existing invasive plant populations, including the use of herbicides to control certain high-priority non-native plants that meet specified criteria. The limited use of herbicides to control invasive plants in the park could have a short-term minor adverse impact on scenic viewsheds. Herbicides and other control techniques could temporarily affect the continuity of the landscape due to alterations in color and texture. These changes would be noticeable for a growing season or until new vegetation colonizes. However, the judicious use of herbicides would increase the number of acres the park could treat each year, making it feasible to control many more acres of invasive plants each year than if herbicides were not used. Therefore, this alternative would result in a long-term moderate beneficial impact on scenic resources in the park.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting scenic resources would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce long-term negligible beneficial impacts. These effects, along with long-term moderate beneficial impacts of Alternative 2, would result in long-term negligible, beneficial impacts.

Conclusion

Alternative 2 would result in a short-term minor adverse impact on scenic resources due to the impacts of control activities. This alternative would result in a long-term moderate beneficial impact on scenic resources as native vegetation is restored. The use of herbicides under Alternative 2 would increase the area of restored vegetation and allow the park to meet management objectives. Because long-term impacts would be moderate and beneficial, scenic resources would not be impaired for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts of comprehensive programmatic actions described for Alternative 3 would be the same as those under Alternative 1. Implementation of a comprehensive program would have a long-term minor beneficial impact on scenic resources in Yosemite.

Control

Alternative 3 proposes more herbicide use than Alternative 2. Herbicides and other control techniques could temporarily affect the continuity of the landscape due to alterations in color and texture. These changes would be noticeable for a growing season or until new vegetation colonizes. However, the use of herbicides would prevent the invasive plant spread into natural habitats. Under Alternative 3, invasive plant control techniques would have a short-term minor adverse impact on scenic viewsheds. There would be long-term moderate beneficial impacts on scenic resources in the park from the reduction of invasive plants

Cumulative

The past, present, and reasonably foreseeable projects affecting scenic resources would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce long-term negligible beneficial impacts. These effects, along with long-term moderate beneficial impacts of Alternative 3, would result in long-term negligible, beneficial impacts.

Conclusion

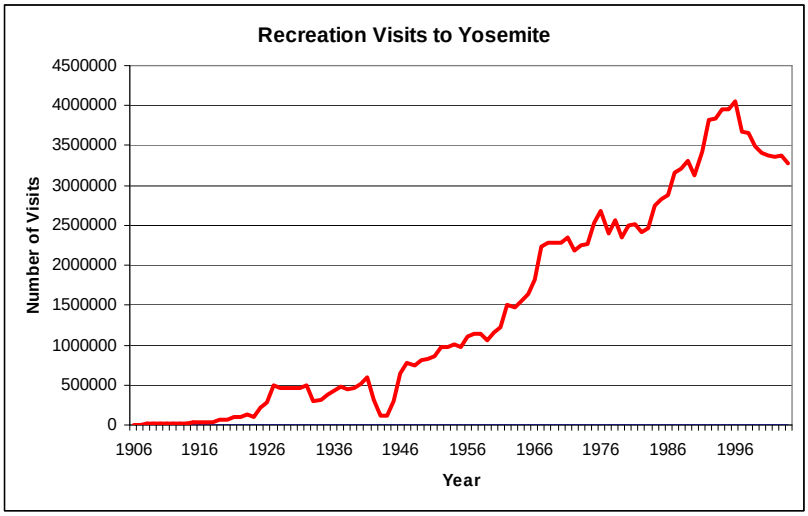
There would be a long-term moderate beneficial impact on scenic resources in the park because the use of herbicides would greatly increase the area of restored vegetation and allow the park to meet management objectives, with short-term negligible to minor impacts from control activities. Because long-term impacts would be moderate and beneficial, scenic resources would not be impaired for future generations.

Visitor Experience and Recreation

Affected Environment

Yosemite is one of the most highly visited parks in the National Park System. More than 3 million people visit the park each year. Visitor use in Yosemite has been tracked by the National Park Service Public Use Statistics Office, as shown in Table III-3. Park use peaked in the mid-1990s at over 4 million recreation visits. Since that time, use has declined slightly and flattened out at the current use level of approximately 3.23 million recreational visits per year. Visitors to the park engage in a diversity of recreation and leisure activities, as described below (Gramann 1992; ORCA 2000; Manning 2001-2002; Littlejohn, Meldrom et al. 2006).

Table III-3: Recreation Use in Yosemite National Park



Camping and Lodging: Yosemite provides a variety of overnight camping and lodging opportunities, ranging from remote Wilderness to front-country drive-in camping and lodging. Wilderness users can camp at-large in the back-country by obtaining a permit, while other park visitors may ride in via stock or hike in on foot to stay at any of five High Sierra Camps, enclaves to Wilderness, operated by one of the park's concessioners. In addition, several designated camping areas exist in the back-country, including the Little Yosemite Valley, Moraine Dome, and Merced Lake backpacker's campgrounds at Merced Lake, Glen Aulin, May Lake, Sunrise, and Vogelsang (adjacent to the High Sierra Camps). The park concessioner also operates park lodging in Yosemite Valley, Wawona, White Wolf, and Tuolumne Meadows.

Sightseeing: Since the inception of Yosemite National Park, the viewing of scenic vistas has been a principal activity. The most notable scenic views in Yosemite are: Half Dome; Yosemite, Bridalveil, Vernal, and other waterfalls; giant sequoia trees at the Mariposa, Merced, and Tuolumne Groves; the mountain peaks of the High Sierra along the Tioga Road corridor; and other historic vistas including Tunnel View, Valley View, and Olmstead Point.

Hiking: More than 800 miles of trails provide visitors with outstanding opportunities for hiking in Yosemite. Trail classifications range from primitive trails in remote Wilderness areas (e.g., the John Muir Trail, a designated National Scenic Trail) to multi-use paved paths in the front-country (e.g., the Valley Loop Trail).

Swimming: The various lakes and rivers in Yosemite provide excellent opportunities for swimming and sun bathing. In particular, visitors use the sandbars and easily accessed banks of the Merced River in Yosemite Valley for swimming. Tenaya Lake is a popular swimming destination in the Tuolumne area along the Tioga Road.

Photography: The scenic grandeur of Yosemite has inspired photographers for decades. Most notable among these was Ansel Adams, who spent time capturing images of Yosemite and the Sierra in the 1900s. Photography remains a popular activity among contemporary park visitors as well. Vistas such as Valley View, El Capitan, and Half Dome continue to be popular subjects.

Picnicking: Picnicking is another popular activity in the park; picnicking takes place at various designated areas as well as at-large along rivers and in meadows. Facility for picnics are available at principal attraction areas throughout the park, including the Wawona District and Yosemite Valley.

Bicycling: Bicycle riding is only allowed on roadways and designated pathways. Riding bicycles is quite popular in Yosemite Valley because it presents visitors with both an alternative mode of transport and a means to experience the park. The park concessioner provides a bicycle rental services at Curry Village and Yosemite Lodge to visitors at Curry Village.

Fishing: Angling is popular in the streams, rivers, and lakes of Yosemite. Brown trout, rainbow trout, brook trout, and smallmouth bass are common species in the park, and are abundant enough to sustain a fishery. The State of California and the National Park Service regulate sport fishing. Park-specific regulations designate certain areas as catch-and-release waters for rainbow trout, and place catch limits on brown trout.

Rock Climbing: Yosemite is a world-class rock climbing destination due in large part to its unique geological features and the abundance of granite formations, most notable of which are the El Capitan and Half Dome monoliths. The park concessioner operates a mountaineering school in the park that provides climbing instruction, guiding services, and equipment rentals and sales.

Stock Use: Both private and commercial stock use occurs in Yosemite. Allowable stock in the park includes horses, mules, burrows, and llamas. The park concessioner provides stock trips to various locations in Yosemite Valley, Wawona, Tuolumne Meadows and the Wilderness. Trips range in duration from two hours to multi-day excursions. The 1989 Wilderness Management Plan and the 1999 Superintendent's Compendium regulate stock use. Commercial stock use is authorized by concession contract or Commercial Use Authorization.

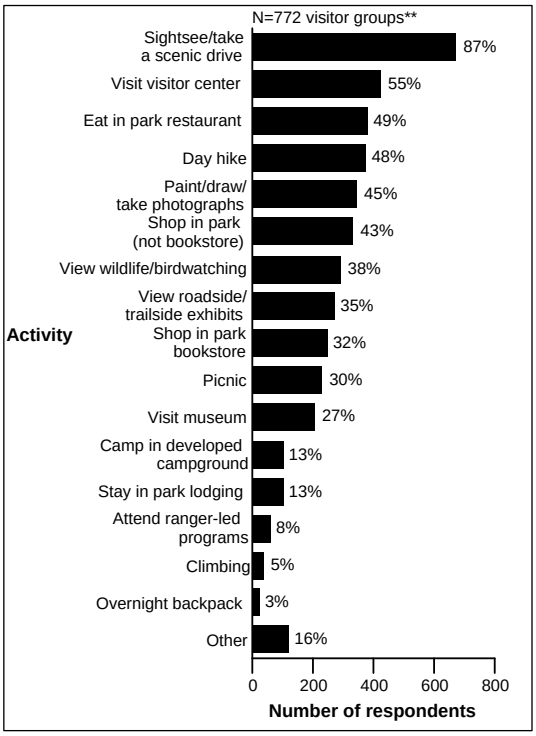
Non-Motorized Watercraft: Non-motorized watercrafts are permitted on designated reaches of the Merced River, and river rafting is a popular activity. The park concessioner is authorized by concession contract to provide raft rental service to park visitors on the Merced River in Yosemite Valley. In 2007, the concessioner rented approximately 13,700 rafts (Catamec 2007). Whitewater rafting and kayaking are

permitted along the reaches of the Merced River through the El Portal Administrative Site. Both personal and commercial rafting occurs in this area.

A visitor use study conducted in summer 2005 reflects the most recent data on recreational use in Yosemite. Table III-4 presents visitor participation in various recreation and leisure activities during this year (Littlejohn, Meldrom et al. 2006).

Invasive plants have the potential to affect visitors as they participate in recreational activities by altering the character of the scenic landscape, limiting access through areas, or limiting the visibility of scenic views. Invasive plants at a high risk of spreading and persisting in scenic viewsheds include non-native blackberry, yellow star-thistle, black locust, and tree-of-heaven. Invasive species have the potential to change the scenic landscape and limit foot travel.

Table III-4: Visitor Activities in Yosemite



Environmental Consequences – Methodology

The methodology used to evaluate impacts on visitor experience and recreation was based on scientific literature and/or expert judgment. Several basic assumptions guided these evaluations:

- Alternative invasive plant management strategies may affect the quality of visitor experiences and the character of recreation opportunities in the park in a different ways depending on the type and intensity of management action taken.
- The quality of a recreational experience may be gauged to some degree by a person's participation in a particular activity (Driver and Knopf 1977).

- Visitor experiences are multi-phasic in that the quality of the experience is determined prior to, during, and after participation in activities (Clawson and Knetsch 1966).

Type of Impact: This analysis identifies impacts on visitor experience and recreation as either beneficial or adverse. Impacts are considered beneficial if implementation of an alternative would enhance the quality of the visitor experience, increase participation, or improve the overall level of service. Impacts are considered adverse if implementation of an alternative would diminish the quality of the experience of, decrease participation in, or reduce the overall level of service of, visitor recreation and leisure activities.

Duration of Impact: The duration of an impact is the time required for visitor experiences and recreation opportunities to recover after treatments for control of invasive plants. Potential impacts are short-term or long-term. Short-term impacts are those that would occur for short periods during invasive plant management actions. Long-term impacts are those that would permanently affect the quality of the visitor experience, perhaps well after an invasive plant management action has been taken.

Intensity of Impact: The intensity of an impact on visitor experience and recreation is a measure of perceptible changes in opportunities for visitors to participate in desired experiences. Impact intensity is characterized as negligible, minor, moderate, or major. Negligible impacts are those that would result in little noticeable change in visitor experience. Minor impacts would result in changes in desired experiences, but would not appreciably limit or enhance critical experiential characteristics or activity participation. Moderate impacts would change the desired experience, appreciably altering critical experiential characteristics and/or activity participation. Major impacts would eliminate or greatly enhance multiple critical characteristics or greatly reduce/increase activity participation.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual and mechanical techniques to control invasive plants, without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The comprehensive programmatic actions described for Alternative 2 would reduce the risk of new invasive plant populations. These practices would address the spread of invasive plants before they could affect the visitor experience and recreation opportunities. Implementation of a comprehensive program would have a long-term minor beneficial impact on recreation and the visitor experience in Yosemite. Implementation of the invasive plant program would cause short-term negligible impacts on the quality of the visitor experience, and these impacts could be either adverse or beneficial. In instances where visitors are seeking solitude, the presence of uniformed park rangers could detract from their experience, particularly in Wilderness settings. However, the experience of other visitors could be enhanced by encounters with rangers as they conduct invasive plant research, monitoring, or control, because these activities present opportunities for visitors to learn about resource management issues and activities.

Control

Control involving hand-pulling or the use of tools for pulling would not cause impacts, other than the negligible intrusion of work groups into the recreational setting. Control activities that involve the use of equipment such as mowing, brush-cutting, and weed-eating would have a short-term minor to moderate adverse impact on the quality of the visitor experience. The noise generated by this equipment can disrupt enjoyment of natural ambient sounds and affect the ability of visitors to obtain a quality leisure experience that includes a sense of solitude and tranquility. The use of heavy equipment could have a short-term minor adverse impact on the visitor experience due to intrusions into the natural landscape that affect visitor enjoyment of scenic vistas and diminish the overall feeling of naturalness in the setting.

Cumulative Impacts

Cumulative impacts on the visitor experience are based on analysis of past, present, and reasonably foreseeable future actions. Past actions that affect the visitor experience include the development of visitor use facilities in the Yosemite region. Local and regional actions listed in Appendix M would provide support to visitors, including Yosemite Motels expansion, Curry Village and east Yosemite Valley Campgrounds (see Appendix M). Present and future regional actions would have long-term minor beneficial impacts on the visitor experience. The Invasive Plant Management Plan does not propose to remove, increase, or modify visitor facilities, and its major influence would be that of local effects upon recreational experiences, including hiking, nature study, and scenic touring. The impacts of other projects in the region, in conjunction with the impacts of Alternative 1, would result in long-term minor beneficial impacts.

Conclusion

Implementation of a comprehensive invasive plant program would have a long-term minor beneficial impact on the visitor experience in Yosemite. Control activities under Alternative 1 would have a short-term minor adverse impact on the visitor experience. There would be a long-term minor beneficial impact on the visitor experience; this alternative would prevent invasive plants from altering the character of the scenic landscape, limiting access to natural areas in the park, or limiting the visibility of scenic views. Because long-term impacts on recreation under Alternative 1 would be minor and beneficial, Alternative 1 would not impair the park's visitor experience or recreational resources for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts of comprehensive programmatic actions described for Alternative 2 would be the same as those under Alternative 1. Implementation of a comprehensive program would have a long-term minor beneficial impact on scenic resources in Yosemite.

Control

The impacts of using manual and mechanical control methods to treat invasive plants would be the same as those described for Alternative 1. In addition, the use of herbicides could affect the quality of the visitor experience due to real or perceived health risks associated with such chemicals. The use of herbicides would greatly increase the area of restored vegetation, and would allow the park to meet management objectives, with only short-term negligible to minor impacts.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting visitor experience would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce long-term minor beneficial impacts. These effects, in combination Alternative 2, would result in long-term minor beneficial impacts.

Conclusion

Impacts under Alternative 2 would be similar to those described for Alternative 1, except for those related to the additional use of herbicides. Alternative 2 would result in a short-term minor adverse impact on the visitor experience due to the localized effects of control activities. There would be a long-term minor beneficial impact on the visitor experience; this alternative would prevent invasive plants from altering the character of the scenic landscape, limiting access to natural areas in the park, or limiting the visibility of scenic views.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts of comprehensive programmatic actions described for Alternative 3 would be the same as those under Alternative 1. Implementation of a comprehensive program would have a long-term minor beneficial impact on scenic resources in Yosemite.

Control

The impacts of using manual and mechanical control methods to treat invasive plants would be the same as those described for Alternative 2. The additional use of herbicides under Alternative 3 could affect the quality of the visitor experience due to real or perceived health risks associated with such chemicals. The use of herbicides would greatly increase the area of restored vegetation, and would allow the park to meet management objectives, with only short-term negligible to minor impacts.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting visitor experience would be the same as those under Alternative 1. Local and regional present and foreseeable future actions would produce long-term minor beneficial impacts. These effects, in combination Alternative 3, would result in long-term minor beneficial impacts.

Conclusion

Alternative 3 would result in a short-term minor adverse impact on the visitor experience due to the localized effects of control activities. There would be a long-term minor beneficial impact on the visitor experience in the park; herbicides use would greatly increase the area of restored vegetation and help ensure that invasive plants do not alter the character of the scenic landscape, limit access to natural areas in the park, or limit the visibility of scenic views.

Park Operations

Affected Environment

The Park Superintendent is responsible for the overall management, operation, and safety operations of the park. The National Park Service in Yosemite is organized operationally into eight divisions, each with a functional area of responsibility. Each division plays a part in invasive plant management. The Division of Resources Management and Science manages the invasive plant program and performs the majority of the functions related to invasive plant control. The Division of Planning oversees the general direction of planning in the park. The Division of Facilities Management maintains the park infrastructure, which includes buildings, grounds, roads, trails, and utilities. Facilities Management employees are stationed throughout the park, including Wilderness areas, and can be an asset in the early detection of invasive plant populations. The Division of Project Management oversees all park construction projects, many of which are completed by private contractors. Project Management employees ensure that contractors are in compliance with park policies that reduce the risk of spread of invasive plants. The Division of Project Management also facilitated the environmental assessment and compliance requirements of this Invasive Plant Management Plan. The Division of Protection oversees law enforcement, fire, and Wilderness

management. Fire managers play an important role in the control of invasive plants, because recently burned ground is highly susceptible to plant invasion. The Division of Interpretation and Education relates a variety of park issues to the public. The public perception of park management policies, including those relevant to invasive plant management, is influenced by Interpretation staff. The Division of Business and Revenue Management administers concessioner contracts, Commercial Use Authorizations, Special Use Permits, land assignments, the park's volunteer program, and entrance station and campground operations. Many operational oversight functions of this division may be of assistance in the implementation of the Invasive Plant Management Plan. The Division of Administration Management performs fundamental services for the success of invasive planning efforts, such as administering staff hiring, contracts, and housing needs.

Environmental Consequences – Methodology

Impacts were evaluated by assessing changes to park operations that would be needed to perform the actions described for each of the alternatives. Alternatives that would necessitate changes in staffing levels would represent an impact on operations. Existing staffing levels were inventoried and assessments were made of current operations. Knowledge about proposed activities was used to anticipate the operational changes that would be needed under each action alternative. An assessment of the labor required to implement these actions was compared to existing operations, staffing, and funding.

Type of Impact: This analysis identifies potential impacts as either beneficial or adverse. Impacts are considered adverse if implementation of an alternative would an increase operating costs. Impacts are considered beneficial if implementation of an alternative would decrease operating costs.

Duration of Impact: The duration of an impact is the time required for park operations to return to current conditions after implementation of an alternative. The analysis identifies impacts as either short-term or long-term. In general, short-term impacts would be temporary transitional effects associated with implementation of an action (e.g., related to construction activities). In contrast, long-term impacts are generally those that would last ten years or more and have a permanent effect on park operations.

Intensity of Impact: The intensity of an impact on park operations is a measure of changes in costs required to continue existing operations. Negligible impacts would not result in a measurable difference in costs from existing levels. Minor impacts are those that would cause measurable additions or reductions in cost of less than 15 percent of existing levels. Moderate impacts would result in additions or reductions in cost of 15 to 30 percent of existing levels. Major impacts would result in additions or reductions exceeding 30 percent of existing levels.

Environmental Consequences of Alternative 1 (No Action)

The National Park Service would manage invasive plants through a comprehensive program using a variety of manual and mechanical and other techniques to control invasive plants without the use of herbicides (see Actions Common to All Alternatives). Prevention, early detection, and prioritization practices would continue to distribute resources as effectively as possible.

Early Detection and Rapid Response, Prevention, Control, Prioritization, Monitoring, Research, Outreach, and Education

Staffing demands would continue in the Division of Resource Management and Science for the programmatic actions described for Alternative 1, including surveys of construction sites, burned areas, Wilderness, and developed areas. These measures could require additional employees. The Divisions of Facilities Management and Project Management could experience increases in project/contract costs for construction site surveys. Prevention measures related to fire management would increase work demands; however, those demands likely would not be enough to warrant the hiring of additional personnel. Additional staffing demands for prevention activities would be more cost-effective than controlling invasive species once they establish.

Control

Control techniques under Alternative 1 do not include the use of herbicides. Manual and mechanical control treatments and re-treatments would require labor-intensive efforts to control high-priority invasive plant populations. Currently, over 75 percent of annual control efforts are committed to re-treating invasive populations. As invasive plant populations spread, the Division of Resource Management and Science would require increased staff for additional control and monitoring efforts. This increased work demand would result in a long-term minor adverse impact.

Cumulative Impacts

Cumulative effects on park operations are based on analysis of past, present, and reasonably foreseeable future actions in Yosemite Valley, along with the potential effects of this alternative. The extent to which past, present, or foreseeable future projects would have a cumulative effect is determined largely by whether such projects would affect park facilities or the demand for park operations, services and facilities. Projects that affect park facilities themselves or the demand for facilities management, resource management, and maintenance of park infrastructure would also have the potential for cumulative effects with the proposed project.

Park operations and facilities have been affected by numerous past management decisions and projects since the inception of the park. For example, implementation of the actions called for in both the Yosemite Valley Plan and the Merced River Plan would have local short- and long-term moderate adverse impacts on park operations and facilities.

Some present projects—e.g., the Utilities Master Plan/East Yosemite Valley Utilities Improvement Plan—would have overall net long-term minor to moderate beneficial impacts to park operations. These projects would improve and/or replace existing infrastructure with more modern and efficient facilities, with the net effect of reducing maintenance and upkeep needs and thus reducing demands on overall park operations. In contrast, the Curry Village and East Yosemite Valley Campgrounds Improvement project may require more maintenance of park infrastructure. Overall, past, present, and reasonably foreseeable future actions would have local long-term minor adverse cumulative impacts because of the increased demand on park operations, services, and facilities over both the short and long term. These cumulative impacts, along with Alternative 1, would result in local short- and long-term minor adverse impacts to park operations and facilities.

Conclusion

There would be a short-term moderate adverse impact on park operations due to increasing staffing needs for prevention, early detection, monitoring, and outreach and education. The Divisions of Facilities Management and Project Management could experience increases in project/contract costs for construction site surveys and invasive plant control. These additional prevention measures would decrease the establishment and spread of invasive plants and the subsequent demand for costly and labor-intensive control efforts over time. Control efforts under this alternative would require labor-intensive efforts that would increase long-term costs to Resources Management. Together, these efforts would result in a long-term minor adverse impact on park operations. Because Alternative 1 would result in a long-term minor adverse impact on park operations, this alternative would not impair park operations for future generations.

Environmental Consequences of Alternative 2: Achieve Management Objectives for High- and Medium-High-Priority Invasive Plants (Preferred Alternative)

Under Alternative 2, the National Park Service would meet management objectives for high- and medium-high-priority invasive plant species using a variety of manual and mechanical control techniques, as described under Actions Common to All Alternatives. Additionally, work crews would use herbicides to control up to 22 invasive plant species if objectives could not be met using other control techniques and invasive plant populations met specified criteria. The area of the park that is free from the impacts of invasive plants is expected to increase over time. The use of herbicides is expected to decline over time as specified invasive plant populations are controlled.

Early Detection and Rapid Response, Prevention, Prioritization, Monitoring, Research, Outreach, and Education

The impacts related to early detection and rapid response, monitoring, prevention, outreach, and education under Alternative 2 would be the same as those for Alternative 1.

Control

Currently, over 75 percent of annual control efforts are committed to the re-treatment of invasive populations. Herbicide use could eliminate the need to re-treat certain species as populations are effectively controlled. Less time and effort would be required annually to treat populations, and the park would be able to treat additional acres with the same level of staffing. Alternative 2 would require an increased level of training for park staff to safely and effectively control invasive plants using herbicides. Over time, it is likely that fewer resources would be required to control invasive plants.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting park operations would be the same as those under Alternative 1. Overall, past, present, and reasonably foreseeable future actions would have local long-term minor adverse cumulative impacts because of the increased demand on park operations, services, and facilities over both the short and long term. These cumulative impacts, along with Alternative 2, would result in local short- and long-term minor adverse impacts to park operations and facilities.

Conclusion

As with Alternative 1, there would be a short-term moderate adverse impact on park operations due to increased staffing needs for prevention, early detection, monitoring, and outreach and education. Invasive plant management efforts would result in a short-term minor adverse impact and a long-term minor beneficial impact on park operations. Overall, Alternative 2 would result in a long-term minor beneficial impact on park operations. This alternative would not impair the park's operations for future generations.

Environmental Consequences of Alternative 3: Achieve Management Objectives for High-, Medium-High-, and Medium-Priority Invasive Plants

Alternative 3 is similar to Alternative 2; however, under Alternative 3, herbicides would be used not only when manual and mechanical control methods are ineffective, but also to increase the efficiency of work efforts in disturbed and developed areas of the park such as road corridors, parking lots, and staging areas. Herbicides are proposed to control up to 35 invasive species (see Table II-6). Under Alternative 3, the National Park Service would meet management objectives for high-, medium-high-, and medium-priority invasive plant species (see Appendix A). The area of the park that is free from invasive plants is expected to increase over time.

Early Detection and Rapid Response, Prevention, Control, Prioritization, Monitoring, Research, Outreach, and Education

The impacts related to early detection and rapid response, monitoring, prevention, outreach, and education under Alternative 2 would be the same as those for Alternative 1.

Control

Under Alternative 3, herbicides would be applied in areas likely to foster the spread of invasive plants. By containing these areas (e.g., road corridors and staging areas), the establishment and spread of invasive plants would be reduced, although continued staffing would be required to apply herbicides. There would be a long-term negligible adverse impact on staffing.

Cumulative Impacts

The past, present, and reasonably foreseeable projects affecting park operations would be the same as those under Alternative 1. Overall, past, present, and reasonably foreseeable future actions would have local long-term minor adverse cumulative impacts because of the increased demand on park operations, services, and facilities over both the short and long term. These cumulative impacts, along with Alternative 3, would result in local short- and long-term minor adverse impacts to park operations and facilities.

Conclusion

Under Alternative 3, staffing demands would remain relatively the same over the long term, resulting in a negligible adverse impact.

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Chapter IV: Wild and Scenic River Act Compliance

Introduction

In the 1960s, the United States came to recognize that the nation's rivers were being dredged, dammed, diverted, and degraded at a rapid rate. In response, in October 1968, the U.S. Congress established the Wild and Scenic Rivers Act to protect and enhance rivers that possess distinctively unique or "outstandingly remarkable values" that set them apart from all other rivers. Wild and Scenic Rivers are designated to protect their free-flowing condition and to protect and enhance their unique values for the benefit and enjoyment of present and future generations (16 USC 1271).

Yosemite contains two Wild and Scenic Rivers. In 1984, Congress designated 83 miles of the Tuolumne River (54 of which are within Yosemite National Park) as part of the National Wild and Scenic River System. In 1987, Congress placed 122 miles of the main stem and South Fork of the Merced River—including the forks of Red Peak, Merced Peak, Triple Peak, and Lyell—into the Wild and Scenic River System. The National Park Service manages 81 miles of the Merced Wild and Scenic River, encompassing both the main stem and the South Fork in Yosemite National Park and the El Portal Administrative Site. This chapter evaluates the consistency of the proposed action in the Invasive Plant Management Plan with the Wild and Scenic Rivers Act.

Methodology

This analysis focuses on five elements of the Wild and Scenic Rivers Act: 1) the relationship of the proposed action to Wild and Scenic River boundaries; 2) the compatibility of the proposed action with Wild and Scenic River classifications; 3) the protection and enhancement of ORVs; 4) user capacity; and 5) the Section 7 requirements of the Wild and Scenic Rivers Act. This analysis compares the Preferred alternative with the No Action alternative (see Chapter 2, Alternatives). The focus of the analysis is on long-term effects (e.g., effects that would last ten years or more or would be permanent). Short-term effects are not addressed in this analysis unless they have a substantial, highly noticeable influence to warrant consideration.

Relationship of the Action to the Wild and Scenic River Boundary

The 1984 Tuolumne River Wild and Scenic River designation established a boundary extending 0.25 mile on either side of the river, the maximum allowed under the Wild and Scenic Rivers Act. In the designating language for the Merced River, the Wild and Scenic Rivers Act signals the intent of Congress to protect a minimum of 0.25 mile from both riverbanks until a Comprehensive Management Plan formally defines the boundaries. The Secretarial Guidelines restate that, for designated rivers for which boundaries are yet to be formally defined, the boundary is "an area extending the length of the river segment authorized for study and extending in width one-quarter mile from each bank of the river." The proposed alternative in the Invasive Plant Management Plan calls for actions within both Wild and Scenic River boundaries in Yosemite, the main stem and South Fork of the Merced Wild and Scenic River, and the Dana and Lyell Forks of the Tuolumne Wild and Scenic River.

Classification Consistency

The Merced and Tuolumne Wild and Scenic Rivers are broken into segments that are classified as Wild, Scenic, or Recreational in accordance with criteria established in the Wild and Scenic Rivers Act at the time of designation. These classifications are derived at the time of designation from the status of impoundments, shoreline development, or road access along the river. The Invasive Plant Management Plan would result in no inconsistencies with the existing classifications.

Outstandingly Remarkable Values

With regard to Wild and Scenic Rivers, Outstandingly Remarkable Values (ORVs) are the river-related/river dependent rare, unique, or exemplary values that make a river worthy of special protection. These values can include scenery, recreation, fish and wildlife, geology, history, culture, and other similar values. Section 10(a) of the Wild and Scenic Rivers Act requires that river managers protect and enhance ORVs. Section 7 of the Wild and Scenic Rivers Act requires river managing agencies to determine whether water resources projects that occur in the bed and banks of the river or upstream tributaries would adversely affect free flow or directly and adversely impact ORVs. Uses that are consistent with this provision and that do not substantially interfere with public use and enjoyment of these values should not be limited (16 USC 1281[a]). ORVs located outside the Wild and Scenic River corridor boundary must also be protected (NPS 2005a).

The analysis of ORVs is focused on segmentwide effects, rather than site-specific or localized effects. Actions that could have substantial effects on specific ORVs, such as degradation of river-related habitat or a special-status species endemic to that location, are also considered. Actions that could degrade ORVs on a segmentwide basis include actions with effects that would be discernible throughout the majority of the river segment, or that would be of sufficient magnitude to affect adjacent segments. This analysis is based on the Draft ORV Report for the Merced Wild and Scenic River (February 2008) and the Draft ORV Report for the Tuolumne Wild and Scenic River. Final ORVS for each river will be published in the Record of Decision for each plan. This analysis considers the following ORVs:

Scientific: The analysis considers whether the preferred alternative would affect the integrity of the Wild and Scenic River as a scientific resource, or would degrade the river's value for research.

Scenic: The analysis considers scenic resources along the river from the perspective of a person situated on the riverbank or on the river.

Geologic Processes/Conditions: The analysis gives primary consideration to designated processes, and the evidence of those processes (e.g., U-shaped valley, hanging valleys, evidence of glaciations, etc.) responsible for creating the river's geologic landscape.

Recreation: The analysis considers whether opportunities to experience a spectrum of river-related recreational activities would be affected.

Biological: The analysis focuses on effects to riparian areas, wetlands, low-elevation meadows, and other riverine areas that provide rich habitat for a diversity of river-related species, including special-status species.

Cultural: The analysis considers effects to river-related cultural resources, including archeological sites, that provide evidence of thousands of years of human occupation and continuing traditional use today. The analysis also considers effects on nationally significant historic resources, such as designed landscapes and developed areas, historic buildings, and circulation systems (trails, roads, and bridges) that provide visitor access to the sublime views of natural features that are culturally valuable.

Hydrologic Processes: Consideration is primarily given to designated processes such as river meandering, world-renowned waterfalls, active flood regimes, oxbows, and fluvial processes.

Merced River Outstandingly Remarkable Values. The ORVs designated for the Wild and Scenic Merced River corridor have been refined over time. Initially, the plan that recommended the river for designation as a Wild and Scenic River, the 1986 Sierra National Forest Draft Forest Land and Resource Management Plan, documented the ORVs for the Wild and Scenic Merced River. In 1996, the National Park Service published these ORVs in the 1996 Draft Yosemite Valley Housing Plan. As part of the development of the Final Merced River Plan/Final Environmental Impact Statement (MRP/FEIS), the ORVs presented in the Draft Merced River Plan/Draft Environmental Impact Statement were further refined based on comments made during scoping for this plan. No changes to ORVs resulted from the planning effort for the Revised Merced River Plan/SEIS (NPS 2005a). The in-progress planning effort will finalize the ORVs in the Merced River corridor.

Tuolumne River Outstandingly Remarkable Values. The Congressional declaration of policy from 16 USC 1271 to protect the Tuolumne Wild and Scenic River and the immediate environment states that all "…remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations" (16 USC 1271). Primary emphasis is placed on protecting a river's "…esthetic, scenic, historic, archaeologic, and scientific features" (16 USC 1281). The park has established Draft ORVs for the Tuolumne Wild and Scenic River. Any future actions as a result of this plan will adhere to the final ORVs established in the final Tuolumne Wild and Scenic River Comprehensive Management Plan. The current analysis uses the following ORVs to define the river values in the corridor: scenic, recreational, geologic, fish and wildlife, historic, archaeologic, scientific, cultural, or other similar values.

Outstandingly Remarkable Values Analysis. The proposed alternative in the Invasive Plant Management Plan would protect and enhance the outstandingly remarkable values of the Merced and Tuolumne Wild and Scenic Rivers by protecting and enhancing the overall integrity of park ecosystems and biological, recreational, wildlife, and scientific values. Control actions for the preferred alternative would provide for the benefit and enjoyment of the Tuolumne Wild and Scenic River for present and future generations.

Wild and Scenic Rivers Act Section 7 Determination Process

Pursuant to the Wild and Scenic Rivers Act, the National Park Service must develop a Section 7 determination on all proposed water resource projects that affect the bed and banks of the Tuolumne or Merced River. This determination ensures that actions do not affect free flow, and do not directly and

adversely impact the ORVs for which the river was designated. A water resources project is any dam, water conduit, powerhouse, transmission line, or other works project under the Federal Power Act, or other developments, that would affect the free-flowing character of a wild and scenic river. In addition to projects licensed by the Federal Energy Regulatory Commission, water resources projects may include dams, water diversions, fisheries habitat and watershed restoration, bridges and other roadway construction, reconstruction projects, bank stabilization projects, channelization projects, levee construction, boat ramps, and fishing piers. It also includes activities that require a Section 404 permit from the U.S. Army Corps of Engineers (IWSRCC 1999). The National Park Service concludes that the Invasive Plant Management Plan, as written, does not fit the definition of a water resources project, and therefore does not trigger the Section 7 Determination process. To ensure that ensuing invasive plant control efforts continue to meet this assessment, project managers and the Environmental Planning and Compliance Office will evaluate future projects using the questionnaire described in Appendix J.

Changes to User Capacity

The proposed action is not expected to result in change in the types or levels of visitor use in the Tuolumne River or Merced River Wild and Scenic River corridors, and would not change existing vehicular or pedestrian circulation patterns.

Chapter V: Consultation and Coordination

This chapter summarizes the consultation and coordination efforts undertaken for the Invasive Plant Management Plan Environmental Assessment.

Internal and Public Scoping

The formal public scoping period for the Invasive Plant Management Plan was open from January 1, 2005 to February 15, 2005. The park announced the opening of public scoping with a December 1, 2004 press release and notices in the Yosemite National Park Electronic Newsletter (e-mailed to about 7,600 individuals, agencies, and organizations), the Gateway Partners Update (sent via e-mail), the Yosemite National Park Daily Report, the Mariposa Gazette, and the Yosemite National Park website. The park invited interested parties to attend two public meetings and monthly public Open Houses during the public scoping period. Professional staff members were available at the Open Houses to introduce the project, answer questions, and accept comments. Open Houses continued monthly from initiation of the scoping period through the conclusion of the planning process. The Open Houses included exhibits about existing conditions, the proposed plan and alternatives, methods and techniques, and environmental considerations. The park received 46 comment letters during the public scoping process, including 29 from individuals and 17 from organizations.

Yosemite National Park convened an alternatives development workshop on April 19, 2005 following the public comment period with park staff and outside specialists. Based on the comments received during the internal and public scoping periods, in addition to applicable federal law, regulations, and Executive Orders, the National Park Service determined that an Environmental Assessment was the appropriate level of NEPA compliance for this project.

Agency Consultation

U.S. Fish and Wildlife Service (Sacramento Fish and Wildlife Office)

The USFWS and National Marine Fisheries Service work collaboratively to provide guidance to other federal agencies for fulfilling the requirements of the federal Endangered Species Act of 1973, as amended. Section 7 of the federal Endangered Species Act (16 USC 1531 et seq.) outlines the procedures for federal interagency cooperation to conserve federally listed species and designated critical habitats.

Section 7(a) (1) requires federal agencies to use their authorities to further the conservation of listed species. Section 7(a) (2) requires federal agencies to consult with the USFWS and National Marine Fisheries Service to ensure that they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat. Other paragraphs of this section establish the requirement to conduct conferences on proposed species; allow applicants to initiate early consultation; and require the USFWS and National Marine Fisheries Service to prepare Biological Opinions and issue Incidental Take statements.

Yosemite National Park is located within the jurisdiction of the Sacramento Fish and Wildlife Office, and consults with this office to obtain lists of federally listed endangered and threatened species that may be

present in the project area. The USFWS sent the park a Species List on January 17, 2006. The park used the Species List (and updates) as the basis for analyzing the affects of this project on federally protected species. Based on this list, park data, and park staff's professional knowledge and judgment, it was determined that the project would have "no affect" on any federally protected species or their critical habitat. During the public review period for this Environmental Assessment, additional consultation will occur to confirm determinations of effect (if needed) with the USFWS. Notice of concurrence with the determinations of effect will be documented in the Finding of No Significant Impact, if prepared, for this Environmental Assessment.

Other Federal Land Management Agencies

Yosemite National Park invasive plant managers work closely with neighboring land management agencies to address invasive plant issues and concerns that cross agency borders. Yosemite managers work with the Sierra National Forest, Stanislaus National Forest, and BLM to map invasive plant populations, prioritize and treat infested areas, and exchange information on invasive plant control.

Yosemite National Park is a member of the Sierra-San Joaquin Noxious Weed Alliance, a local organization that brings together county, State, federal, and private landowners from Fresno, Mariposa, and Madera Counties to coordinate and combine action and expertise in control of common invasive plants. This group functions under the authority of a mutually developed memorandum of understanding, and is subject to statutory and regulatory invasive plant control requirements. The Sierra National Forest Botanist chairs this group. Botanists from the Sierra National Forest and the Stanislaus National Forest (Groveland and Miwuk Ranger Districts) aided in the review and development of the Invasive Plan.

California State Office of Historic Preservation/Advisory Council on Historic Preservation

In 1999, the National Park Service, the California State Historic Preservation Officer, and the Advisory Council on Historic Preservation developed a Programmatic Agreement (NPS 1999) in consultation with American Indian tribes and the public. The Programmatic Agreement stipulates procedures for Yosemite National Park to carry out its responsibilities under Section 106 of the NHPA. In accordance with the 1999 Programmatic Agreement, public involvement was coordinated as part of the NEPA public involvement and scoping process for the Invasive Plant Management Plan. Pursuant to the 1999 Programmatic Agreement, the park is responsible for reviewing projects of this nature and magnitude in-house with no additional consultation with the State Historic Preservation Office or the Advisory Council on Historic Preservation. The NHPA Section 106 review process is documented in this Environmental Assessment. If the subsequent decision is a Finding of No Significant Impact, the park will report to the State Historic Preservation Office, the Advisory Council on Historic Preservation, American Indian tribes, and other consulting parties in its annual report.

American Indian Consultation

The project scope includes areas with known traditional cultural properties and other traditional cultural resource use areas to which American Indians attach religious or cultural significance. Yosemite National Park is consulting with American Indian tribes that have a cultural association with Yosemite Valley—

including the American Indian Council of Mariposa County (also known as Southern Sierra Miwuk), the Tuolumne Band of Me-Wuk Indians, the North Fork Rancheria of Mono Indians, the Picayune Rancheria of Chukchansi Indians, the Bishop Paiute Tribe, the Bridgeport Pauite Indian Colony, and the Mono Lake Kutzadika'a Paiute Tribe—to ensure no adverse effect on traditional cultural properties or traditional cultural use areas. Yosemite National Park staff presented the project at tribal meetings on December 2, 2004 and January 27, 2005. Information sharing and project planning will continue in consultation with the American Indian tribes throughout the planning and implementation of the proposed project to ensure that any potential concerns are addressed accordingly and management recommendations are implemented as appropriate.

Commenting on this Environmental Assessment

This Environmental Assessment is available for a thirty (30) day public review and comment period from June 13, 2008 through July 13, 2008. The availability of the Environmental Assessment was announced in the Mariposa Gazette, and the Environmental Assessment is being mailed or e-mailed to the list of persons and agencies that have expressed interest in Yosemite National Park's proposed actions and events. The Environmental Assessment will also be available at local libraries in Mariposa, Wawona, Oakhurst, and Groveland. An electronic copy of the Environmental Assessment is available online at http://www.nps.gov/yose/planning.

Comments on the Environmental Assessment, or requests for additional copies of this Environmental Assessment (please specify CD or printed copy) should be directed to:

Superintendent, Yosemite National Park
ATTN: Invasive Plant Management Plan
P.O. Box 577
Yosemite, CA 95389
Fax: 209-379-1294
Email: yose_planning@nps.gov
For a copy of this document, please call Yosemite National Park at (209) 379-1365.

Comments must be submitted in writing by July 13, 2008.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, please be aware that your entire comment—including personal identifying information—may be made publicly available at any time. While you may request in your comment that your personal identifying information be withheld from public review, we cannot guarantee compliance with that request.

The planning team will document and analyze comments at the close of the public review period. If the planning team does not identify potential significant impacts that could result from the proposed action, the park will prepare a Finding of No Significant Impact, which will be sent to the National Park Service Pacific West Regional Director and recommended for signature.

During the public review period, additional consultation will occur to confirm determinations of effect (if needed) with the California State Historic Preservation Office, the USFWS, and the U.S. Army Corps of

Engineers. Notice of concurrence with the determinations of effect will be documented in the Finding of No Significant Impact, if prepared, for this Environmental Assessment.

For more information concerning this Environmental Assessment, please contact the park office of Environmental Planning and Compliance at (209) 379-1365.

List of Agencies, Organizations, and Businesses that Received the Invasive Plant Management Plan for Yosemite National Park

American Alpine Club
American Indian Council of Mariposa County
California Air Resources Board
California Department of Fish & Game
California Department of Transportation (Caltrans)
California Regional Water Quality Control Board
California State Library
Californians for Alternatives to Toxics
Caltrans Central Regional Environmental Analysis Office
Central Sierra Environmental Resource Center
Central Sierra Partnership Against Weeds
Columbia College Library
Delaware North Corporation
El Portal Town Planning Advisory Committee
Friends of the River / American Rivers
Friends of Yosemite Valley
George Radanovich, Representative
Government Information Shields Library
Groveland Community Services District
Groveland Ranger District
Hayward Area Recreation and Park District
Inyo National Forest
Mammoth Mountain Ski Area
Mariposa County Board of Supervisors
Mariposa County Chamber of Commerce
Mariposa County Commissioner
Mariposa County Department of Public Works
Mariposa County Fire Department
Mariposa County Planning Department
Mariposa County School District
Mariposa County Visitors Bureau
Mariposa Public Utility District
Mariposans for Environmental Responsible Growth
Merced County Association of Governments
Merced Sun Star
Mono County Board of Supervisors
National Parks and Conservation Association, National Office
National Parks Conservation Association
National Park Service - Water Resources Division

National Park Service - Columbia Cascades Seattle Office
National Park Service - Denver Service Center
National Park Service - Denver Service Center, Planning
National Park Service - Denver Service Center, Technical Information Center
National Park Service - Pacific West Region
Oakhurst Public Library
Office of Assemblyman Dave Cogdill
Sacramento County Public Library
San Francisco City Public Library
San Francisco Planning Department
San Francisco Public Utilities Commission, Hetch Hetchy Water and Power
San Joaquin Valley Air Pollution Control District
Senator Barbara Boxer
Senator Dianne Feinstein
Sierra and San Joaquin Weed Management Areas
Sierra Club
Sierra Club Yosemite Committee
Sonoma County Library
Sonoma State University, Salazar Library
Stanford University Green Library
Stanislaus Council of Government
The Access Fund
Tuolumne County Board of Supervisors
Tuolumne County Visitor Bureau
Tuolumne Me-Wuk Tribal Council
Tuolumne River Preservation Trust
U.S. Army Corp of Engineers
U.S. Department of Agriculture, Forest Service, Sierra and Stanislaus National Forests
U.S. Department of the Interior, Bureau of Land Management
U.S. Department of the Interior, Fish and Wildlife Service
U.S. Department of the Interior, National Park Service, Sequoia and Kings Canyon National Parks
U.S. Department of the Interior, Office of Environmental Policy & Compliance
U.S. Environmental Protection Agency, Region IX
U.S. Federal Highway Administration
U.S. House of Representatives, Subcommittee on National Parks & Public Lands
United States Attorney's Office
University of California Bancroft Library
University of California Santa Barbara, Bioscience & Natural Resources Library
University of Minnesota
Upper Merced River Watershed Council
Virginia Lakes Pack Outfit
Wawona Area Property Owners Association
Wawona Town Plan Advisory Committee
Wilderness Watch
Yosemite Area Audubon

List of Preparers and Reviewers

Table V-1 lists the National Park Service employees who served on the core planning team or contributed to the Invasive Plant Management Plan.

Table V-1: List of Preparers and Reviewers

Name	Responsibility	Education	Years Experience
National Park Service, Yosemite National Park			
Michael J. Tollefson	Superintendent	B.A. Business Administration (Marketing and Finance)	31 NPS
Kevin Cann	Deputy Superintendent	2 years undergraduate	28 NPS
Niki Nicholas	Division Chief, Resources Management and Science	Ph.D. Forestry M.S. Ecology B.A. Biology	3 NPS 18 other
Linda Dahl	Chief of Planning	B.S. City and Regional Planning Graduate work in Environmental Sciences	14 NPS 26 other
Mark Butler	Compliance Program Manager	M.P.A. Public Administration B.S. Soils and Water Science	27 NPS 2 other
Lead Writers and Preparers			
Brent Johnson	Invasive Species Program Manager	B.A. Anthropology B.S. Environmental Science M.S. Biology	4 NPS 10 other
Lisa Acree	Botany Program Manager	B.A. Environmental Studies	18 NPS
Tim Croissant	Supervisory Interdisciplinary Natural Resource Specialist	B.S. Wildlife Biology and Botany	9 NPS 2 other
Yosemite National Park Authors and Technical Experts			
Martin Acree	Restoration and Invasive Species Specialist		27 NPS
Jim Bacon	Planner	B.A. English M.S. Natural Resource Planning	2 NPS 3 other
Sue Beatty	Restoration Biologist	B.S. Recreation	27 NPS
Ed Billington	Branch Chief, Engineering Park Operations	2 years undergraduate studies	27 NPS
Tony Brochini	Facilities Management Liaison		31 NPS
Annette Catamec	Concessions Management Specialist	B.S. Park Administration, emphasis in Resources Recreation and Visitor Management	27 NPS
Mark Fincher	Wilderness Specialist	B.A Geography and Environmental Studies	18 NPS
Joy S. Fisher	Biological Technician	B.S Environmental Science	6 NPS
Victoria Hartmann	Wilderness Restoration Specialist	B.S. Natural Resource M.A. Psychology	8 NPS

Table V-1: List of Preparers and Reviewers

Name	Responsibility	Education	Years Experience
Dave Humphrey	Branch Chief, History, Architecture, and Landscapes	B.S. Landscape Architecture	21 NPS 3 other
Laura Kirn	Park Archeologist	B.S. Anthropology	20 NPS
Carol Knipper	Division Liaison, Resources Management and Science	B.S. Natural Resource Management	23 NPS
Tim Ludington	Roads and Trails Foreman Park Operations		33 NPS
Joseph Meyer	Branch Chief, Physical Resources and Geographic Information System	B.S. Biology	17 NPS 3 other
Maureen McGlinchy	Biological Technician	B.S. Natural Resources	6 NPS
Suzanna Montague	Project Archeologist	B.A. Anthropology	
Lusetta Nelson	Biologist	B.S. Environmental Science M.S. Environmental Education and Botany	1 NPS 4 other
Jen Nersesian	Public Involvement and Outreach Coordinator	M.P.P. Public Policy B.A. Philosophy	3 NPS 12 other
Charles Palmer	Historic Architect	B.A. History M.A. History PHD History	3 NPS
Ann Roberts	NEPA Compliance Specialist	M.S. Forestry-Ecological Restoration B.S. Wildlife	3 NPS 6 Public 5 other
Jim Roche	Park Hydrologist	M.S. Geology B.S. Chemistry	8 NPS 3 other
Donald Schweizer	Restoration Ecologist	M.S. Hydrology	15 NPS
Jeannette Simons	Historic Preservation Officer, Section 106 Consultation	M.A. Anthropology, emphasis in archeology B.A. Anthropology	10 Public 12 other
Leland Tarnay	Air Quality Specialist	B.S. Environmental Science and Health Ph.D. Environmental Science and Health	6 NPS
Steve Thompson	Branch Chief, Wildlife Management	M.S. Ecology – Wildlife B.S. Biology	21 NPS 5 other
Heather Todd	Biological Technician	B.A. Linguistics	7 NPS
Judi Weaser	Branch Chief, Vegetation and Restoration	M.S. Community Development B.S. Zoology	3 NPS 16 Public
Erik Westerlund	Interpretation Specialist	B.S. Biology M.S. Natural Resource Management	7 NPS

Note:
NPS = National Park Service

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Chapter VI: Glossary

Glossary of Terms

Affected environment: Existing natural, cultural, and social conditions of an area that are subject to change, both directly and indirectly, as a result of a proposed human action.

Adjuvant: A substance mixed with an herbicide that increases the effectiveness of the herbicide. "Surfactants" are one class of adjuvants. Other adjuvants include pH modifiers, wetting agents, and gelling agents.

Alternatives: Sets of management elements that represent a range of options for how or whether to proceed with a proposed project. An Environmental Assessment analyzes the potential environmental and social impacts of the range of alternatives presented, as required under NEPA.

Aquatic*:* Growing or living in or frequenting water; taking place in or on water.

Biological diversity (also referred to as biodiversity): The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and ecological processes that connect everything in a common environment.

Biomass: The total weight of all living organisms in a biological community.

Bioregion: A biological subdivision of the earth's surface delineated by the flora and fauna of the region.

Council on Environmental Quality: The Council on Environmental Quality was established by NEPA, and was given the responsibility for developing federal environmental policy and overseeing the implementation of NEPA by federal agencies.

Chemical control: A method of controlling invasive plants by employing herbicides.

Community: Any grouping of populations of different organisms that live together in a particular environment.

Control: A desired goal of invasive plant management in which only follow-up maintenance treatments are required to meet management objectives for that specific invasive plant population (see Manual control, Mechanical control).

Critical habitat areas: Areas designated for the survival and recovery of State or federally listed threatened or endangered species.

Cultivar: A variety of a plant produced and maintained by horticultural techniques and not normally found in wild populations.

Disturbance: An event or change in the environment that alters the composition and successional status of a biological community and may deflect succession onto a new trajectory, such as a forest fire or hurricane, glaciation, agriculture, or urbanization.

Ecosystem restoration: The study of renewing a degraded, damaged, or destroyed ecosystem through active human intervention.

Ecology: The interrelationships of living things to one another and to their environment, or the study of these interrelationships.

Ecosystem: An arrangement of living and non-living things and the forces that move them. Living things include plants and animals. Non-living parts of ecosystems include rocks and minerals. Weather and wildland fire are two of the forces that act within ecosystems.

Endangered species: Plant and animal species that are in danger of extinction throughout all or a significant portion of their range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Endemic: Exclusively known to a place or a biota.

Environmental Assessment: A public document required under the National Environmental Policy Act (NEPA) that (a) helps determine whether the impact of a proposed action or its alternatives could be significant; (b) aids the National Park Service in compliance with NEPA by evaluating a proposal that will have no significant impacts, but may have measureable adverse impacts; or (c) evaluates a proposal that is either not described on list of categorically excluded actions, or is on the list, but exceptional circumstances apply.

Eradicate: To pull up from the roots, or to do away with as completely as if by pulling up from the roots.

Ethnobotany: The study of the relationship between people and plants.

Exotic species: An introduced, non-native species, or a species that is the result of direct or indirect, deliberate or accidental introduction of the species by humans, and for which introduction permitted it to cross a natural barrier to dispersal. In North America, exotic often refers to those species not present in a bioregion before the entry of Europeans in the 16th century, or those present in later parts of that region and later introduced to an ecosystem by human-mediated mechanisms.

Fauna: The animal life of a region or geological period.

Finding of No Significant Impact: The public document describing the decision made on selecting the "preferred alternative" in an Environmental Assessment (see Environmental Assessment).

Fire management activities: Include fire planning; management strategies, tactics, and alternatives; prevention; preparedness; and education that addresses the role of mitigation, post-fire rehabilitation, fuels reduction, and restoration activities in fire management.

Fire Management Plan: A strategic plan that defines a program to manage wildland fires based on an area's approved land management plan. Fire Management Plans must address a full range of fire management activities that support ecosystem sustainability, values to be protected, protection of firefighters and public safety, public health, and environmental issues, and must be consistent with resource management objectives and activities of the area.

Fire Regime: The combination of fire frequency, predictability, intensity, seasonality, and extent characteristic of fire in an ecosystem.

Flora: Plant or bacterial life forms of a region or geological period.

Foreign species: A species introduced to a new area or country. Similar terms include alien species, exotic species, introduced species, non-indigenous species, and non-native species.

Fuels management: The planned manipulation and/or reduction of living and dead forest fuels for forest management and other land use objectives.

Fuels treatment: The treatment of fuels that, left untreated, would otherwise interfere with effective fire management or control. For example, prescribed fire can reduce the amount of fuels that accumulate on the forest floor.

Habitat: The place, including physical and biotic conditions, where a plant or an animal usually occurs.

Herbicide: Pesticide that specifically targets vegetation.

Indigenous: A species that occurs naturally in an area; a synonym for native species (see Endemic).

Initial attack: The aggressive response to a wildland fire based on values to be protected, benefits of response, and reasonable cost of response.

Interagency: Coordination, collaboration, and communication among cooperating agencies.

Introduced species: Species that have been transported by human activities, either intentionally or unintentionally, into a region in which they did not occur in historical time and are now reproducing in the wild.

Invasion: The expansion of a non-native species into an area occupied by native species.

Invasive species: Generally, this term refers to a subset of plants or animals that is introduced to an area, survives, and reproduces, and causes harm economically or environmentally within the new area of introduction. Invasive species displace native species and may have the ability to cause large-scale changes in an ecosystem.

Integrated pest management: Focus upon long-term prevention or suppression of pests. The integrated approach to weed management incorporates the best suited cultural, biological, and chemical controls that have minimum impact on the environment and on people.

Inventory & Monitoring Program: A National Park Service initiative to acquire the information and expertise needed by park managers in their efforts to maintain ecosystem integrity in the approximately 270 National Park System units that contain significant natural resources.

Landscape: A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts.

Management action: Actions taken by Park management to protect river values and return conditions to established standards based on information gathered by the Visitor Experience & Resource Protection monitoring program.

Manual control: Invasive plant removal that utilizes hand-pulling, lopping, or cutting with non-motorized equipment such as shovels, axes, rakes, grubbing hoes, and hand clippers to expose, cut, and remove flowers, fruits, stems, leaves, and/or roots from target plants.

Mechanical control: Invasive plant removal method that utilizes hand-held motorized equipment such as brush-cutters (with strings or blades) and hedge trimmers.

Mitigation: Activities that will avoid, reduce the severity of, or eliminate an adverse environmental impact.

Monoculture: A plant community (forest, range) consisting of only one species; uniform throughout.

Native Range: The ecosystem that a species inhabits.

Native species: A species that occurs naturally in an area, and that has not been introduced by humans either intentionally or unintentionally. A synonym for indigenous species.

National Environmental Policy Act: An act of Congress passed in 1969 declaring a national policy to encourage productive and enjoyable harmony between people and the environment, to promote efforts to prevent or eliminate damage to the environment and the biosphere and stimulate the health and welfare of people, and to enrich the understanding of the ecological systems and natural resources important to the nation, among other purposes.

National Park Service Organic Act: In 1916, the National Park Service Organic Act established the National Park Service to "promote and regulate use of parks…" and defined the purpose of the national parks as "to conserve the scenery and natural and historic objects and wild life therein and to provide for the enjoyment of the same in a manner and by such means as will leave them unimpaired for the

enjoyment of future generations." This law provides overall guidance for the management of Yosemite National Park.

National Park Service Management Policies: Guiding principles and procedures that set the framework and provides direction for National Park Service management decisions. National Park Service policies are guided by and consistent with the U.S. Constitution, public laws, Executive proclamations and orders, and regulations and directives from higher authorities. Policies translate these sources of guidance into cohesive directions. National Park Service Management Policies 2006 are applicable National Park Servicewide. Director's Orders supplement and may amend Management Policies.

No Action alternative: The most likely condition expected to exist in the future if current management continues unchanged.

Non-ionic surfactant: A surface active substance without electromagnetically charged compounds.

Non-native species: Along with "introduced species" and "non-indigenous species," this is one of the most commonly used terms to describe a plant or animal species that is not originally from the area in which it occurs. Similar terms include "alien species," "exotic species," and "foreign species." This term has also been defined as a species whose presence is due to intentional or unintentional introduction as a result of human activity.

Noxious weed: This term is frequently a legal term in State code, denoting a special-status of the plant as, for example, prohibited or restricted. Noxious weeds are aggressive non-native plants or plant products that injure or cause damage to interests of agriculture, irrigation, navigation, natural resources, public health, or the environment. Implies a species' adverse effects on humans—either directly (e.g., species that produce toxins that are harmful to humans) or indirectly (e.g., species that infest nature reserves). Any species of plants—annual, biennial, or perennial—reproduced by seed, root, underground stem, or bulblet, which, when established, is or may become destructive and difficult to control. Examples of noxious weeds in Yosemite include yellow star-thistle, spotted knapweed, bull thistle, and Himalayan Blackberry.

Perennial: A plant that lives for three or more years.

Pesticide: A chemical or biological agent intended to prevent, destroy, repel, or mitigate plant or animal life, and any substance intended for use as a plant regulator, defoliant, or desiccant. Includes insecticides, fungicides, rodenticides, herbicides, nematocides, and biocides.

Population: A group of potentially inter-breeding individuals of the same species found in the same place at the same time.

Preferred Alternative: The alternative within the range of alternatives presented in an Environmental Assessment that the agency believes would best fulfill the purpose and need of the proposed action. While the Preferred Alternative is a different concept from the Environmentally Preferable Alternative, they may be one and the same for some Environmental Assessments.

Prescribed fire: Any fire ignited by management actions to meet specific objectives.

Propagule: A cutting, seed, or spore that can grow or reproduce.

Restoration: Holistic actions taken to modify an ecosystem to achieve desired healthy and functioning conditions and processes.

Riparian area: The area along a watercourse or around a lake or pond.

Riparian ecosystem: The ecosystem around or next to water areas that support unique vegetation and animal communities as a result of the influence of water.

Record of Decision: An official document in which a deciding official states the alternative that will be implemented from a prepared Environmental Impact Statement.

Rosettes: A circular cluster of leaves that radiate from a center or close to the ground.

Sensitive species: Plant or animal species that are susceptible to habitat changes or impacts from activities.

Seed bank: Seeds that become incorporated into the soil.

Species: A class of individuals having common attributes and designated by a common name; a category of biological classification ranking immediately below the genus or subgenus; comprising related organisms or populations potentially capable of interbreeding.

Staging area: Staging areas are locations set aside for materials and equipment storage for specific construction projects and/or places that are used for many years or decades for ongoing projects and park operations. Examples of staging areas include roadside pullouts, parking lots, and sites where infrastructure once existed such as abandoned roads. Larger staging areas include former quarries, borrow pits, abandoned roads, and infrastructure. Often, surplus project-generated materials such as rock and soil will remain at such areas for future park uses.

Stewardship: Responsibility of federal agencies to manage natural resources on public land.

Surfactants: A supplemental aid to herbicides for adherence and penetration.

Threatened species: Plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future, as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

Tilling: Turning over of soil with heavy equipment such as a bobcat; would be used for invasive plant control only in heavily disturbed sites.

Traditional Cultural Properties: A resource to which American Indian tribes attach cultural and religious significance that is eligible for listing or is listed in the National Register of Historic Places, and includes structures, objects, districts, geological and geographical features, and archaeology. National Register Bulletin 38 provides guidance for identifying and evaluating such properties for eligibility.

Treatment area: The site-specific location of a resource improvement activity.

Understory: The trees and woody shrubs growing beneath branches and foliage formed collectively by the upper portions of adjacent trees.

Vector: Mode by which a species establishes in a new environment.

Watershed: The entire region drained by a waterway, lake, or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

Wilderness: An area of land designated by Congress to be managed according to the Wilderness Act of 1964.

Wildland: An area in which development is essentially non-existent, except for roads, railroads, power lines, and other transportation facilities.

Wildland fire: Any non-structural fire that occurs on wildlands that is not a prescribed fire.

Wildland urban interface: The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Acronyms and Abbreviations

BLM	Bureau of Land Management
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CDFA	California Department of Food and Agriculture
CDPC	California Invasive Plant Council
CDPR	California Department of Pesticide Regulation
CFR	Code of Federal Regulations
dB	decibel(s)
dBA	decibels on the A-weighted scale
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
LD50	lethal dose to 50 percent
MOU	Memorandum of Understanding
MSDS	material safety data sheet
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_x	nitrogen oxides
NP	nonylphenol
NPE	nonylphenol polyethoxylate
NPS	National Park Service
NP9E	nonylethoxylate
NRHP	National Register of Historic Places
ORV	Outstandingly Remarkable Values
OSHA	Occupational Safety and Health Administration
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
POEA	polyethoxylated tallowamine
PPE	personal protective equipment
TCP	traditional cultural property
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
96-H LC50	96-hour lethal concentration 50 percent dose

Special-Status Wildlife Designations:

FE	Federal Endangered
FT	Federal Threatened
FC	Federal Candidate
SE	State Endangered
ST	State Threatened
CSC	California Species of Concern

Chapter VII: Bibliography

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Appendix A: Invasive Plant Species-Specific Management Objectives

Invasive plant program managers developed the following objectives for the highest priority invasive plants in Yosemite National Park. This list is based on the likely threat of each invasive species to park resources, the current locations of the invasive plant, and the knowledge of the effectiveness of invasive plant control actions for the species in Yosemite National Park. Effective control of a species is considered to be achieved when follow-up maintenance is the only treatment required to meet management objectives. The difficulty of control is considered in the context of Yosemite National Park and the size and location of existing populations.

High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Cheat grass (*Bromus tectorum*)		
Impact: High Threat: Low Difficulty of Control: High	Document abundance and distribution throughout the park. Survey in areas that are recently burned (El Portal, Yosemite Valley, Wawona). Develop management objectives once parkwide abundance and distribution is better understood.	Work with Fire Management for effective use of fire to enhance native plant competition and limit extent of spread.
Italian thistle (*Carduus pycnocephalus*)		
Impact: Low Threat: High Difficulty of Control: Low	Parkwide emphasis on immediate detection of new populations. Survey every two years for new populations in the foothill woodland zone. Survey annually in areas with ground disturbance for a minimum of three years after disturbance. Document the location of each individual encountered throughout the park. Prevent all populations from establishment in the park throughout all vegetation zones.	There are no known persistent populations in the park at this time. Practice parkwide early detection and immediate control or eradication of new populations.
Spotted knapweed (*Centaurea maculosa*)		
Impact: Medium Threat: High Difficulty of Control: Low	Parkwide emphasis on immediate detection of new populations. Survey annually for new populations in Foresta. Survey annually in areas with ground disturbance for a minimum of three years after disturbance. Document the location of each individual encountered throughout the park. Census location and life stage data. Prevent all populations from establishment in the park throughout all vegetation zones.	Eradicate existing populations from Foresta and Yosemite Valley. Practice parkwide early detection and immediate control or eradication of new populations.

High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Yellow star-thistle (*Centaurea solstitialis*)		
Impact: High Threat: High Difficulty of Control: Medium	Parkwide emphasis on immediate detection of new populations. Directed surveys for new populations along all roads within the foothill woodland zone and the lower montane forest. Update abundance and distribution maps every three years. Monitor effectiveness of control techniques. Monitor plant community response to control techniques. Prevent the transport of seed from infested areas of the park. No transfer of fill material from infested areas within and outside the park to uninfested areas. Prevent all new populations outside the foothill woodland zone from becoming established.	Reduce current populations to 30% of the current extent and 25% of the current abundance. Eradicate all populations found outside the foothill woodland zone.
Bull thistle (*Cirsium vulgare*)		
Impact: Medium Threat: High Difficulty of Control: Medium	Yearly assessment of abundance in meadows, recent burn areas, and other high-priority areas. Document abundance and distribution in Wilderness areas.	Control populations in developed areas in the lower montane vegetation zone. Eradicate populations in Yosemite Valley meadows populations found within the upper montane vegetation zone. Eradicate in high-use Wilderness areas (Pate Valley and Little Yosemite Valley).
French broom (*Genista monspessulana*)		
Impact: Low Threat: High Difficulty of Control: Low	Parkwide emphasis on immediate detection of new populations. Survey annually in areas with ground disturbance for a minimum of three years after disturbance. Document parkwide distribution and abundance. Keep areas of the Tuolumne and South Fork of the Merced free of infestation. Eliminate ornamental planting in residential areas with community outreach and education.	Eradicate from El Portal. Practice parkwide early detection and immediate control or eradication of new populations.
Common velvet grass (*Holcus lanatus*)		
Impact: Medium Threat: High Difficulty of Control: Medium	Update abundance and distribution maps every three years. Monitor effectiveness of control techniques. Monitor plant community response to control techniques.	Eradicate from restoration sites. Control populations in priority wetland areas and Wilderness areas (Pate Valley and Tiltill Valley) to maintenance levels, where regular follow-up is the only treatment necessary.

High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Perennial pepperweed (*Lepidium latifolium*)		
Impact: Medium Threat: High Difficulty of Control: Low	Parkwide emphasis on immediate detection of new populations. Survey annually for new populations in Foresta. Survey annually in areas with ground disturbance for a minimum of three years after disturbance. Document the location of each individual encountered throughout the park. Prevent all populations from establishment in the park throughout all vegetation zones.	Eradicate known population in Foresta. Practice parkwide early detection and immediate control or eradication of new populations.
Himalayan blackberry (*Rubus discolor*)		
Impact: High Threat: High Difficulty of Control: High	Survey annually in areas with ground disturbance for a minimum of three years after disturbance. Update abundance and distribution maps every three years. Monitor effectiveness of control techniques. Monitor plant community response to control techniques. Prevent spread into Wilderness, meadow, riparian, and wetland areas parkwide.	Control populations within high-priority sites throughout the park (high visitor use sites, wetlands, meadows, riparian areas, Wilderness, Tenaya Canyon, Pate Valley, Poopenaut Valley).

Medium-High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Prostrate pigweed (*Amaranthus albus*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Survey for populations in recently disturbed sites within or above the upper montane forest zone. Document occurrences of this plant that occur when observed within or above the upper montane forest zone. Prevent establishment in recent restoration sites, construction sites, staging areas, Wilderness areas, and undisturbed areas.	Eradicate existing population at Snow Creek Quarry.
Giant reed (*Arundo donax*)		
Impact: Low Threat: High Difficulty of Control: Medium	Parkwide emphasis on immediate detection of new populations. Document the location of each individual encountered throughout the park.	Eradicate from El Portal. Practice parkwide early detection and immediate control or eradication of new populations.

Medium-High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Black mustard (Brassica nigra)		
Impact: Low Threat: Medium Difficulty of Control: Low	Prevent species from invading developed areas above 4,000 feet.	Reduce existing populations along El Portal Road and El Portal Administrative Site.
Field mustard (Brassica rapa)		
Impact: Low Threat: Medium Difficulty of Control: Low	Prevent species from invading developed areas above 4,000 feet.	Reduce existing populations within the El Portal Maintenance Complex.
Tocolote (*Centaurea melitensis*)		
Impact: Medium Threat: Low Difficulty of Control: Medium	Directed surveys along the El Portal Road every other year. Document changes in abundance and distribution of this plant in El Portal. Document changes in relationship with fire. Prevent from spreading to areas outside of the Foothill Woodland Zone.	Eradicate all occurrences found above the Foothill Woodland Zone.
Bermuda grass (*Cynodon dactylon*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Parkwide emphasis on immediate detection of new populations. Document abundance and distribution throughout the park. Prevent all new populations from becoming established in the park throughout all vegetation zones.	Eradicate populations in Yosemite Valley. Eradicate populations within and adjacent to riparian areas. Practice parkwide early detection and immediate control or eradication of new populations.
Foxglove (*Digitalis purpurea*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Prevent from spreading into areas above 5,000 feet.	Control throughout developed areas in the park. Eradicate from Wilderness.
English ivy (*Hedera helix*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution throughout the park. Prevent spread into meadow, riparian, and wetland areas throughout the park. Do not allow plant for landscaping in the park. Eradicate from construction sites.	Eradicate populations found in riparian areas and wetlands throughout the park to preserve Tompkin sedge habitat.

Medium-High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Shortpod mustard (*Hirschfeldia incana*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Document abundance and distribution in Wilderness areas.	Control populations within the El Portal Maintenance Complex.
Hops (*Humulus lupulus*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution throughout the park.	Eradicate known populations from Yosemite Valley and Wawona.
Perennial sweet pea (*Lathyrus latifolius*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Document parkwide distribution and abundance.	Reduce population in developed areas (Wawona, Foresta, and El Portal). Eradicate all populations that occur in riparian areas throughout the park.
Oxeye daisy (*Leucanthemum vulgare*)		
Impact: Medium Threat: High Difficulty of Control: High	Document parkwide distribution and abundance. Monitor effectiveness of control techniques. Monitor plant community response to control techniques. Prevent spread into Wilderness, meadow, riparian, and wetland areas parkwide.	Contain currently known populations within all vegetation zones. Begin control after abundance and distribution has been established.
Rose campion (*Lychnis coronaria*)		
Impact: Medium Threat: Medium Difficulty of Control: Medium	Document distribution in Yosemite Valley, Wawona, and other developed areas. Prevent spread into Wilderness areas.	Control populations that occur away from developed areas within all vegetation zones.
White sweetclover (*Melilotus alba*) yellow sweetclover (*Melilotus officinalis*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Document abundance and distribution with a high priority in areas away from developed areas. Monitor populations in disturbed sites to determine ability to spread into adjacent undisturbed areas. Control in road maintenance areas.	Control populations along roadsides, in developed areas, and in construction sites.

Medium-High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Spearmint (*Mentha spicata* var. *spicata*)		
Impact: Medium Threat: Medium Difficulty of Control: Medium	Prevent from becoming established in restoration and construction sites.	Control populations in restoration sites that persist for more than four years.
Sourclover (*Melilotus indica*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Prevent species from invading developed areas above 4,000 feet.	Control populations along roadsides, in developed areas, and in construction sites.
Manyflower tobacco (*Nicotiana acuminata* var.)		
Impact: Low Threat: Medium Difficulty of Control: Low	Document abundance and distribution in Wilderness areas.	Control populations in restoration sites that persist for more than four years.
Woodbine, Virginia creeper (*Parthenocissus vitacea*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Prevent species from invading developed areas above 4,000 feet.	Control populations along roadsides, in developed areas, and in construction sites.
Black locust (*Robinia pseudoacacia*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution throughout the park.	Eradicate all individuals in Yosemite Valley that are not historically significant. Eradicate from El Portal.
Cutleaf blackberry (*Rubus laciniatus*)		
Impact: Medium Threat: High Difficulty of Control: High	Survey annually in areas with ground disturbance for a minimum of three years after disturbance. Update abundance and distribution maps every three years. Monitor effectiveness of control techniques. Monitor plant community response to control techniques. Prevent spread into Wilderness, meadow, riparian, and wetland areas.	Control populations within high-priority sites throughout the park (high visitor use sites, wetlands, meadows, riparian areas, Wilderness, Tenaya Canyon, Pate Valley, Poopenaut Valley).

Medium-High-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
London rocket (*Sisymbrium irio*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Document distribution in Yosemite Valley and other developed areas.	Control populations within the El Portal Maintenance Complex.
Rose clover (*Trifolium hirtum*)		
Impact: Medium Threat: Medium Difficulty of Control: Medium	Prevent population from El Portal Road from moving higher in elevation to Yosemite Valley and elsewhere into the park.	Reduce populations along the El Portal Road Corridor and Administrative Site. Eradicate all populations within the El Portal Maintenance Complex.
Purple vetch (*Vicia benghalensis*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Monitor for expansion into undisturbed areas. Prevent the spread of vetch away from roads and developed areas in El Portal.	Control populations along El Portal Road and within the El Portal Administrative Site.
Common mullein (*Verbascum Thapsus*)		
Impact: Low Threat: Medium Difficulty of Control: Low	Document abundance and distribution in Wilderness areas.	Control to maintenance levels in developed areas throughout the park, where regular follow-up is the only treatment necessary.

Medium-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Tree-of-heaven (*Ailanthus altissima*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document parkwide abundance and distribution.	Eradicate from El Portal and Yosemite Valley.

Medium-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Foxtail chess (*Bromus madritensis* ssp. *rubens*)		
Impact: Low Threat: Low Difficulty of Control: Low	Document abundance and distribution in Wilderness areas and front-country sites above 6,000 feet.	Control populations in Wilderness areas that occur above 6,000 feet.
Bachelor's button (*Centaurea cyanus*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution in Wilderness areas. Prevent species from invading developed areas above 4,000 feet.	Eradicate all populations that occur within and above the lower montane vegetation zone. Eradicate populations within the El Portal Maintenance Complex.
Jerusalem oak (*Chenopodium botrys*)		
Impact: Low Threat: Low Difficulty of Control: Low	Document abundance and distribution in Wilderness areas.	Control populations that remain in restoration sites for greater than four years.
Gypsyflower (*Cynoglossum officinale*)		
Impact: Low Threat: Low Difficulty of Control: Low	Document abundance and distribution in all vegetation zones of the park.	More information is needed to develop management objectives. Objectives will be developed once the significance of the threat has been determined.
Lanceleaf tickseed (*Coreopsis lanceolata*)		
Impact: Low Threat: Low Difficulty of Control: Low	Document abundance and distribution in all vegetation zones of the park.	More information is needed to develop management objectives. Objectives will be developed once the significance of the threat has been determined.
Tall fescue (*Festuca arundinacea*)		
Impact: Low Threat: Low Difficulty of Control: Low	Document abundance and distribution in developed areas and Wilderness sites throughout the park.	More information is needed to develop management objectives. Objectives will be developed once the significance of the threat has been determined.
Common St. Johnswort (*Hypericum perforatum*)		
Impact: Medium Threat: Medium Difficulty of Control: High	Document abundance and distribution in Wilderness areas.	Maintain populations to control levels in developed areas and road corridors throughout all vegetation zones.

Medium-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Black bindweed (*Polygonum convolvulus*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution in park areas above 5,000 feet.	Control populations in restoration and construction sites. Eradicate from Wilderness areas if found.
Radish (*Raphanus sativus*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution in Wilderness areas.	Control populations in Yosemite Valley.
Blackeyed Susan (*Rudbeckia hirta* var. *pulcherrima*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution throughout the park.	Eradicate all populations found in wetlands throughout the park.
Bouncingbet (*Saponaria officinalis*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution in Wilderness areas.	Eradicate populations within all vegetation zones that are greater than 1 square meter and have a density of greater than 10 individuals per square meter.
Charlock mustard (*Sinapis arvensis*)		
Impact: Low Threat: Low Difficulty of Control: Low	Document abundance and distribution in all vegetation zones of the park.	More information is needed to develop management objectives. Objectives will be developed once the significance of the threat has been determined.
Dandelion (*Taraxacum officinale*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution in Wilderness areas.	Control populations in Wilderness.

Medium-Priority Species		
Priority of Control	**Early Detection, Monitoring, and Prevention Management Objective**	**Control Management Objective**
Yellow salsify (*Tragopogon dubius*)		
Impact: Low Threat: Low Difficulty of Control: Low	Document abundance and distribution in Wilderness areas.	Control populations in Wilderness and developed areas within and above the lower montane vegetation zone. Control populations to maintenance levels in meadows and roadsides throughout the park.
Puncture vine (*Tribulus terrestris*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution in Wilderness areas.	Control populations in Wilderness and developed areas.
Greater periwinkle (*Vinca major*)		
Impact: Low Threat: Medium Difficulty of Control: Medium	Document abundance and distribution throughout the park. Prevent spread into meadow, riparian, and wetland areas throughout the park. Do not allow plant for landscaping in the park.	Eradicate populations found in riparian areas and wetlands throughout the park to preserve Tompkin's sedge habitat. Eradicate from construction sites.

Appendix B: Non-Native Plant Species in Yosemite

*Agrostis capillaries**	colonial bentgrass
*Agrostis gigantean**	redtop
*Agrostis stolonifera**	creeping bentgrass
*Ailanthus altissima**	tree-of-heaven
Aira caryophyllea	European hairgrass
*Amaranthus albus**	prostrate pigweed
Anagallis arvensis	scarlet pimpernel
Anthemis cotula	stinkweed
Anthriscus caucalis	burr chervil
Arabidopsis thaliana	mouse ear cress
*Arundo donax**	giant reed
Avena barbata	slender wild oat
Avena fatua	wild oat
Bidens tripartita	threelobe beggarticks
Brassica nigra	black mustard
Brassica rapa	field mustard
Briza minor	little quaking grass
Bromus arenarius	Australian brome
Bromus catharticus	rescue grass
Bromus diandrus	ripgut brome
*Bromus hordeaceus**	soft brome
Bromus inermis ssp. *inermis**	smooth brome
Bromus japonicus	field brome
Bromus madritensis ssp. *rubens*	foxtail chess
Bromus secalinus	rye brome
Bromus sterilis	poverty brome
Bromus tectorum	cheat grass
Capsella bursa-pastoris	shepherd's purse
Carduus pycnocephalus	Italian thistle
Centaurea cyanus	bachelor's button
Centaurea maculosa	spotted knapweed
Centaurea melitensis	Tocolote
Centaurea solstitialis	yellow star-thistle
Cerastium fontanum ssp. *vulgare*	big chickweed
Cerastium glomeratum	sticky chickweed
Chamomilla suaveolens	pineapple weed
*Chenopodium album**	lambs quarters
*Chenopodium botrys**	Jerusalem oak
*Cirsium vulgare**	bull thistle
Cnicus benedictus	blessed thistle
Convolvulus arvensis	Field bindweed
*Coreopsis lanceolata**	lanceleaf tickseed
Crepis capillaris	smooth hawksbeard
Cynodon dactylon	bermuda grass
*Cynoglossum officinale**	gypsyflower
Cynosurus echinatus	hedgehog dogtail
*Dactylis glomerata**	orchard grass
Dianthus barbatus ssp. *barbatus*	sweet William
*Digitalis purpurea**	foxglove
Digitaria ischaemum	smooth crabgrass
Digitaria sanguinalis	hairy crabgrass

*Echinochloa crus-galli**	barnyard grass
Epipactis helleborine	broadleaf helleborine
Eragrostis cilianensis	lovegrass
Erigeron annuus	eastern daisy fleabane
Erigeron strigosus	prairie fleabane
Erodium botrys	long-beaked stork's bill
Erodium brachycarpum	short fruit stork's bill
Erodium cicutarium	redstem stork's bill
*Festuca arundinacea**	tall fescue
*Festuca pratensis**	meadow fescue
Filago gallica	narrow-leaved herba impia
Gaillardia pulchella	firewheel
Galium parisiense	wall bedstraw
Genista monspessulana	French broom
Geranium dissectum	cutleaf geranium
Geranium robertianum	Robert geranium
Glechoma hederacea	ground ivy
Hedera helix	English ivy
Herniaria hirsuta ssp. *cinerea*	rupture wort
Herniaria hirsuta ssp. *hirsuta*	hairy rupture wort
Hirschfeldia incana	shortpod mustard
*Holcus lanatus**	common velvet grass
Hordeum marinum ssp. *gussoneanum*	mediterranean barley
Hordeum murinum ssp. *glaucum*	smooth barley
Hordeum murinum ssp. *leporinum*	leporinum barley
Hordeum murinum ssp. *murinum*	wall barley
Humulus lupulus	hops
Hypericum perforatum	common St. Johnswort
*Hypochaeris glabra**	smooth cat's ear
*Hypochaeris radicata**	hairy cat's ear
*Lactuca serriola**	prickly lettuce
Lamium amplexicaule	henbit dead nettle
Lathyrus latifolius	perennial sweet pea
*Lepidium latifolium**	perennial pepperweed
Lepidium virginicum var. *virginicum*	Virginia pepperweed
*Leucanthemum vulgare**	oxeye daisy
Lolium multiflorum	Italian ryegrass
*Lolium perenne**	perennial ryegrass
Lolium temulentum	darnel
Lunaria annua	annual honesty
Lychnis coronaria	rose campion
Malva nicaeensis	bull mallow
Malva parviflora	cheeseweed
*Marrubium vulgare**	horehound
Medicago lupulina	black medick
*Medicago polymorpha**	California burclover
Medicago sativa	alfalfa
Melilotus alba	white sweetclover
*Melilotus indica**	sourclover
*Melilotus officinalis**	yellow sweetclover
Mentha spicata var. *Spicata**	spearmint
Mollugo verticillata	carpet-weed, indian chickweed
*Muhlenbergia schreberi**	nimblewell
Nicotiana acuminata var. *multiflora*	manyflower tobacco

*Nicotiana glauca**	tree tobacco
Oxalis corniculata	creeping woodsorrel
Panicum miliaceum	broomcorn millet
Parapholis incurva	curved sickle grass
*Parthenocissus vitacea**	woodbine, Virginia creeper
*Phleum pretense**	cultivated timothy
Plantago lanceolata	English plantain
*Plantago major**	common plantain
Poa annua	annual bluegrass
Poa bulbosa	bulbosa bluegrass
*Poa compressa**	Canada bluegrass
Poa nemoralis	wood bluegrass
*Poa palustris**	fowl bluegrass
Poa pratensis ssp. *pratensis**	Kentucky bluegrass
Polycarpon tetraphyllum	four-leaved allseed
Polygonum arenastrum	common knotweed
*Polygonum convolvulus**	black bindweed
Polygonum persicaria	spotted ladysthumb
Polygonum ramosissimum	bushy knotweed
Polypogon maritimus	Mediterranean beard grass
*Polypogon monspeliensis**	annual beard grass
Portulaca oleracea	little hogweed
Ranunculus muricatus	spinyfruit buttercup
Raphanus raphanistrum	jointed charlock
*Raphanus sativus**	Radish
*Robinia pseudoacacia**	black locust
*Rubus discolor**	Himalayan blackberry
*Rubus laciniatus**	cutleaf blackberry
Rudbeckia hirta var. *pulcherrima**	blackeyed Susan
*Rumex acetosella**	sheep sorrel
Rumex conglomeratus	Dock
*Rumex crispus**	curly dock
*Saponaria officinalis**	Bouncingbet
Scirpus cyperinus	Woolgrass
Secale cereale	cereal rye
Senecio vulgaris	common groundsel
Setaria pumila	yellow foxtail
Setaria viridis	green bristlegrass
Silene gallica	common catchfly
Silene latifolia ssp. *alba*	bladder campion
Sinapis arvensis	charlock mustard
*Sisymbrium altissimum**	tall tumblemustard
Sisymbrium irio	London rocket
Sisymbrium officinale	hedge mustard
Soliva sessilis	field burrweed
Sonchus asper ssp. *asper**	prickly sow thistle
Sonchus oleraceus	common sow thistle
Spergularia rubra	red sandspurry
Stellaria media	common chickweed
*Tanacetum parthenium**	feverfew
Taraxacum officinale	dandelion
*Torilus arvensis**	spreading hedge-parsley/miner's lice
Tragopogon dubius	yellow salsify
Tribulus terrestris	puncture vine

Trifolium dubium	little hop clover
Trifolium hirtum	rose clover
Trifolium pratense	red clover
*Trifolium repens**	white clover
Triticum aestivum	common wheat
Urtica urens	Dwarf nettle
Verbascum blattaria	moth mullein
*Verbascum Thapsus**	common mullein
Veronica anagallis-aquatica	water speedwell
Veronica arvensis	corn speedwell
Veronica persica	Persian speedwell
Vicia benghalensis	purple vetch
Vicia cracca	bird vetch
Vinca major	greater periwinkle
Viola arvensis	European field pansy
*Vitis vinifera**	wine grape
Vulpia bromoides	brome fescue
Vulpia myuros var. *myuros*	foxtail fescue

* Potential to occur in wetlands — obligative wetland species, facultative wetland species, or facultative species. Obligate wetland species almost always occur in wetlands. Facultative wetland species usually occur in wetlands (estimated probability 67 to 99 percent). Facultative species are equally likely to occur in wetlands or non-wetlands (estimated probability 34 to 66 percent).

Appendix C: Watchlist for Invasive Plant Species Not Yet Found in Yosemite National Park

The purpose of Table C-1 is to prioritize the invasive plant species that have not yet reached Yosemite, for use in early detection surveys. Drucker and Bradshaw (Drucker 2007) prioritized these invasive plants into four broad groups according to the threat they pose to natural habitat in Yosemite and their proximity to the park. The list is limited to plant species previously documented in California and plant species with a history of wildland invasion.

Table C-1: Invasive Plant Species Not Yet Found in Yosemite National Park

Invasive Plant Species	Habitat
Priority Group 1 – California Invasive Plant Council status of "High," "Moderate," or "Limited"; found within 62 miles of park boundary; found within the elevation range of the park; previously documented in California	
Acroptilon repens	Scrub, grasslands, riparian, pinyon-juniper woodland, forest
Aegilops triuncialis	Grassland, oak woodland
Bromus japonicus	Great Basin grassland, valley and foothill grassland, pinon and juniper woodland, lower montane coniferous forest
Cardaria chalapensis	Central Valley wetlands; limited distribution in California; may not be as invasive as Cardaria draba
Cardaria draba	Riparian areas, marshes of central coast
Cardaria pubescens	Grasslands and meadows
Carduus tenuiflorus	Valley and foothill grasslands
Centaurea calcitrapa	Grasslands
Centaurea diffusa	Fields and roadsides
Chondrilla juncea	Grasslands
Cirsium arvense	Grasslands, riparian areas, forests
Conium maculatum	Riparian woodland, grassland
Cytisus scoparius	Coastal scrub, oak woodland
Descurainia sophia	Scrub, grassland, woodland
Ficus carica	Riparian woodlands
Halogeton glomeratus	Scrub, grasslands, pinyon-juniper woodland
Hordeum marinum	Grasslands, drier habitats
Hordeum murinum	Grasslands and wetlands
Iris pseudacorus	Riparian, wetland areas, especially southern California
Isatis tinctoria	Great Basin scrub and grasslands, coniferous forest
Linaria genistifolia ssp. *dalmatica*	Grasslands, forest clearings
Lythrum hyssopifolium	Grasslands, wetlands, vernal pools
Lythrum salicaria	Wetlands, marshes, riparian areas
Medicago polymorpha	Grasslands; widespread weed of agriculture and disturbed areas
Mentha pulegium	Vernal pools, wetlands.
Myriophyllum aquaticum	Freshwater aquatic systems

Table C-1: Invasive Plant Species Not Yet Found in Yosemite National Park	
Invasive Plant Species	**Habitat**
Schismus arabicus	Scrub, thorn woodland
Silybum marianum	Grasslands, riparian; widespread, primarily in disturbed areas
Spartium junceum	Coastal scrub, grasslands, wetlands, oak woodland, forests
Taeniatherum caput-medusae	Grasslands, scrub, woodland
Tamarix parviflora	Riparian areas, desert washes, coastal scrub
Tamarix ramosissima	Desert washes, riparian areas, seeps and springs
Torilis arvensis	Disturbed areas
Priority Group 2 – California Invasive Plant Council status of "High," "Moderate," or "Limited"; found from 124 to 186 miles of the park boundary; found within the elevation range of the park; previously documented in California **OR** California Invasive Plant Council status of "High," "Moderate," or "Limited"; found within 62 miles of the park boundary; found within the elevation range of the park; not previously documented in California	
Anthoxanthum odoratum	Coastal prairie, coniferous forest
Carduus acanthoides	Valley and foothill grasslands
Carduus nutans	Grasslands
Cordyline australis	Coniferous forest
Cotoneaster franchetii	Coniferous forest
Crataegus monogyna	Riparian habitats, woodland
Dipsacus fullonum	Grasslands, seep, riparian scrub
Dipsacus sativus	Grasslands, seep, bogs
Egeria densa	Streams, ponds, sloughs, lakes
Elaeagnus angustifolia	Riparian areas
Glyceria declinata	Vernal pools, moist grasslands
Kochia scoparia	Scrub, chaparral, grasslands
Linaria vulgaris	Valley and foothill grassland, Great Basin grassland, riparian woodland, lower montane coniferous forest, upper montane coniferous forest
Nicotiana glauca	Coastal scrub, grasslands, riparian woodland
Onopordum acanthium	Wet meadows, sage brush, riparian areas
Polygonum cuspidatum	Riparian areas, wetlands, forest edges
Polygonum sachalinense	Riparian areas
Potamogeton crispus	Freshwater aquatic systems
Rubus armeniacus (discolor)	Riparian areas, marshes, oak woodlands
Schinus molle	Riparian areas; limited distribution
Senecio jacobaea	Grasslands, riparian
Tanacetum vulgare	Riparian areas, forest

Table C-1: Invasive Plant Species Not Yet Found in Yosemite National Park	
Invasive Plant Species	**Habitat**
Priority Group 3 – California Invasive Plant Council status of "High," "Moderate," or "Limited"; found more than 186 miles from the park boundary; found within the elevation range of the park; previously documented in California **OR** California Invasive Plant Council status of "Evaluated Not Listed"; found more than 186 miles from the park boundary; found within the elevation range of the park; and not previously documented in California	
Brachypodium sylvaticum	Forests in Santa Cruz mountains; spreading rapidly
Centaurea virgata	Scrub, grassland, pinyon-juniper woodland
Chorispora tenella	Dry disturbed sites, winter annual crops, especially winter wheat, roadsides, waste places
Daucus carota	Disturbed sites, particularly roadsides
Erigeron karvinskianus	Shaded rock walls, moist disturbed habitats
Erodium botrys	Present in wildlands, but impacts are unknown
Erodium brachycarpum	Present in wildlands, but impacts are unknown
Euphorbia esula	Forests, woodlands, juniper forest
Geranium molle	Present in wildlands, but impacts are unknown
Geranium retrorsum	Present in wildlands, but impacts are unknown
Phytolacca americana	Riparian forest, riparian woodland
Salvia aethiopis	Sagebrush, juniper, bunchgrass; limited distribution
Schismus barbatus	Scrub, thorn woodland
Ulmus pumila	Waste places, roadsides, washes
Priority Group 4 – Previously documented in California and not found within the elevation range of the park	
Acacia melanoxylon	Coniferous forest, chaparral, woodland, riparian
Aegilops cylindrica	Disturbed sites, fields, and roadsides
Anagallis arvensis	Disturbed sites
Anthriscus caucalis	Disturbed sites
Apium graveolens	Wetlands, moist disturbed sites
Arenaria serpyllifolia	Disturbed, sandy, rocky soil
Arrhenatherum elatius	Meadows, fields, open ground, waste places, and roadsides
Asparagus asparagoides	Riparian woodlands
Asparagus officinalis	Fields, woods, fencerows, roadsides
Barbarea verna	Disturbed areas
Bellardia trixago	Grasslands
Bellis perennis	Present along trails, not known to spread into undisturbed areas
Briza minor	Swamp margins, seasonal wetlands and around vernal pools, open woodlands, sandhills, roadsides, and pastures
Bromus arenarius	Can invade many plant communities
Bromus catharticus	Disturbed areas
Bromus sterilis	Disturbed areas
Bromus trinii	Dry plains, rocky or wooded slopes
Capsella bursa-pastoris	Pastures, orchards and disturbed areas

Table C-1: Invasive Plant Species Not Yet Found in Yosemite National Park	
Invasive Plant Species	**Habitat**
Carthamus tinctorius	Disturbed areas and roadsides
Catalpa bignonioides	Escaped cultivar found in wildlands; native to United States, but not to California
Cerastium fontanum ssp. *vulgare*	Disturbed areas, grassy slopes, damp woods, marshy ground
Cerastium glomeratum	Dry hillsides, grasslands, chaparral, disturbed areas
Chamaesyce maculata	Waste places, gardens
Chamomilla suaveolens	Disturbed sites, sandbars, riverbanks, footpaths, roadsides, grazed land
Cistus ladanifer	Uncommon in disturbed areas
Cnicus benedictus	Disturbed areas
Coronopus didymus	Disturbed areas, gardens, fields
Cortaderia selloana	Coastal dunes, coastal scrub, Monterey pine, riparian, grasslands, wetlands, serpentine soils
Crassula tillaea	Open, gravelly sites
Crupina vulgaris	Forest, woodland, and grasslands
Digitaria sanguinalis	Disturbed places, fields, roadsides
Dittrichia graveolens	Spreading rapidly in grasslands and riparian scrub
Ehrharta erecta	Scrub, grasslands, woodlands, and forests
Eichhornia crassipes	Aquatic systems in Sacramento-San Joaquin Delta
Elymus repens	Open areas with moderate to high nutrient levels such as agricultural fields, lightly grazed pastures, and waste places
Elytrigia elongata	Disturbed areas, slopes
Eragrostis cilianensis	Disturbed areas
Euphorbia oblongata	Meadows and woodlands
Euphorbia peplus	Waste places, gardens
Filago gallica	Common, weedy; bare or grassy places*
Foeniculum vulgare	Grasslands and scrub
Fraxinus uhdei	Riparian, escaped cultivar
Fumaria officinalis	Disturbed areas
Galium murale	Damp, mossy places, undergrowth on grassy hillsides
Galium parisiense	Warm, dry, generally rocky soil
Gastridium ventricosum	Open, generally dry, disturbed sites
Gnaphalium luteo-album	Fields, waste places
Gypsophila paniculata	Disturbed sites, especially on sandy soils and in open, grassy places
Herniaria hirsuta	Disturbed, sandy or clay soils
Hydrilla verticillata	Freshwater aquatic systems; the most important submerged aquatic invasive in southern states
Juglans regia	Persisting near abandoned habitations
Lamarckia aurea	Open ground, moist seeps, rocky hillsides, sandy soil
Lamium amplexicaule	Disturbed sites, cultivated or abandoned fields
Ligustrum lucidum	Riparian possible

Table C-1: Invasive Plant Species Not Yet Found in Yosemite National Park	
Invasive Plant Species	**Habitat**
Lolium temulentum	Open, disturbed sites
Malus sylvestris	Disturbed areas
Malva neglecta	Disturbed areas
Malva parviflora	Disturbed areas
Mollugo verticillata	Common. Moist, exposed, disturbed wetland margins, roadsides, fields
Morus alba	Disturbed areas, moist soil, streambanks
Myosotis latifolia	Coniferous forest, riparian
Ononis alopecuroides	Grasslands, oak woodland
Paspalum dilatatum	Moist places, ditches, roadsides
Pennisetum clandestinum	Present at low levels in numerous wildland habitats; also a turf weed
Petrorhagia dubia	Disturbed areas, woodland savanna
Phalaris minor	Disturbed areas
Phalaris paradoxa	Disturbed areas
Physalis philadelphica	Waste places, cultivated fields, roadsides
Plantago major	Disturbed areas
Poa annua	Abundant in disturbed moist ground, lawns, etc.
Poa palustris	Disturbed ground in moist forests or sagebrush scrub, meadows, along streams
Polycarpon tetraphyllum	Disturbed areas, roadsides, shaded waste areas
Polygonum arenastrum	Common in disturbed areas
Polygonum argyrocoleon	Fields, disturbed places
Polypogon australis	Edges of streams, ditches
Polypogon interruptus	Common; streambanks, ditches
Polypogon maritimus	Riparian, moist areas
Polypogon viridis	Moist places, ditches, roadsides
Prunus cerasifera	Riparian habitats, chaparral, woodland
Ranunculus repens	Riparian areas and coniferous forest
Ranunculus parviflorus	Waste areas, wet fields
Ranunculus testiculatus	Waste areas, overgrazed pastures, scrub
Raphanus raphanistrum	Disturbed areas, fields, roadsides
Rosmarinus officinalis	Widespread, can invade wildland areas
Rumex conglomeratus	Common in moist areas
Rumex dentatus	Common in moist areas
Sapium sebiferum	Spreading rapidly in riparian areas along the American River
Schinus terebinthifolius	Riparian areas
Scleranthus annuus ssp. *annuus*	Meadows, stream margins, serpentine areas, disturbed areas
Senecio vulgaris	Abundant in gardens, farmlands, and other disturbed sites
Sesbania punicea	Riparian areas
Setaria pumila	Riparian areas

Table C-1: Invasive Plant Species Not Yet Found in Yosemite National Park	
Invasive Plant Species	**Habitat**
Setaria viridis	Waste places, fields, roadsides
Silene gallica	Fields, disturbed areas
Sisymbrium officinale	Disturbed areas, gardens, roadsides
Sisymbrium orientale	Disturbed areas, fields
Soliva sessilis	Disturbed areas, especially hard-packed paths, roadsides, and lawns
Sonchus oleraceus	Abundant weed in waste places, gardens, etc.
Sorghum bicolor	Disturbed areas, roadsides, fallow fields
Sorghum halepense	Disturbed areas, ditchbanks, roadsides
Spergularia rubra	Open forests, gravelly glades, meadows, mud flats, disturbed areas
Stellaria media	Oak woodlands, meadows, disturbed areas
Tamarix chinensis	Canyons, riverbanks, roadsides
Torilis nodosa	Disturbed areas
Trifolium campestre	Disturbed areas, roadsides, lawns
Vicia sativa	Disturbed areas, fields
Vitis vinifera	Abandoned fields, roadsides

References

Drucker, B. and G.L. Bradshaw (2007). Early Detection Priority for Watchlist Species of Devil's Postpile National Monument and Sequoia, Kings Canyon and Yosemite National Parks. Unpublished report prepared for the National Park Service Inventory and Monitoring Program.

Appendix D: Best Management Practices to Prevent the Spread of Invasive Plants

Prevention can be the most effective, and cost-effective, way to limit the impacts of invasive plants. Prevention practices would be incorporated at the planning, implementation, and follow-up of park projects and routine maintenance operations. This prevention plan addresses three primary activities within the park: 1) projects and maintenance programs that require ground disturbance; 2) Wilderness activities; and 3) fire management activities.

Ground-Disturbing Projects and Maintenance Programs

- Incorporate weed prevention and control into project layout, design, and evaluation when ground-disturbing activities are a necessary component of a project or routine maintenance operations.
- Include assessments to identify project-specific risks of invasive plant introduction and spread and project-specific prevention practices. Identify needs and treatments at the onset of project planning.
- Conduct invasive plant surveys within the project site, and access routes during the planning process. Develop treatment prescriptions for existing invasive plant populations.
- Identify staging areas that are free of invasive plants during the project planning stages, and use when possible.
- Take measures to minimize the extent of ground disturbance during routine maintenance operations by limiting project boundaries to the minimum necessary to complete the project.
- Inspect materials that are imported from outside the park, such as sand, gravel, and fill materials at the source, to ensure that they are free of invasive plants before transport and use. If sources of sand, gravel, and fill are contaminated with invasive plants, use alternative sources.
- Clean and inspect equipment and machinery that has been working in areas contaminated by invasive plants before moving to a different site or an uninfested site.
- Before entering the park, clean mud, dirt, and plant parts from heavy equipment and vehicles, including contractor equipment and equipment rented by the park.
- Keep stockpiled, non-infested materials free of invasive plants by preventing weed seed contamination with physical barriers, and by frequently monitoring and quickly eradicating new invasive plant populations immediately after they are detected.
- When working in vegetation types with relatively closed canopies, retain shade to the extent possible to suppress weeds and prevent their establishment and growth.
- A staging area standard operating procedure would be developed for each staging area in the park to identify how and where materials stored or taken from a staging area can be used throughout the park.
- If hay or straw is needed for a project, certified weed-free hay or straw would be used.
- Incorporate invasive plant prevention practices into road and utility project design and redevelopment, evaluation, and decisions.
- Encourage drought-tolerant local native plant use in landscaping to eliminate the need for overhead watering systems that encourage invasive plants.

Post Project

- Identify site-specific invasive plant monitoring in project plans.
- Survey project sites for a minimum of three years post-project to ensure that invasive plants are detected and controlled. Conduct follow-up treatments and surveys as needed.
- Establish native vegetation where project disturbance creates bare ground to prevent conditions that favor invasive plants. Revegetation may include topsoil replacement, planting, seeding, and weed-free mulching.
- Retain and replace native topsoil, when feasible.

Routine Maintenance by Park Operations

- Clean park vehicles of soil and debris before moving to another site in the park.
- Minimize soil disturbance during routine maintenance activities (e.g., road grading, snow removal).
- Maintain landscaped areas to minimize the risk of invasive species spreading into natural areas. Mulching, weeding, and mowing lawns can be effective methods of reducing the risk of invasive plants from spreading away from administrative areas.
- Convert existing landscapes to local natives with low-flow drip irrigation to discourage weed habitat.

Wilderness Activities

- Before entering Wilderness areas, ensure that boots, socks, additional clothing, camping equipment, helicopters, and all items entering the Wilderness are free of seeds and plant propagules.
- Develop a comprehensive weed-free feed plan for stock use in Wilderness areas throughout the Sierra Nevada.
- Conduct directed surveys in Wilderness areas, and eradicate small invasive plant populations in Wilderness areas promptly.
- Regularly inspect trailheads and other Wilderness staging areas, and remove invasive plants.

Housing Administration

- Ensure that housing policies do not promote the introduction and spread of invasive species in the park.
- Do not plant non-native species that have the potential to invade adjacent natural areas.
- Survey government houses as they become vacant to determine whether existing invasive plants are present within the site. If invasive species are present, eradicate invasive plant populations.
- Support education efforts to assist in-holders with invasive plant eradication.

Fire Management Activities

Yosemite National Park boasts one of the most active fire management programs in the country. Fire managers in Yosemite use prescribed fire, wildland fire, fire suppression, and mechanical fuels treatments to meet management objectives and restore and maintain fire as a natural ecosystem process. Operations are conducted parkwide in both front- and back-country settings, and occur year-round, although they are concentrated in the summer and fall months. Yosemite Fire Management employs a maximum of 80

people at the height of the season, and has an impressive fleet of engines, patrol vehicles, water tenders, a committed helicopter, crew buggies and trucks, and all-terrain vehicles. Off-park resources are often ordered to assist with managing fires in the park, and it is common for National Park Service crews, crews from other federal agencies, and contractor crews to work on incidents within the park. During the 1996 Ackerson Fire Complex, a maximum of 3,379 people staffed the fire. Yosemite Fire Management has the potential to make a significant impact on the status of invasive plant species within the park by using fires as vectors for invasive plant introduction and spread.

General

- Strive to retain shaded fuel breaks in forested areas to discourage invasive plants.
- Monitor and control invasive plants in fuel breaks.

Firefighter Inspection

- **Boots:** Inspect boots at the beginning and end of each shift. Wear leather laces to decrease the likelihood of picking up weed seed.
- **Clothing:** Inspect nomex pants, shirts, and socks for weed seed.
- **Gear:** Inspect initial attack gear (especially water bottle pockets and exterior of pack) for weed seeds.
- Dispose of any found weed seed in plastic bags and deposit in trash receptacle.

Tool/Equipment Inspection

- Ensure that hand tools, chainsaws, chaps, saw kits, pumps, weed whackers, etc. are free of weed seed before and after each shift.

Vehicle Inspection

- Frequently wash soil and debris from body, tires, and undercarriage of all vehicles used on fire operations.
- Wash in designated vehicle washing stations.

Vehicle Washing Stations

- Establish portable vehicle washing stations in the four districts of the park (Crane Flat, El Portal, Hodgdon, Wawona, and Yosemite Valley) to catch, contain, and dispose of weed seeds and/or propagules.
- Acquire a mobile washing station for large incidents.

Off-Park Crews

- Ensure that incoming crews either arrive with clean vehicles, personnel, tools, and equipment, or report to a vehicle washing station within the park prior to reporting for duty.
- Incoming crews will be briefed by the Incident Commander, Burn Boss, or Resource Advisor on tactics (e.g., cleaning and inspections) necessary to prevent the introduction and/or spread of invasive plant species.

Resource Advisor/Fire Ecologist

- Incorporate invasive species management into briefings, "after action" reviews, and fireline operations by encouraging pre- and post-shift inspections. Alert personnel if they are working in areas of invasive plants, and point out invasive species during briefings (carry photos of the "Top 10"species).
- Incorporate spatial data of invasive plant populations into resource advisor maps.
- Familiarize firefighters with local invasive plants. Encourage reporting of suspected invasive plant populations to invasive plant managers.
- Discuss Yosemite's invasive plant management program, and introduce a system of inspections, cleaning, and detection.
- Encourage the reporting of previously undetected invasive plant species sighted on the fireline.

Incident Commander/Burn Boss/Holding Specialist/Ignition Specialist

- If possible, conduct line construction away from areas of known infestation, and limit the amount of travel/ground disturbance through affected areas.

Appendix E: Obtaining Pesticide Registration

Prior to commercial use, all pesticides sold in the United States must be registered with the U.S. Environmental Protection Agency (EPA) in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). FIFRA allows state governments to impose their own registration processes and requirements, providing that such requirements are equal to or more stringent than the EPA requirements (CDPR 2004; EPA 2007b). All herbicides proposed for use in the Invasive Plant Management Plan are registered with both the EPA and the California Department of Pesticide Regulation (CDPR).

EPA and California Mandated Testing

To obtain EPA registration, the applicant proposing to register must provide to the EPA the results of testing, and certify that testing was conducted in full compliance with Good Laboratory Practice standards [40 CFR§160.135(a)]. The EPA has "harmonized" testing, i.e., tests required by a variety of government agencies consolidated into a single unified series of requirements (EPA 2007a). Federal data requirements are found in 40 CFR Part 158.

Eight testing series are required for all synthetic chemical herbicides:

1. Product performance
2. Product properties
3. Fate, transport, and transformation
4. Spray drift
5. Ecological effects
6. Residue chemistry
7. Health effects
8. Occupational and residential exposure

Two additional series exist, but they are required only for biochemicals and microbial pesticides; glyphosate and aminopyralid do not fall into either class. However, all synthetic chemical pesticides must be tested for the first eight series on the list (EPA 2007a).

Each series contains multiple individual tests and/or data requirements, as listed in the tables at the EPA website (http://www.epa.gov/opptsfrs/home/guidelin.htm). For instance, the Ecological Effects Test Guidelines requires 49 individual tests and requirements, all subject to Good Laboratory Practices, and all subject to specific EPA-mandated methods (EPA 2007a).

Data required by the EPA also meets State of California requirements, although the CDPR may require additional testing above and beyond what the EPA requires. Testing done exclusively for California, however, is not required to meet Good Laboratory Practice standards. Additional testing required by California is included in the California Code of Regulations (CCR) (6176-6193.5), and is quoted on the CDPR website (CDPR 2004).

EPA Review of Data and Registration Process

Prior to analyzing the data, both the EPA and CDPR require the applicant to provide sample labels that meet EPA labeling requirements (CDPR 2004; EPA 2007b).

Once data is presented to the EPA, it is analyzed by a Project Manager, who coordinates peer review and communicates with the applicant (the company that developed the pesticide under review). The proposed product and data provided are reviewed based on three broad classes of criteria. The first criterion is public health (with special emphasis on children and others who are particularly sensitive to contaminants). The second criterion is the health of the workers who would be exposed. The third criterion is the effect on the environment (EPA 2007b).

The EPA then compiles a Comprehensive Health and Risk Assessment, which looks at health and environmental impacts and is open to scientific peer review. The Comprehensive Health and Risk Assessment is used to develop mitigation measures and risk management (EPA 2007b).

The EPA then determines if the pesticide can be used at all, and, if so, what restrictions would apply (EPA 2007b).

If the EPA determines that the health and environmental impacts associated with the proposed pesticide are too great, it then notifies the applicant of the basis for rejection. The EPA may recommend changes in labeling restrictions or other modifications that would allow the product to be registered, or request additional data or further studies (EPA 2007b).

If the EPA approves the product, it then approves registration, subject to risk mitigation and labeling restrictions, and publishes that approval in the Federal Register (EPA 2007b).

California Review of Data and Registration Process

The State of California will only accept an application for registration after the product has been successfully registered with the EPA. California requires that all data submitted to the EPA also be submitted to the CDPR, and has additional requirements as well, depending on the specific pesticide (CDPR 2004).

Data requirements specific to California that might have been applied to different glyphosate formulations and/or aminopyralid include:

- Safety related to exposure
- Mixer, loader, applicator exposure
- Management of poisoning
- Spray adjuvants
- Foliar and field re-entry
- Field re-entry
- Residue test method
- Residue data

- Efficacy
- Hazards to bees
- Effects on pest management
- Inert ingredient hazard
- Volatile organic compounds
- Acute effects dietary hazard

California data requirements are found in CCR sections 6159, and 6170 through 6200 (CDPR 2004).

California also requires the applicant to submit proposed labels for the product; many pesticides develop labels specifically for California due to the State's stringent regulation requirements (CDPR 2004).

California DPR scientists review the data (which may or may not result in additional data requests), and submit recommendations to a Registration Specialist, who opens the submission to a 30-day public review, prior to approving or disapproving. If approved, the product is registered for use in California (CDPR 2004).

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Appendix F: Glyphosate Herbicide Information Sheet

This information sheet summarizes existing scientific knowledge pertaining to the use of glyphosate proposed in Alternatives 2 and 3 (but not Alternative 1) in the Invasive Plant Management Plan. This information sheet is intended to be a starting point in pursuing more in-depth information on glyphosate. Glyphosate has been widely studied and its use monitored worldwide. It is one of the most thoroughly researched herbicides.

Under Alternatives 2 and 3, glyphosate would be used on Himalayan blackberry, tree-of-heaven, cut-leaf blackberry, yellow star-thistle, spotted knapweed, perennial pea, black locust, perennial pepperweed, and other species listed in Tables II-4 and II-6, when populations meet the defined thresholds for population size and location. The park would use different formulations depending on the location and the application method used. Glyphosate would be applied at no more than the equivalent of 4 quarts per acre per year. The herbicide would be applied by on of the following methods: foliar spray using backpack sprayers; wiped on using a wick, sponge, paintbrush, or something similar; cut stump application immediately after cutting the tree or shrub down; or frill by application immediately after small cuts are made into the cambium.

Overview

Glyphosate, an isopropylamine salt of N-(phosphonomethyl)glycine, is the active ingredient of Rodeo®/Aquamaster® and Roundup® (Monsanto 2001; Monsanto 2005). Glyphosate is a broad-spectrum, nonselective systemic herbicide used for control of annual and perennial plants including grasses, sedges, broad-leaved weeds, and woody plants. It is widely applied worldwide to agricultural and non-agricultural areas (WHO 1994). Glyphosate was the seventh most commonly used conventional pesticide in U.S. agricultural crop production, and the second most commonly used homeowners applications in 1995 (EPA 1997).

The patent for Glyphosate has expired and is now manufactured by at least seven different companies, and sold under multiple brand names and formulations. The most common glyphosate formulation is Roundup®, which is labeled only for terrestrial use.

In secondary literature and news reports, the words “glyphosate” and “Roundup®” are frequently presented as synonyms (Belmonte 2006). This is incorrect and can be misleading. Roundup® itself is only one brand name of many that include glyphosate as an ingredient. Glyphosate is the active and primary ingredient in Roundup®, but is not the only ingredient (SERA 2003) (Richard et al. 2005).

A major qualitative difference between the effect of glyphosate and glyphosate formulations on aquatic and terrestrial organisms concerns the surfactant used. For example, the surfactant in Roundup® is much more toxic than glyphosate to aquatic organisms. Unlike glyphosate, the surfactant is more toxic in alkaline water than in acidic water. Thus, the relative potency of the surfactant with respect to glyphosate is pH dependent. Relatively little information exists regarding the toxicity of Roundup Pro® to aquatic species. Nonetheless, the acute lethal potencies of Roundup® and Roundup Pro® are similar. Rodeo® (Dow AgroSciences) and Aquamaster® (Monsanto) are two products that have been specifically

developed for application directly into water. Surfactants are specifically addressed later in this appendix, and specifically discussed to be applicable to multiple brand formulations.

Mode of Action

Glyphosate is effective on plant control primarily from the inhibition of the shikimate pathway, which is involved in the synthesis of aromatic amino acids in plants and microorganisms. Glyphosate mimics the plant hormone auxin, which selectively binds to receptor sites on the enzyme 5-enolpyruvlyshikimate-3-phosphate synthase, which would normally accept phosphoenol-pyruvate to allow conversion of one amino acid (shikimate) to another (chorismate). Blocking this step in the shikimate acid pathway stops production of secondary products (aromatic amino acids) and causes a buildup of shikimate (Baumann et al. 1999; Shaner 2006; (SERA 2003).

Glyphosate typically circulates through the entire plant, and blocks the shikimate pathway. The plant continues to photosynthesize, but with the blocked pathway, the plant dies. Although microorganisms have the shikimate pathway, research suggests glyphosate has no effect or slight enhancement to microorganisms in soil (SERA 2003)Powell et al. 1991; Haney et al. 2002; Busse et al. 2001). The shikimate metabolic pathway does not occur in humans and other animals (SERA 2003).

Human Toxicity

Multiple peer-reviewed scientific studies are available to estimate glyphosate exposure routes and toxicity. Glyphosate is partially absorbed through oral exposure. About 30 percent of ingested glyphosate is absorbed (SERA 2003). Acute oral toxicity studies are based on the lethal dose to 50 percent (LD50) of laboratory animals. The LD50 for glyphosate in mammals ranges from about 2,000 to 6,000 milligrams of glyphosate to kilograms of body weight). The estimated LD50 in humans is approximately 3,000 milligrams per kilogram (mg/kg) (Williams et al. 2000). For comparison, the LD50 for caffeine is 127 mg/kg (Science Lab 2005a), and the LD50 for salt (sodium chloride) is 3,000 mg/kg (Science Lab 2005b). A study on deliberate ingestion by humans has shown fatal doses to be greater than 200 milliliters (Lee et al. 2000)

Glyphosate is poorly absorbed through dermal application. In vitro studies show absorption of 1.4 percent of the dose (Wester et al. 1996). In vivo studies in rhesus monkeys have shown that 2 percent of glyphosate is absorbed in 12 hours (Wester et al. 1991). Low concentrations of glyphosate have been found in agriculture workers and their families after application. On the day of application, 60 percent of farmers and 4 percent of spouses were found to have low concentrations of glyphosate in their urine (Acquavella et al. 2004).

Glyphosate has not shown signs of causing neurotoxicity, and has the lowest risk of carcinogenicity (EPA 1993). Chronic or subchronic exposure to glyphosate tends to cause loss of body weight, and has not been shown to bioaccumulate (SERA 2003).

Environmental Fate

Glyphosate is not mobile in soil because it quickly and strongly bonds to soil and does not displace easily. Soil bacteria and microorganisms metabolize and break it down.

Glyphosate readily adsorbs to soil, with the equilibrium constant for dissociation ranging from 500 to 2,600 (SERA 2003). Once the glyphosate adsorbs to the soil, it is no longer available to plants. This strong adsorption to the soil limits the environmental transport of residual glyphosate from the application site. It is not likely for glyphosate to reach groundwater or surface water from upland use because of the binding with soil. The affinity between soil and glyphosate also helps eliminate glyphosate from water. Glyphosate is largely partitioned to particles suspended in natural waters. The glyphosate preferentially bonds to organics in the solution, reducing the glyphosate in solution. This is likely the largest sink of glyphosate in water. The half-life for glyphosate in water is a few days to two weeks (Tatum 2004).

Glyphosate is biodegraded in both water and soil. Glyphosate in soil is primarily biodegraded by microorganisms. The half-life for glyphosate in soil ranges from 1 to 197 days (Tatum 2004). Both bound and unbound molecules are biodegraded. Glyphosate is biodegraded rapidly, even while strongly bound to the soil (Dubbin et al. 2000). Some microorganisms possibly increase with application, although the effect is not apparent until large quantities of glyphosate are applied. Field application rates appear to have little effect on microbial communities. Application of 100 times the field application rate does increase microbial communities (Ratcliff 2006).

Glyphosate has relatively low toxicity to birds and mammals and moderate toxicity to aquatic species (Tu, Hurd et al. 2001). Toxicity to birds and mammals can be extrapolated from the human toxicity information. In determining the toxicity to aquatic species, the ecological context and effects of particular formulations should be considered. Aquatic toxicity is considered further in the surfactant section of this fact sheet.

The primary breakdown product of glyphosate is aminomethylphosphonic acid; this product primarily breaks down into carbon dioxide, ammonium, and phosphate. Like glyphosate, aminomethylphosphonic acid binds well with soil and sediments (Newton et al. 1994) and has low toxicity (Williams et al. 2000). There is limited literature on the effects of aminomethylphosphonic acid (Cox 2004), but it is currently considered of less toxicological concern (SERA 2003).

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Appendix G: Surfactant Information Sheet

This information sheet is a summary of existing scientific knowledge pertaining to the surfactants used in conjunction with herbicides proposed under Alternatives 2 and 3 (but not Alternative 1) in the Invasive Plant Management Plan. This information sheet is intended to be a starting point in pursuing more in-depth information on surfactants.

A surfactant is an adjuvant to an herbicide, used to increase the amount of active ingredient in the herbicide that is delivered to the target plant, thus increasing the effectiveness of the herbicide and decreasing the amount of herbicide required. In choosing a specific surfactant, factors such as environmental conditions before and after application and leaf surface characteristics are considered. Surfactants are part of the "inert ingredients" in most herbicide formulations.

Many formulations of glyphosate exist, most of which contain added chemicals (surfactants and other adjuvants) to enhance uptake of the herbicide by target plants. Different formulations are applicable in various circumstances. Some formulations do not come mixed with a surfactant. This allows the use of different surfactants for different applications.

Surfactants are rated as either aquatic or terrestrial. Most are registered as terrestrial instead of aquatic, and are required to be used only in terrestrial environments (in part, because many surfactants are very toxic to aquatic organisms) (USFS 2003). The surfactants used with glyphosate frequently pose more risk to humans and other organisms than the actual herbicide itself (Tatum 2004).

The surfactant R-11 is proposed for use in Alternatives 2 and 3 of the Invasive Plant Management Plan. This surfactant will be used in formulations of both glyphosate and aminopyralid (and commercial formulations of Rodeo®).

Mode of Action

Surfactants are amphiphilic (i.e., soluble) in both organic solvents and water. Surfactant molecules have a hydrophobic end that preferentially is found in an organic solvent, and a hydrophilic end that preferentially is found in water. Because the surfactant has both hydrophobic and hydrophilic ends, it tends to be found along the molecular interfaces between water and organics.

The surfactants proposed for use in Yosemite decrease the surface tension of herbicide droplets on plants, thus creating greater surface contact with the leaf tissue. The surfactant also helps the herbicide stick to the plant or leaf surface. This ensures that most of the herbicide applied will go to the target plant species.

The absorption process that surfactants enhance is not species-specific; thus, unlike herbicides, surfactants cannot target specific plant species. Surfactants are not biologically active in plants; they only serve to facilitate the entry of herbicide into the plant. However, a surfactant is more effective on some plants, depending on its effectiveness in reducing surface tension on the absorption of herbicide into the plant. The chemical structure of the surfactant also affects plant uptake of the herbicide (Liu 2004). In general, when surfactants are used, plants with leaves that are thick and waxy, hairy, or very narrow will absorb significantly more herbicide than without the use of a surfactant (Miller and Westra 2006).

The proposed surfactant R-11 is used with Rodeo®. R-11 is in the broad group of chemical compounds called alkylphenol ethoxylates, and is assumed to contain primarily nonylphenol polyethoxylates (NPEs). R-11 is classified as "aquatic," and is the only herbicide surfactant rated for aquatic use in the state of California. The NPE polyethoxylated tallowamine (POEA) has been found to be highly toxic to aquatic organisms (Howe et al, 2004). Formulations that include POEA, such as Roundup®, are restricted to terrestrial use.

In general, the toxicity of R-11 is lower than POEA, but it has the potential for more chronic estrogenic effects. POEA is less mobile in soil than R-11, and is preferred for terrestrial applications because it degrades in place.

Toxicity

Unlike pesticides themselves, the Federal Insecticide, Fungicide, and Rodenticide Act does not regulate surfactants. As a result, surfactants are generally not as thoroughly tested for human health and safety effects as are pesticides. Information regarding the health effects of surfactants is generally less encompassing, and information can be less accessible than similar information regarding herbicides.

R-11

R-11 is a non-ionic surfactant. As stated above, R-11 is an alkylphenol ethoxylate surfactant, and is assumed to primarily consist of a nonylethoxylate (NP9E) (USFS 2003). NP9E is a compound consisting of a straight or branched nine-carbon alkyl group (nonyl) bonded to a phenol ring to create a nonylphenol (NP). The NP has a polyethoxylate chain attached. R-11 typically has a NP9E. The metabolite of NPE is NP (Trumbo 2005).

NPE products include cosmetics, shampoos, and spermicide. These products have been extensively tested for human health effects. Most of these formulations contain 1 to 30 ethoxylate groups. Nonoxynol-9 spermicide contains nine ethoxylate groups, making it similar to R-11 (USFS 2003).

Acute toxicity studies for NP9E ranges from 1,000 to 10,000 micrograms per liter (Staples et al. 1998). The lethal dose to 50 percent (LD50) ranges from 620 to 5,600 milligrams per kilogram (mg/kg) (USFS 2003). NP LD50 ranges from 580 to 1,620 mg/kg (USFS 2003). Anaerobic degradation produces NP. Aerobic degradation shows greater than 99 percent reduction of NP9E after 4 days, with no NP (Jonkers et al. 2001). Ingested NP9Es are metabolized quickly, unlike glyphosate and aminopyralid, both of which pass through the digestive tract largely unchanged. Some of the metabolites have endocrine disrupting characteristics.

In both in vitro and in vivo testing, NP9Es have been shown to be weakly estrogenic (USFS 2003). NP is more strongly estrogenic than NP9E, and can have reproductive effects at chronic doses. The No Observed Adverse Effect Level for chronic effects is assumed to be 10 mg/kg per day (USFS 2003). R-11 used in Yosemite will primarily be subject to aerobic breakdown, creating little to no NP.

The U.S. Forest Service estimated possible NP9E exposure scenarios, to both the public and workers, under conditions identical to what would occur under this proposal (workers with hand-held booms or

backpack sprayers in wildland conditions). This assessment resulted in a suggested exposure limit of 0.10 mg/kg per day (USFS 2003).

Exposure scenarios do exist in which workers and the public could exceed these limits, but they are unlikely. Exposure scenarios resulting from intentional application would require workers to be using maximum application rates on maximum acreage working long days without breaks. Accidental exposure scenarios involve spills of 200 gallons into a 1,000-cubic meter pond, with no degradation of the product over time (USFS 2003).

In aquatic situations, R-11 can be toxic to fish at concentrations of 1 to 6 micrograms per liter (mg/L), compared to 500 mg/L for glyphosate. Although R-11 is more toxic than glyphosate, work crews in Yosemite would not apply R-11 in water or within six feet of water. R-11 would be applied in label-approved concentrations, far below the concentrations toxic to fish. In a study by Trumbo (2005), a mix of glyphosate and R-11 was applied to a pond at rates higher than would be expected in an actual scenario. These higher rates were achieved by staying within labeling restrictions, with one exception: the herbicide mixture was sprayed directly onto open water, instead of onto plants growing in the open water, resulting in a higher concentration in the water than might otherwise be expected. Concentrations of NPE in the pond water approached the 96-hour lethal concentration 50 percent dose (96-H LC50) for larval northern leopard frogs, but then declined to well below the 96-H LC50 level within 24 hours of the application. Larval leopard frog LC50 levels were determined in separate laboratory analysis; no frogs or larvae were present in the pond. However, the decline of NPE levels within 24 hours suggests that less than half of the frogs would have died, as the LC50 levels were determined by exposing the frogs to a constant concentration over a much longer 96-hour period. Aquatic invertebrates (*Ceriodaphnia dubia*) in the pond had no significant mortality (Trumbo 2005). Acute toxicity tests determined that R-11 was much more toxic to amphibians than glyphosate (Trumbo 2005).

POEA

POEA is a non-ionic surfactant used to increase the effectiveness of herbicide. It has not been as rigorously researched as glyphosate. It is considered more toxic than glyphosate, and possibly can have synergistic effects when combined with glyphosate.

POEA, the surfactant used in Roundup®, has an LD50 of approximately 1 to 2 grams per kilogram, which is consistent with other surfactants (SERA 1997). While consistent with other surfactants, POEA is more toxic than R-11. POEA is not registered for aquatic use. It is significantly more toxic to aquatic organisms than glyphosate (Tsui and Chu 2003), and toxicity increases as the tallowamine chain length is reduced (Brausch and Smith 2007). This toxicity makes POEA unsuitable for application in wetlands because of the potential effects to sensitive aquatic organisms.

POEA binds with soil and sediment. The concentrations in water decrease rapidly in the presence of sediment (Wang et al. 2005). Because of this binding with soil, POEA has low mobility in soil, and thus will primarily remain at the application site.

Studies published in recent years on the effects of Roundup® on amphibians were not available prior to 1995 (Relyea 2006). Recent studies have shown differences on the toxicity of Roundup® on different

amphibian species (Mann and Bidwell 2004; Edginton et al. 2004; Howe et al. 2004). Roundup® has been found to reduce amphibian diversity when applied to wetlands (Relyea 2005). This is likely from the direct application of POEA to water (Thompson et al. 2006). The toxicity of POEA becomes an important environmental concern in small wetlands that are difficult to avoid when aerial applications are used.

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Appendix H: Aminopyralid Herbicide Information Sheet

This information sheet summarizes existing scientific knowledge pertaining to the use of aminopyralid (4-amino-3,6dichloropyridine-2-carboxylic acid or 2-pyridinecarboxylic acid, 4-amino-3,6-dichloro-) proposed under Alternatives 2 and 3 (but not Alternative 1) in the Invasive Plant Management Plan. This information sheet is intended to be a starting point in pursuing more in-depth information on aminopyralid.

Aminopyralid would be used on yellow star-thistle, Italian thistle, spotted knapweed, and ox-eye daisy when conditions are appropriate. Additional species not yet occurring in the park would be considered for treatment if they arrive in the park, including Canada thistle (*Cirsium arvense*) and various species of knapweed/star thistle (*Centauria* spp.). Aminopyralid would be applied by one of the following methods: via foliar spray using backpack sprayers; wiped on using a wick, sponge, paintbrush, or similar tool; cut stump application immediately after cutting the plant; or frill by application immediately after small cuts are made into the cambium. Aminopyralid is the active ingredient in Milestone®, manufactured by Dow AgroSciences. Milestone® is a terrestrial-use herbicide, intended for use up to the water line and during the dry phase of seasonally flooded wetlands (Dow 2005a). Aminopyralid (currently only available in the form of Milestone®) would be applied at no more than the equivalent of seven ounces per acre per year.

Overview

Aminopyralid is of the chemical class pyridine carboxylic acid. This class of chemicals also includes the herbicides clopyralid, picloram, and triclopyr. The formulations of aminopyralid found in Milestone® contain triisopropanolammonium salt of aminopyralid. Neither Milestone® nor Milestone VM® contain inert ingredients other than water and triisopropanolamine (SERA 2007).

Aminopyralid was approved for use in California in October 2006. It is a relatively new herbicide, specifically designed for non-crop or wildland areas for noxious and invasive weed species control. Like all new herbicides, little published research exists on aminopyralid when compared to other herbicides that have been used for many years. Dow AgroSciences has produced toxicity studies to support registration by the U.S. Environmental Protection Agency (EPA), as well as by the California Department of Pesticide Registration (CDPR).

The processes for pesticide registration are very thorough, and are described separately in Appendix E. CDPR does not start its registration process until after a federal registration is given to a pesticide by the EPA. The State of California requires additional testing, and has more stringent requirements than does the federal government.

Mode of Action

Milestone® is a semi-selective broad-spectrum herbicide. At sufficient concentrations, it kills most vegetation with which it comes in contact. Members of the sunflower/composite (*Asteraceae*) Pea/Legume (*Fabaceae*), and Nightshade (*Solonaceae*) families are more strongly affected by the chemical than most other types of plants. Grass (*Poaceae*) species are less affected than most other types of plants. By using lower concentrations, the herbicide can be used in a selective fashion (EPA 2005a). Aminopyralid is expected to be effective at lower application rates than clopyralid, picloram, and triclopyr. The

strongest concentration recommended for wildland application with hand sprayers is 0.0025 percent Milestone® to 99.9975 percent water, although the solution can be diluted as much as 0.00012 percent Milestone® to 99.99988 percent water (Dow 2005a).

Aminopyralid is an auxin-like growth regulator (Dow 2005b). Auxins are plant hormones that control plant stem and root growth by binding to receptor sites on individual cells and triggering responses from those cells. Auxin mimics, such as aminopyralid, bind to those receptor sites, preventing the auxins from binding. This disrupts or alters plant growth in ways that lead to mortality or decreased vigor (EPA 2005a; PMRA 2007; Wood 2006).

Human Toxicity

Auxins are plant hormones and are not present in animals except as ingested food. Animal cells do not have auxin-binding sites. Auxin mimics have no impact on hormonal processes in animals, including humans (EPA 2005a; PMRA 2007). Orally ingested aminopyralid passes through the digestive tract largely un-metabolized and unchanged. When orally ingested, 96 percent of aminopyralid is excreted unchanged through urine and feces (PMRA 2007). The mechanism for toxicity to mammals is not well established (SERA 2007).

In animal testing, Milestone® is non-mutagenic, not likely to produce cancer in humans, has a low acute oral toxicity, and is not thought to bio-accumulate. In oral ingestion studies, less than 0.73 percent of ingested aminopyralid was recovered in animal tissues (EPA 2005a). The No Observed Adverse Effect Level was greater than 1,000 milligrams per kilogram (mg/kg) per day in mammals, with lethal dose 50 percent concentration greater that 5,000 mg/kg per day (PMRA 2007). Milestone® formulation is slightly irritating to the eye (Dow 2005c; EPA 2005a; PMRA 2007).

Environmental Fate

The physical and chemical properties of aminopyralid suggest the potential of the molecule to degrade slowly and be mobile in the environment. Studies suggest that aminopyralid weakly sorbs to soil, and is primarily degraded by photolysis (EPA 2005b).

After application, aminopyralid is likely to primarily degrade aerobically by metabolism in the soil. The EPA bases soil half-life used in the risk assessment (103.5 days) on the only soil in the study that has an admissible material balance that could be used for quantification (EPA 2005b). Half-life in this study ranges from 6 to 533.2 days (EPA 2005a). The longest half-life (533.2 days) assumes that all "non-extractable residues" were the parent chemical (PMRA 2007). On the surface, photo-degradation occurs with a half-life of 72 days. This degradation produces carbon dioxide, non-extractible residues, and small amounts of acidic volatiles (EPA 2005a).

The metabolic breakdown of aminopyralid is not understood. The amino and carboxyl groups should be easily removed, but the chlorinated ring structure could be resistant to degrading in natural systems (EPA 2005b). In laboratory experiments, aminopyralid has been found to degrade to small acids, acid amines, and carbon dioxide by aqueous photolysis (EPA 2005a).

Based on the adsorption equilibrium constant for dissociation (soil/water coefficient) average of 0.22 and median of 0.13 (SERA 2007), aminopyralid can be expected to be mobile in soil. The EPA suggest that aminopyralid weakly adsorbs to the soil and is fairly non-mobile, with only a small fraction of the material leaching farther than 15 to 30 centimeters below the surface (EPA 2005a). However, leaching may have been missed in the sampling (SERA 2007; EPA 2005b).

In a lab experiment, aminopyralid in clear water degrades by photolysis with a half-life of 0.6 day (EPA 2005a). Aminopyralid is considered stable in an anaerobic environment (EPA 2005a) and stable to hydrolysis (Dow 2005c). In aerobic sediment-water systems, half-life ranges from 462 to 990 days (EPS 2005a).

Aminopyralid appears to have low acute and chronic oral toxicity to mammals, birds, terrestrial invertebrates, and aquatic animals including amphibians (SERA 2007). In water, aminopyralid was shown to be toxic to aquatic vascular plants and algae, and slightly toxic to some species of oysters, fathead minnow (*Pimphales promelas*), and midges (*Chiromus riparus*). It tested as virtually non-toxic to all other species of fish tested (both fresh water and marine), amphibians, marine invertebrates, and marine algae (EPA 2005a; PMRA 2007).

The low application rates needed to target plant species, combined with the low toxicity indicated by the initial studies, suggest that aminopyralid will not adversely affect other organisms. The deficit of research is a product of the newness of the herbicide, and will likely become more thorough over time. Mobility and degradation in field conditions are a concern. Further research will help to verify the preliminary research and widen the scope of knowledge of aminopyralid. Routine monitoring of research literature as part of the Invasive Plant Management Plan will keep knowledge current.

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Appendix I: Herbicide Use and Storage **Pesticide Regulation. All herbicides used would conform to U.S. Environmental** Protocol

Herbicides would be handled only by those trained and certified by the California Department of Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), and State of California work safety standards and pesticide regulations, as well as internal National Park Service work safety and integrated pest management policies.

All application methods would involve the least amount of herbicide needed to achieve management objectives. Precautions would be taken to reduce or eliminate non-target mortality and reduce spills. All weed control efforts would use focused application methods and ensure that only specific targeted plants are affected. Only herbicides appropriate for the targeted species would be used within Yosemite National Park, and they would be applied as prescribed by their label and as approved by the regional integrated pest management coordinator. Manufacturer's guidelines would be followed at all times.

Application Equipment

- Herbicide application equipment would be kept in good working order and routinely evaluated for leaks, cracks, loose fittings, bad gaskets, signs of spillage, or any other indication of real or potential leakage.
- Spray equipment would be equipped with pressure limiting valves and check valves to reduce pressure at the wand tip and to prevent dripping. Specialized tips would be installed to aid in control of droplet size and to reduce potential for drift.
- Filters would be embedded in the sprayer wand to keep debris out of the spray nozzle and to ensure an even and predictable spray pattern.
- Crews would routinely calibrate spray equipment to ensure proper functioning and desired application rates.
- Crews would attempt to schedule work such that spray equipment would be empty at the end of the work day; however, if not possible, the spray equipment would be tagged to indicate contents, stored in a plastic containment tub, and secured in a locked pesticide holding facility.
- At the end of any work week (or at the end of the day if sprayers will not be used the following day), backpack sprayers would be emptied into the appropriate officially labeled containers. Containers would be secured in a locked pesticide holding facility.
- Prior to overnight storage, empty containers would be triple rinsed as per California Department of Pesticide regulations. Wastewater would be retained in containers labeled as "Pesticide Waste Water," and the rinsed containers would list the pesticides contained. Wastewater would be stored, labeled, and handled in the same manner as herbicides. This wastewater would either be reused to dilute additional herbicide for application, or disposed of semi-annually as chemical waste by the park Safety office. Once triple rinsed, containers would be labeled as "Triple-Rinsed Pesticide Containers."
- Backpack sprayers would be kept upright when in use.
- During transport or storage, backpack content would be labeled and stored in an EPA-approved plastic containment tub.

- Dye would be added to the herbicide to make all applications visible; workers would be able to see exactly where the herbicide is being applied. Dye is non-colorfast and fades after two to three weeks.
- Herbicide application would not take place when winds are at greater than 10 miles per hour. Meteorological conditions such as temperature and relative humidity would be taken into account before and during spray hours.
- As stated above, pressure limiting valves and check valves would be used to prevent dripping at the wand tip when not spraying.

Herbicide Handling and Mixing

Procedures for the handling of pesticides are provided on the pesticide labels. Label guidelines would be followed at all times.

When conditions permit, mixing and loading would occur in developed areas prior to being deployed in the field. A containment tub would be used to catch spills if it is deemed necessary to mix and load in the field. The mixer would be donned with appropriate personal protection equipment (PPE). If an accidental spill were to occur, it would be immediately contained and the contaminant appropriately disposed of.

The following precautions would be followed:

- Work crews would wear OSHA-approved safety gear for herbicide handling.
- Mixing would never take place near surface water sources such as streams, rivers, lakes, and riparian areas.
- An air gap would be maintained between any fresh water source and equipment to avoid back-siphoning into the clean water.
- Mixing would take place over a plastic containment tub.
- Mixers would wear appropriate PPE while mixing and loading. Such PPE includes, but is not limited to, face shields, chemical resistant gloves, long pants, long-sleeved shirts, impervious aprons, and respirators.

Spill Prevention/Response

- Crew members would maintain and have access to a spill response kit while applying herbicides.
- When not in use, all herbicide and application equipment would be stored in clearly labeled and locked facilities. These facilities would be posted with appropriate placards, and would contain copies of all material safety data sheets (MSDSs) and product labels, emergency response information, and supplies and equipment needed for spill control. An inventory of facility contents would be maintained off site.
- Work crews would follow product label guidelines and wear appropriate PPE.

Spill Response

- Consult product labels and MSDSs to determine response and safety protocols.
- Report spills as warranted by information provided on pesticide container labels and MSDSs.
- Wear appropriate PPE when handling a spill. Crews would be familiar with, maintain, and carry a spill response kit at all times.

- Spill response kits would include a shovel, empty containers, dedicated miscellaneous tools, hose and hose clamps, duct tape, booms and socks, plastic tarp, heavy plastic bags, absorbent material, and spare hardware (nuts, bolts, and screws).

Methods for Stopping or Containing Spills

- Wear appropriate PPE at all times.
- Identify any spilled product and consult product labels and MSDSs for safety protocols.
- Prevent additional spillage first if can be done safely.
- If in a building or pickup bed, use absorbent material to soak up liquid.
- If on the ground, use booms or socks, then shovel and scrape earth to form dikes to contain the spill. Use plastic sheeting and absorbent material as needed.
- Flag the spill area to indicate parameters.
- As soon as spill is contained, notify the Safety Officer who would determine whether the spill is minor (can be handled using readily available resources) or major (requiring the notification of appropriate authorities).

Methods for Collection of Spilled Pesticides and Material

- If not in contact with soil, collect spilled liquid with absorbent material and put into heavy plastic bags or containers. Label, store, and dispose of the contents in the appropriate manner.
- If in contact with soil, collect spilled liquid with absorbent material and contaminated soils, and place in heavy plastic bag or containers. Label, store, and dispose of the contents in the appropriate manner.

Worker Safety

- Only trained and certified employees would handle herbicides.
- Employees working with or near herbicides would wear OSHA-recommended PPE at all times, including, but not limited to, boots, long pants, long-sleeved shirts, eye protection, and chemical-resistant gloves.
- While wearing backpack sprayers, all employees would wear, at a minimum, label-required PPE, which includes long pants, long-sleeved shirts, and shoes and socks.
- The park would provide additional PPE to those employees who wish to use them.
- The park would provide employees with dedicated facilities to wash the clothing they wear while working with or near herbicides (to prevent the employees from taking contaminated clothing home and possibly contaminating their residences, families, roommates, pets, or shared laundry facilities).
- The park would provide employees with clean extra clothing to wear in the event their own clothing becomes contaminated.
- Access routes to, from, and around all application areas would be surveyed prior to entering the area with the sprayer. The scouting would focus on finding the safest routes to reduce the chance of falling or stumbling.
- Herbicides would never be transported inside the cab or passenger compartment of a vehicle.
- At every application site, the park would provide workers with contamination safety kits that include soap, clean water for washing, absorbent towels, spare clothing, and eyewash.

- At every application, storage, or handling site, workers would have access to MSDSs, product specimen labels, and information regarding emergency medical response, including directions to the nearest emergency care facility.
- The park would provide showering facilities in El Portal and Yosemite Valley for employees to use in the event of contamination.

Public Safety

- Areas in which pesticide application is taking place would be signed. Signage would include: the type of herbicide in use, target species, time of application, scope of treated area, re-entry time, and contact information.
- To prevent ingestion of contaminated fruit, mature fruit-bearing blackberry would not be sprayed. Plants would be first mowed, burned, or cut. Subsequent vegetative re-sprouts would then be treated with herbicide. (Re-sprouting vegetation does not produce berries; only stems that are at least two or more years old produce berries.)
- In the event of a spill near or into a body of water, that body of water would be closed to public swimming or boating for at least 24 hours, or until water quality tests determine that the water is safe.
- On Mariposa County and Mariposa Unified School District land assignments and leases, and other land assignments in Yosemite National Park, the National Park Service would work with agencies and partners to achieve integrated pest management goals. The National Park Service would work with residents, parents, and other interested parties to develop the most appropriate solutions for high-priority invasive plant control on playing fields or playgrounds on National Park Service lands and the El Portal Administrative Site. Invasive plant control efforts would not take place without prior notification of local residents.
- Herbicide would not be applied in the yards of residences or within 25 feet of residences without consultation and prior notification of occupants.

Labeling

- All pesticide containers and application equipment would be clearly labeled at all times.
- Labels would state the herbicide (by brand name and active ingredients) in the container, the adjuvants or dilutants added (and at what ratio), the manufacturer name and emergency number, the EPA Pesticide Registration number, and contact information for the National Park Service person in charge of the spray operation.

Reporting

- All herbicide use would be recorded and filed with the County Agricultural Commissioner and the National Park Service integrated pest management reporting system.
- Herbicide spills greater than 1 ounce undiluted aminopyralid or 1 gallon diluted aminopyralid, or 32 ounces undiluted aquatic glyphosate or 1 gallon diluted aquatic glyphosate, would immediately be reported to the park Safety Officer and the County Agricultural Commissioner.

Waste Disposal

- In accordance with the directions included on the EPA specimen labeling, empty pesticide containers would be triple rinsed, punctured (to prevent re-use), and disposed of with regular garbage.

- Wastewater from triple rinsing could be used to dilute herbicide, but only if the triple-rinsed container contained herbicide and adjuvants compatible with the herbicide being diluted and the desired application methods and sites.
- Liquid waste (including rinse water) that could not be used to dilute herbicide would be labeled and stored with the herbicide in clearly marked and locked locations.
- This waste would be disposed of during the twice annual parkwide toxic waste disposal (in compliance with all State, federal, and local regulations).

Labeling/MSDS and Right-to-Know Regulations

Yosemite National Park would not exceed any pesticide label restrictions. All other laws and regulations that apply to pesticide handling, including purchase, storage, transportation, application, and reporting, would also be followed.

OSHA Right-to-Know laws would also apply; all workers have the right to access MSDSs for any toxic chemicals found in the work place. Yosemite National Park would follow all Right-to-Know regulations at all times.

Pesticide labels are regulated by the EPA; each commercially sold pesticide formulation has a registered EPA number. These labels describe what can and cannot be done with a particular herbicide, including whether or not it can be used in aquatic situations, and restrictions on how much may be used per acre over a given period.

Pesticide labels also contain information regarding public and worker safety, first aid, physical and chemical hazards, and many other safety-related subjects, as well as environmental fate and other natural resource-related subjects.

The restrictions printed on pesticide labels are legally binding federal regulations.

The park would never conduct any activity specifically prohibited on the label of the pesticide in use at the time, such as exceeding maximum use rates or non-re-entry intervals.

The park would never deliberately apply terrestrial-use herbicides into aquatic systems.

Although the park is proposing to use aquatic formulations of glyphosate, the park would nonetheless never deliberately apply any herbicide into water, or to plants growing in standing water, despite that fact that the label for such formulations allows the product to be applied in such a manner.

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Appendix J: Wild and Scenic River Invasive Plant Control Questionnaire

This questionnaire assists the Planning and Compliance Office in determining whether invasive plant control projects are water resources projects that require review under Section 7 of the Wild and Scenic Rivers Act. In Wild and Scenic River corridors, actions must not intrude upon or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area on the date Congress designated the river as a component of the Wild and Scenic Rivers System. Project managers would fill out this form prior to initiation of an invasive plant control project and submit the form to the U.S. Environmental Protection Agency's Office of Environmental Compliance. The Office of Environmental Compliance would determine whether a Wild and Scenic Rivers Act Section 7 analysis and determination must take place before work commences.

Project Title: <Project Title>

Location: <Park Location>, <County>, California

Project Manager: <NPS Project Manager>, <Park Division>, Yosemite National Park

Project Description: <Enter Project Description>

Analysis of Potential Impacts

This section identifies potential impacts to water quality, outstandingly remarkable values, and the free-flow of Wild and Scenic Rivers. Provide appropriate notations about the extent (e.g., quantities of materials affected or released, number of individuals affected, square meters affected), duration (e.g., temporary—give length of time, or permanent), and intensity (none, negligible, minor, moderate, major) of the potential impact.

Potential Impacts on the River's Free Flow and Water Quality

Section 7 Considerations	Short-Term Impacts	Long-Term Impacts
Free Flow Characteristics • Channel width/depth • Vertical drop • Channel form		
Water Quality • Turbidity • Temperature • Nutrient availability		

Potential Impacts on the Outstandingly Remarkable Values for Which the River was Designated Wild and Scenic

River Outstandingly Remarkable Values	Project Impacts
Scenic	•
Geologic Processes/Conditions	•
Recreation	•
Biological	•
Cultural	•
Hydrologic Processes	•

Appendix K: Herbicides Considered for Use in Yosemite and Rejected

Managers considered six herbicides for use during the development of this Environmental Assessment. Two were accepted (and proposed for use under Alternatives 2 and 3). Program managers rejected four herbicides, primarily to decrease the risk of human health and safety and environmental impacts. Herbicides were also judged for their risk of off-target impacts, such as damage to native vegetation or animals.

Managers considered two herbicides (glyphosate and aminopyralid) to be safe and effective enough to be considered in the action alternatives. Managers rejected the following four herbicides under all alternatives, as listed below.

Triclopyr

Triclopyr is a selective herbicide manufactured by Dow AgroSciences. The chemical name is [(3, 5, 6-trichloro-2-pyridinyl) oxy]acetic acid. Triclopyr is sold in two common formulations: triethylamine salt (triclopyr amine or salt), and a butoxyethyl ester (triclopyr ester) (Tu et. al 2001). The two formulations are marketed as Garlon 3A and Garlon 4, respectively (Dow 2006; Dow 2007).

Garlon 4 is the ester formulation of triclopyr, usually applied as an oil-based mixture diluted with specialty vegetable or mineral oils. The mixture includes kerosene, causing a strong odor; some dilutants contain limonene, which adds additional odor. Garlon 4 has been in use since the late 1980s. Triclopyr ester is also sold under the brand names Access, Turflon Ester, Crossbow, ET, Pathfinder II, Redeem, and Remedy. Triclopyr ester is heavily used for wildland weed control in the United States; it is very effective for treating woody dicots, and is the most common herbicide used to treat salt cedar (Tu et. al 2001).

Garlon 4 is sold as a clear liquid with a brownish tint to it. Garlon 4 should never be applied in any situation where the herbicide can contact water or in areas where amphibians are present (Dow 2007; SERA 2003). Garlon 4 and Remedy are manufactured by Dow AgroSciences.

Garlon 3A is the salt formulation of triclopyr. It is applied as a water-based mixture, usually with added adjuvants. Garlon 3A is used on the same species as Garlon 4, but is approved for use in wetlands, or in situations where accidental overspray may result in the herbicide coming into contact with water. Garlon 3A is marketed in retail stores as Turflon amine or Brush-B-gone. Garlon 3A can cause severe eye damage due to its high pH (Tu et. al 2001).

Pro: Very effective at treating woody shrubs, trees, and vines. It is harmless to monocots (grasses, sedge, and similar species). Triclopyr is more effective than glyphosate for blackberry, locust, tree-of-heaven, and others.

Con: Garlon 4 very toxic to aquatic organisms and cannot be used in or near water; it also has a strong smell (aesthetically unpleasant, which can be an issue in visitor use areas). Garlon 3A less toxic to aquatics and has no smell, but can cause immediate eye damage, and has a California Department of Pesticide

Regulation rating of category 2, with a mandatory label of "DANGER." This requires additional training of staff prior to use.

Basis for Rejection: The species targeted for treatment with triclopyr can also be treated with glyphosate. Depending on application method, glyphosate is generally less effective on woody species than triclopyr, but with proper follow through, glyphosate can still achieve control.

Imazapyr

Imazapyr is manufactured by American Cyanimid/BASF. The most common commercial formulation is called Stalker**,** but imazapyr is also sold under the brand names Arsenal, Chopper, Habitat, and others. Its primary advantage is its ability to translocate throughout the entire plant before killing the plant, which increases its effectiveness, especially with turf grasses, vines, and other plants that cover large areas (Tu et. al 2001,).

Stalker is sold as a clear liquid with a slight brownish tint. It is diluted with water, and adjuvants may be added. Imazapyr is effective on a wide range of plants, although some are more affected than others. Legumes and some vines in the Rose family (including Himalayan blackberry) are not strongly affected by it (BASF 2004).

Imazapyr is classified by the EPA as Category 4, nearly non-toxic. It is considered to be very safe to use around humans and animals. Plants treated with imazapyr die slowly, sometimes taking a year or more to die (as in the case of woody species such as tree-of-heaven). When plants are treated with sub-lethal doses, the bud tips grow out gnarled and deformed for a season or two before resuming normal growth (SERA 2004b).

In Yosemite, imazapyr would have been most useful for treating giant reed (*Arundo donax*), and tree-of-heaven (*Ailanthus altissima*), both of which are limited almost exclusively to El Portal.

Pro: Very effective against tree-of-heaven and giant reed.

Con: Species for which it is effective have very limited distribution in Yosemite, and control is possible with glyphosate (but will take more and longer treatments). At sub-lethal doses, plants produce deformed, gnarled leaves and buds at branch tips, which can impact scenic resources.

Basis for Rejection: The species in Yosemite targeted for treatment with imazapyr can also be treated with glyphosate. The use of an additional herbicide would have complicated permit, storage, and labeling requirements. This herbicide would be of limited benefit in Yosemite.

Clopyralid

Manufactured by Dow Agrosciences, the chemical formula is 3,6-dichloro-pyridinecarboxylic acid. It is sold under the brand name Transline (Tu et. al 2001). Clopyralid is selective, more effective on plants in the *Asteraceae* family than other families, and it is virtually harmless to most species of grass. Clopyralid is diluted with water, usually with additional adjuvants added; it is typically applied at a rate of 10 ounces per acre or less (Dow 1999).

Clopyralid contains trace amounts of pentachlorobenzene and hexachlorobenzene as impurities; however, the concentrations of these substances are too low to pose a measurable human health risk. U.S. Forest Service worst case scenarios result in a potential maximum human exposure 33 times lower than the lowest level of concern (SERA 2004a).

Clopyralid does, however, have a potential to cause substantial harm to non-target vegetation in ways that cannot always be controlled by land managers. Clopyralid can be mobile in the environment, and leach into groundwater or surface water. Additionally, it remains bio-active for a relatively long time, which, coupled with its mobility, results in off-target impacts. For instance, there have been many examples of vegetation being treated with clopyralid, and later cut or mowed and added to compost piles. When the compost is later used in gardens or landscaping, the clopyralid is still potent enough to kill the vegetation on which the compost has been applied (SERA 2004a).

Pro: Selective for *Asteraceae*, proven effectiveness on star thistle.

Con: Produces dioxin when burned, and is highly mobile in the environment; can leach into water supplies if applied above label rate over porous soils (Cox 1998)

Basis for Rejection: Aminopyralid is selective in the same ways, with fewer negative risks.

2,4-D

2,4-D [(2,4-dichlorophenoxy) acetic acid] herbicide selectively controls broad-leaved vegetation without harming grasses, reeds, sedges, and other "monocot" plants. 2,4-D was originally developed during the 1940s, and was used widely as an ingredient of Agent Orange during the Vietnam war. Until the 1970s, 2,4-D was manufactured through a process that produced dioxin as an impurity in the mix. More recently, manufacturing processes have completely eliminated contamination of 2,4-D with dioxin (Tu et. al 2001).

Agent Orange itself was a mix of 2,4-D and another herbicide called 2,4,5-T, both of which contained dioxin as impurities. 2,4,5-T was banned from use in the United States in 1983, after it became clear that it could not be manufactured without dioxin impurities (Tu et. al 2001).

The U.S. Forest Service conducted a risk assessment of 2,4-D, and concluded that it is toxic to the immune system and developing immune system, and has potential to cause harm to the reproductive system. In most cases, careful planning and strict guidelines for application can prevent these problems from occurring. However, the fact remains that 2,4-D does have a potential to cause greater harm to human health than many of the newer herbicides, many of which offer vegetation control similar to that offered by 2,4-D (USFS 2006). Despite this, 2,4-D is still widely used, frequently in combination with other selective herbicides and/or fertilizers for use in controlling weeds in lawns and gardens (Tu et. al 2001).

Pro: Effective and selective for broad-leaf herbaceous plants; harmless to grass and woody plants.

Con: Category 2, requires additional permit levels. Strong potential for human health issues.

Basis for Rejection: Aminopyralid will fill the same need, but is more selective; causes fewer off-target impacts, and has vastly reduced potential for health impacts.

Summary

Triclopyr is effective on Himalayan blackberry, which is the most invasive non-native plant in Yosemite Valley. It would also have been effective on tree-of-heaven, black locust, and many other woody species. However, one formulation posed significant risks to Yosemite's wetlands, and the other posed risks to the workers applying it.

Imazapyr is more effective than glyphosate for low volume treatments of arundo and tree-of-heaven. However, both of those species can still be controlled with glyphosate, provided that workers are careful and tenacious. Imazapyr is virtually non-toxic to animals and has few off-target impacts if used correctly. Ultimately, it was rejected for use because it would have introduced additional tracking and storage issues, for only two invasive plant species.

Clopyralid was considered early in the planning process for control of star thistle. However, the herbicide land managers were uncomfortable with the off-target plant and human health impacts. Aminopyralid was developed specifically as a safer alternative to clopyralid.

2,4-D was rejected due to potential human health impacts.

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Appendix L: Mitigation Measures Common to All Alternatives

The National Park Service would apply the following mitigation measures to actions proposed in the Invasive Plant Management Plan to protect valued resources and the quality of the visitor experience. In addition, the National Park Service would complete appropriate environmental review for any future actions not addressed in this Environmental Assessment.

Natural Resources

- During the planning phase of invasive plant control activities, the National Park Service shall determine whether special-status plant species are present in the area. If special-status species occur in the proximity of invasive plant control activities, the park shall develop site-specific mitigations to ensure no adverse effects to special-status plant species. If federally protected plant species are discovered in proposed work areas, the U.S. Fish and Wildlife Service would be consulted, and no control activities would take place until that consultation is complete. Currently, no federally listed plants are documented in the park.
- During the planning phase of invasive plant control activities, biologists shall determine whether invasive plant control measures would take place in likely habitat for special-status wildlife. If invasive plant control work would take place in likely special-status wildlife habitat, surveys would be conducted before any type of invasive plant control measures were performed. In the event that special-status wildlife occupy areas planned for treatment with herbicides, chemical treatments would not be conducted, and managers would develop site-specific mitigations to ensure no adverse effects to special-status wildlife.
- Work crews would not apply herbicides in standing water, or within six feet of standing water.
- Work crews would utilize only aquatic-approved formulations of glyphosate, even in upland areas.
- In the case of non-native blackberry, work crews would cut down and remove plant foliage prior to herbicide treatments. Later in the year, or the following year, work crew would follow up with foliar spray herbicide treatments on re-sprouts, which would not have developed berries. This would reduce the risk of wildlife or humans ingesting sprayed berries.
- Program managers shall schedule invasive plant activities when such activities are least likely to disturb great gray owls and other special-status birds.
- The park shall revegetate or reseed treatment areas with native species if areas require revegetation after invasive plant control activities. Revegetation may be needed in areas where non-native vegetation formed monocultures, which, once removed, would leave the area without native plants.
- If weed control efforts leave areas devoid of vegetation, the park shall implement erosion control methods as needed.
- Prior to leaving weed control areas, all crews shall inspect boots, clothing, and equipment, and shall remove any seeds, dirt, mud, or other debris that might contain invasive plant seeds or propagules.
- All equipment shall be kept clean and free of mud, dirt, vegetative debris, or other materials that could contribute to the spread of weeds in the park.
- Vehicles used in invasive plant control projects shall be kept clean, and shall be staged where weed populations do not exist.
- The park shall properly dispose of viable seeds and plant materials to prevent the spread of noxious weeds.

- All vegetation crews shall be "Bear Aware" by using appropriate food handling and storage techniques.

Cultural Resources

- Prior to any ground-disturbing activity, the park shall consult with National park Service archeologists. Archeologists shall review proposed treatments for the development of mitigation strategies to ensure no adverse impacts to cultural resources.
- During the planning phase of invasive plant control activities, managers would coordinate with locally affiliated tribes (through the National Park Service Historic Protection Officer) to ensure no adverse impacts to traditional cultural properties.
- The park shall not conduct ground-disturbing activities on identified archeological sites without a cultural resource monitor present or without prior approval from cultural resource specialists.
- During the planning phase of invasive plant control activities, project managers shall consult with National Park Service cultural resource specialists, including a landscape architect and an archeologist, to ensure no adverse impacts to historic cultural landscapes.
- The park shall incorporate the protection of cultural resources in annual training programs for invasive plant work crews.
- The park shall not remove non-native vegetation that is a critical component of American Indian cultural properties.

Air Quality

- The park shall use low-smoke two-cycle oil in all two-cycle equipment employed to control non-native plants.
- As equipment powered by two-cycle engines wears out and becomes irreparable, it shall be replaced with equivalent four-stroke equipment, if such equipment exists and has sufficient power-to-weight ratios to be practical in the field.

Noise and Visitor Experience

- Plant management crews shall not leave motorized equipment running when it is not in use.
- All work that generates noise levels above 76 decibels near residential or visitor use areas shall be performed between 8:00 a.m. and 5:00 p.m.

Wild and Scenic River Corridors

- During the planning phase of invasive plant control activities, managers shall fill out and submit the Wild and Scenic River Invasive Plant Control Questionnaire (Invasive Plant Management Plan for Yosemite National Park - Appendix J) to determine if Section 7 Determinations are necessary for the project.
- Work crews shall not apply herbicides below the ordinary high water mark of Wild and Scenic Rivers or their tributaries.

Wilderness

- Before program managers consider herbicide use, invasive plant populations shall be at an ecosystem-level threat to Wilderness character and resources, determined to be the minimum tool for control, and meet the location and size thresholds.

- Herbicide use shall meet the conditions of the Wilderness Minimum Tool Requirements Analysis for the Invasive Plant Management Plan.
- Crews shall follow "Leave No Trace" camping and work protocols.
- Crews shall be limited to legal group size limits (15 in trailed areas, 8 in off-trail areas).
- Crews shall minimize the need for pack-stock support.
- Work crews shall follow the Herbicide Use Protocol in the Invasive Plant Management Plan.

Employee and Public Safety

- The National Park Service shall work with residents, parents, and other interested parties to develop the most appropriate solutions for high-priority invasive plant control on playing fields or playgrounds on National Park Service lands and the El Portal Administrative Site. Invasive plant control efforts shall not take place without prior notification of local residents.
- On Mariposa County and Mariposa Unified School District land assignments and leases, and other land assignments in Yosemite National Park, the National Park Service shall work with agencies and partners to achieve integrated pest management goals.
- The National Park Service shall provide all necessary personal protective equipment (PPE), except footwear, to park employees, interns, and volunteers. Depending on the task, this equipment includes (but is not limited to) hard hats, gloves, eye protection, snake gaiters, Kevlar chaps, hearing protection, mesh face shields, and reflective vests.
- Prior to project implementation and continuing throughout, all employees shall receive safety training, including (but not limited to) dangerous plants and animals, heat-related health issues, fall protection, hazmat protection (for gas and oil associated with power tools), working around heavy equipment, traffic safety, defensive driving, and first-aid/CPR.
- Prior to project implementation, the park shall develop an Oil and Hazardous Materials Spill Prevention, Control, and Countermeasure Plan to address hazardous materials storage, spill prevention, and response. During project implementation, the park shall comply with all requirements of the Oil and Hazardous Materials Spill Prevention, Control, and Countermeasure Plan.
- Crews shall be familiar with, maintain, and carry spill response kits.
- Crews shall maintain and carry first-aid supplies for hazmat exposure accidents.
- With the exception of fuel used for cooking or lighting fires while camping, crews shall not store hazardous or flammable chemicals in the field overnight. All overnight storage shall occur in appropriate locked facilities.
- Crews shall carry spill response materials, including absorbent pads and other materials to contain hazardous material spills, into the field.
- Crews shall inspect all equipment for leaks on a daily basis.
- Crews shall use absorbent pads when refueling equipment (including hand-held equipment), and shall not refuel equipment in wetland areas or in the River Protection Overlay. Fuel containers brought into the field shall be stored on absorbent pads, on level ground, and away from working power equipment.
- The park Safety Office shall be notified in the event of a hazardous materials spill. All spills shall be documented.

- When working on road shoulders, workers shall wear appropriate PPE (e.g., reflective vests or jackets), and shall use appropriate signage or traffic control to ensure the safety of workers and visitors.
- When working in construction areas, workers shall wear appropriate PPE (e.g., hard hats, eye and hearing protection) and shall obey site control rules (sign in and out, etc…) as defined by the entity (National Park Service or contractor) that controls the construction site.
- Weed control workers (including park workers, as well as interns, volunteers, and contract labor) shall correctly wear all PPE that is appropriate to the job.
- Volunteers shall not operate power tools or motorized equipment.

Mitigations Measures Relating to Herbicide Use (Alternatives 2 and 3)

- The Herbicide Use and Storage Protocol for the Invasive Plant Management Plan (see Appendix I) shall be followed.
- The park shall develop an herbicide use, storage, and safety plan for each treatment area to ensure the safety of workers and visitors, as well as to prevent soil and/or water contamination. The plan shall include sequence of treatment, dates, times, locations, herbicide trade name, U.S. Environmental Protection Agency (EPA) registration numbers, authorized uses, chemical composition, formulation, original and applied concentration, application rates of active ingredient, and equipment used for application. The plan shall also include information on herbicide transportation and storage, as well as herbicide safety.
- Invasive plant program managers shall develop annual work plans that identify timing and locations of planned herbicide use. Herbicide treatment shall not take place outside of identified locations. Information shall be made available to the public via the Yosemite National park website and other print media, prior to herbicide application.
- Herbicide application methods, equipment, and rates shall be selected to minimize the potential for drift and off-target impacts while meeting invasive species objectives.
- All use of herbicides with an EPA registration number must be approved by the National Park Service Pesticide Approval System and designated integrated pest management coordinator. Annual pesticide use logs shall be filled out in the National Park Service approval system.

Appendix M - Cumulative Projects List

This appendix presents the past, present, and reasonably foreseeable projects in Yosemite that have been evaluated in conjunction with the impacts of alternatives to determine cumulative impacts. These projects were included in the cumulative effects analysis presented in Chapter III of this Invasive Plant Management Plan.

Project List

Reasonably Foreseeable Actions

- Comprehensive Transportation Plan
- El Portal Concept Plan
- El Portal Road Improvements Project (Narrows to Pohono Bridge)
- Yosemite Valley Loop Trail to West Yosemite Valley
- Visitor Use and Floodplain Restoration in East Yosemite Valley Project
- Yosemite Motels Expansion
- Yosemite Village Interim Parking Improvements
- Wilderness Management Plan

Present Actions

Local

- Curry Village and East Yosemite Valley Campgrounds Improvements
- El Capitan Meadow Restoration Project
- Environmental Education Campus Project
- Glacier Point Road Rehabilitation
- Hetch Hetchy Communication System Upgrade Project
- Hodgdon Meadow Housing Area Trailer Replacement Project
- Indian Cultural Center
- New Merced Wild and Scenic River Comprehensive Management Plan
- Rehabilitation of the Yosemite Valley Loop Road
- The Tunnel View Overlook Rehabilitation
- Tuolumne Meadows Concept Plan
- Tuolumne Wild and Scenic River Comprehensive Management Plan
- Utilities Master Plan/East Yosemite Valley Utilities Improvement Plan
- Yosemite Lodge Area Redevelopment
- Yosemite Museum Master Plan
- Yosemite Valley Shuttle Bus Stop Improvements

Regional

- Mariposa, Madera, & Fresno Counties Sierra-San Joaquin Noxious Weed Alliance (Weed Management Area)
- California Department of Transportation (Caltrans)
- Mariposa County
- U.S. Forest Service, Inyo National Forest
- Tuolumne County
- Bureau of Land Management, Merced Canyon

Past Actions

- Cascades Diversion Dam Removal
- Cook's Meadow Ecological Restoration
- Curry Village Employee Housing
- El Portal Road Improvement Project–Park Boundary to Cascades Diversion Dam
- Happy Isles Fen Habitat Restoration Project
- Lower Yosemite Fall Project
- Merced River Ecological Restoration at Eagle Creek
- Yosemite Valley Plan
- Fire Management Plan
- Wilderness Management Plan

Project Descriptions

Reasonably Foreseeable Actions

Agency Name: National Park Service
Project Name: Comprehensive Transportation Plan
Description: This plan will study modern transportation solutions for the park. Many past plans have studied transportation, both parkwide and in specific areas such as Yosemite Valley. However, many areas such as the Wawona and Tioga Road corridors have not been reexamined since the 1980 General Management Plan. Previous plans defined problems and solutions to deal with visitation and demographic projections that reflected trends characteristic of that time period. Since then, the park has continued to update transportation and visitor information through a grant from the Federal Transit Administration. These new data indicate that many previous predictions and assumptions are not consistent with current conditions; thus, a fresh examination of transportation systems and solutions is warranted. Park planners, social and natural scientists, and transportation managers will work together to prepare a new plan. They will compile past plans and decisions regarding visitor experience, access, and resource conditions relative to our transportation system, examine how the system is currently functioning. In addition, with public input, they will identify issues, develop alternatives, and present solutions in a comprehensive transportation management plan.

Agency Name: National Park Service
Project Name: El Portal Concept Plan
Description: The Yosemite Valley Plan calls for relocating employee housing, administrative offices, and parking from Yosemite Valley to El Portal. The Concept Plan will provide a comprehensive site plan for the specific layout and design of administrative facilities, including employee housing, offices, and parking areas in the El Portal area. This plan will address the specific functions and spatial requirements of the facilities that the Yosemite Valley Plan recommends to be located in El Portal. Although the Yosemite Valley Plan generally outlined the facilities that would be relocated to El Portal, it did not provide specific details for each facility or for the interrelationships between existing, redeveloped, and new facilities. The Concept Plan would evaluate these interrelationships and determine the most efficient use of the limited developable areas in El Portal.

Agency Name: National Park Service
Project Name: **El Portal Road Improvements Project** (Narrows to Pohono Bridge)
Description: Original designs for El Portal Road improvements called for the entire one-mile segment from just east of the Big Oak Flat Road intersection to Pohono Bridge to be completed as one project, referred to as "Segment D". Due to litigation, that project has been scaled back; at this time, the project will only address an unstable portion of road beginning at the Big Oak Flat Road intersection and extending east approximately 1,350 feet (the subject of this Environmental Assessment). Road improvements will eventually be necessary throughout the remainder of El Portal Road. This segment of road has two narrow travel lanes, each 9.5-feet wide. Road improvements would be designed to improve safety and minimize the chance of roadway failures in the future.

Agency Name: National Park Service
Project Name: Yosemite Valley Loop Trail to West Yosemite Valley
Description: Approximately 80 percent of Yosemite's 4 million visitors per year stop at Yosemite Valley destinations. Bicyclists, hikers, visitors using wheelchairs, and those with strollers find that the multi-use paved trail in the east Valley ends abruptly near Swinging Bridge. To continue the trail to west Valley destinations (such as El Capitan or Bridalveil Fall), users must either confront automobile traffic by traveling along the edge of a busy roadway (a potentially life-threatening safety hazard) or return to private vehicles, ending an important aspect of their recreational experience and adding to traffic noise, emissions, and congestion. This project would provide an accessible trail, separate from automobile traffic, to allow convenient, safe, accessible, and enjoyable access to destinations in the west Valley. The project would be funded by a shared-cost partnership of the National Park Service and the nonprofit Yosemite Fund cooperating association.

Agency Name: National Park Service
Project Name: Visitor Use and Floodplain Restoration in East Yosemite Valley Project
Description: The ecological restoration program seeks to restore natural processes to ecosystems so that portions of Yosemite Valley can recover from past human development and activities. A plan is being developed for the ecological restoration of the Upper River, Lower River, North Pines, and the northwest end of Lower Pines campgrounds; Group Camp, Backpackers Camp; Housekeeping Camp within the River Protection Overlay of the Merced River; and The Ahwahnee tennis court in Yosemite Valley. Ecological restoration may include:

- Removal of imported fill material
- Removal of abandoned roads and infrastructure
- Reestablishment of natural contours on the land
- Restoration of natural surface and groundwater movement
- Replanting of native vegetation
- Removal of non-native plant and animal species
- Restoration of carbon and nitrogen cycles in degraded soils

Agency Name: Mariposa County
Project Name: Yosemite Motels Expansion
Description: This project site is located along the north and south sides of Highway 140 at the existing Yosemite View Lodge development, within the El Portal Town Planning Area. Permitting has been requested to construct a 78-unit motel and a multi-purpose chapel/recreation building. Proposed access to the 78-unit motel and multi-purpose chapel/recreation building would be from the north side of Highway 140.

Agency Name: National Park Service
Project Name: Yosemite Village Interim Parking Improvements
Description: In keeping with the actions outlined in the Yosemite Valley Plan, an interim project is needed to improve the visitor experience and park operations at the Yosemite Village main day visitor parking area. The parking area is located south of Yosemite Village and east of Sentinel Bridge, between the Merced River and Northside Drive. This area has hosted a variety of uses over the past 100 years, and has historically been referred to as Camp 6. The project may include some or all of the following components:

- Parking for day visitors, including recreational vehicles and disabled persons
- The relocation of tour bus loading and unloading facilities
- Roadway realignments to improve vehicular and pedestrian traffic circulation and safety
- Pedestrian/bicycle paths to improve pedestrian/bicycle traffic circulation and safety
- Valley shuttle bus service operations and facilities
- Interpretation facilities, including wayfinding signs
- Other visitor facilities, such as restrooms

Agency Name: National Park Service
Project Name: Wilderness Management Plan
Description: More than 94 percent of Yosemite is Congressionally designated Wilderness. As such, management of this land is guided by the Wilderness Act of 1964, which mandates the preservation of Wilderness character. Yosemite Wilderness is part of one of the largest unbroken expanses of Wilderness in the lower 48 states, and is also one of the most popular. This plan, an update of the 1989 Wilderness Management Plan, would guide management for all administrative activities and visitor use in Wilderness and potential Wilderness additions.

Present Actions

Local

Agency Name: National Park Service
Project Name: Curry Village and East Yosemite Valley Campgrounds Improvements
Description: A site plan is being developed for east Yosemite Valley to implement actions called for in the Yosemite Valley Plan. The project area generally extends south of the Merced River from the eastern boundary of Housekeeping Camp to Happy Isles, and encompasses the area along Tenaya Creek for proposed campsites. The site plan will ensure that all related actions proposed for the east Valley are implemented in a logical, feasible, and cost-effective manner. Most of the improvement actions will not begin for several years; however, at this time, the site plan will detail how, and in what order, the projects in the east Valley should be implemented. Following are examples of the many actions identified in the Yosemite Valley Plan for east Yosemite Valley:

- Reconfiguring campgrounds at Upper and Lower Pines
- Adding campsites at the new South Camp and Tenaya Creek Campgrounds
- Removing Curry Orchard and restoring the area to natural conditions
- Constructing new visitor cabins-with-bath in Curry Village
- Relocating the Curry Village ice rink
- Providing new and reconfigured food service and concession facilities at Curry Village
- Relocating the concessioner stable
- Converting Southside Drive to two-way traffic
- Constructing a fire station in the Curry Village area

A Finding of No Significant Impact for this project was issued in February 2004. Construction activity will commence following resolution of the Merced River Comprehensive Management Plan planning process.

Agency Name: National Park Service
Project Name: El Capitan Meadow Restoration Project
Description: The 60-acre El Capitan Meadow is located in west Yosemite Valley between El Capitan, and the Merced Wild and Scenic River. A popular destination for many park visitors, El Capitan Meadow affords people an opportunity to enjoy magnificent views of Cathedral Spires and El Capitan, as well as take part in other recreational activities. El Capitan is also a world renowned “big wall” that attracts rock climbers from all over with hopes of completing one of its many routes to the top. This often attracts visitors to the meadow to view the massive rockface for climbers making the 3,589-foot ascent.

Vegetation and soils in the meadow are becoming increasingly degraded due to trampling from visitor foot-traffic and inappropriate vehicle parking. A significant impact to the meadow was the removal of a portion of the El Capitan Moraine in 1879, which lowered the water level four to six feet in the area. While this was beneficial to early settlers because it allowed for more useable dry land, it greatly reduced the amount of water available to the meadow. Other historic actions such as tilling, ditching, culverts, and

road building have also contributed to meadow deterioration. The major goals of the proposed project are to:

- Restore meadow vegetation and natural processes
- Minimize social trails
- Develop ecologically appropriate visitor access
- Improve visitor experience
- Protect sensitive meadow areas

Agency Name: National Park Service
Project Name: Environmental Education Campus Project
Description: Since 1972, Yosemite Institute has partnered with the National Park Service to fulfill a shared mission of providing environmental educational opportunities in Yosemite for youth from diverse backgrounds. Yosemite Institute's immersive environmental educational programs cover field science, arts, backpacking, and leadership, and are designed to complement California State Educational Content Standards. Yosemite Institute programs inspire a personal connection to the natural world and foster future generations of environmental stewards. Each year, Yosemite Institute's non-profit programs serve over 13,000 students, and generate over 480,000 hours of visitor activities.

Yosemite Institute is a non-profit organization, and currently operates its environmental education campus at Crane Flat under a cooperative agreement with the park. The campus facilities are composed of older buildings and structures that have been assembled over time and were not originally designed for educational purposes. These old buildings are deteriorating, in need of extensive repairs, and barely adequate in terms of modern design standards for teaching, residential accommodations, and accessibility. The National Park Service and the Yosemite Institute are planning to create a new campus with upgraded/improved sustainable facilities that will provide a more optimal learning environment and serve a greater number and diversity of students. The campus will be designed as an example of environmental sustainability, according to Leadership in Energy and Environmental Design Green Building standards.

The goals of this project are to:

- Provide an environmental education campus location and program that serves the combined missions of Yosemite National Park and the Yosemite Institute
- Facilitate multi-day educational programs that complement California State Standards and offer opportunities for research and study of the natural world
- Provide a campus facility that is sustainable in design and enables high quality, immersive, and safe educational experiences for students
- Promote development of future stewards of the environment and the National Park system

An Environmental Impact Statement is currently being prepared.

Agency Name: National Park Service
Project Name: Glacier Point Road Rehabilitation
Description: Rehabilitation of the Glacier Point roadway is proposed to repair and resurface existing roadway pavement and drainage facilities. Pavement rehabilitation likely will involve some sort of in-place recycling of the existing deteriorated pavement, followed by the placement of new asphalt paving. All drainage culverts will be examined for condition, capacity, and proper location. Culverts found to be in poor condition, undersized, and/or poorly located will be replaced in improved locations with properly sized pipes. As necessary, the drainage channels to and downstream of existing culverts will be examined for potential improvements. Existing stone masonry at culvert headwalls and outlets may be salvaged and reused. The proposed pavement rehabilitation work likely can be accomplished within the existing disturbed road corridor. However, culvert relocation or rehabilitation and the improvement of drainage channels to existing culverts may require disturbance of some new areas. An Environmental Assessment is currently being prepared.

Agency Name: National Park Service, U.S. Forest Service, City and County of San Francisco, San Francisco Public Utilities Commission, and Hetch Hetchy Water and Power
Project Name: Hetch Hetchy Communication System Upgrade Project
Description: This project will update the communications infrastructure by replacing or updating components of the Hetch Hetchy communications system from the Bay Area to Tuolumne County, including adding one new communications site within Yosemite National Park, near Poopenaut Pass. The current equipment utilizes existing phone lines to transmit voice and data communications essential to the operation and security of Hetch Hetchy Water and Power's electric and water supply utilities and Hetch Hetchy dam. It is also used by Yosemite personnel for park communications in that area. The existing radio and fiber optic equipment are obsolete and no longer supported by their manufacturers. The system upgrade will provide the framework necessary to support improved radio communications that are vital to park operational activities, such as law enforcement, search and rescue, and fire management, and improve the capability to ensure dam security, visitor and staff safety, and protection of park resources. The project spans multiple jurisdictions; therefore, the National Park Service is currently working collaboratively with Hetch Hetchy Water and Power, the City and County of San Francisco, and the U.S. Forest Service to prepare an Environmental Assessment/Initial Study. The Finding of No Significant Impact for this project was signed April 2008.Agency Name: National Park Service

Project Name: Hodgdon Meadow Housing Area Trailer Replacement Project
Description: This project will construct a duplex in the Hodgdon Meadow Housing Area and replace two obsolete trailers that were previously removed from the housing area. The new duplex, which will house up to eight park employees or two park employees and their families, will be located on a previously impacted site formerly occupied by one of the two trailers. This project is part of an agencywide effort to replace trailers and other substandard housing with new cost-effective, energy-efficient structures. Upgrades to the well water disinfection system will accompany the duplex construction. The Finding of No Significant Impact for this project was signed September 2007.

Agency Name: American Indian Council of Mariposa County, Inc. (Southern Sierra Miwuk Nation)
Project Name: Indian Cultural Center
Description: An Indian Cultural Center would be established by the American Indian Council of Mariposa County, Inc. (Southern Sierra Miwuk Nation) at the site of the last-occupied Indian village in Yosemite Valley (west of Camp 4). This center would provide a location for culturally associated Indian people to conduct traditional ceremonies, and to practice and teach techniques of traditional ways of life. While the center would be open to the public, access might be limited during special ceremonies. Some public interpretation would occur, but this cultural center would not replace the primary educational function of the current Indian Village of Ahwahnee at Yosemite Village.

Facilities at the Indian Cultural Center would consist of structures and landscape features typical of an Indian village from the mid- to late-19th century. One large partly subterranean ceremonial roundhouse and a smaller sweat lodge would be constructed. Approximately 15 cedar bark umachas (conical houses) would be built in the vicinity of the roundhouse and sweat lodge. Plants important for food, basketry, and medicinal uses may be grown. Existing archeological features, such as mortar rocks, would remain in place and be incorporated into the village design. The last extant structure from the original village, a small cabin (the former Westley and Alice Wilson home) currently being used as a National Park Service office, would be moved back to the village and adaptively reused as the cultural center office. A new kitchen and restroom facility would be constructed. Utilities (water, sewer, propane, unimproved road access, and electrical service) would be provided. Screening would be established where necessary to visually separate the cultural center and Northside Drive, Yosemite Lodge, Camp 4, and Valley Loop Trail. The Valley Loop Trail could be relocated to a route south of the cultural center to minimize intrusions. Overnight parking for scheduled activities would be provided at the Indian Cultural Center or other administrative areas.

The environmental compliance for this project was completed in September 2003. The American Indian Council of Mariposa County, Inc. is presently preparing fundraising plans and activities to support this project.

Agency Name: National Park Service
Project Name: New Merced Wild and Scenic River Comprehensive Management Plan
Description: The National Park Service manages 81 miles of the Merced River, which includes the Main Stem and the South Fork that travels through Yosemite National Park and the El Portal Administrative Site. The Merced is a federally designated Wild and Scenic River protected by the provisions of the 1968 Wild and Scenic Rivers Act. Seventy-five percent of the Merced River in National Park Service jurisdiction is located in designated Wilderness; however, most visitors experience the Merced in Yosemite Valley. As a World Heritage Site, the Merced River in Yosemite Valley attracts millions of people each year from around the globe to gaze at the striking granite walls and thundering waterfalls. The focus of the agency's planning effort for the Merced River is striking a balance between access and use of the river and protection and enhancement of the "values" that made the river worthy of protection. These are known as Outstandingly Remarkable Values (ORVs) according to the Wild and Scenic Rivers Act. To protect the ORVs, a plan for the Merced River will be created to help guide future land managers in determining appropriate actions and uses along the river. Previous plans were developed for the

Merced River in 2000 and again in 2005. However, the park was mandated by the U.S. District Court to complete a new plan and a final Record of Decision anticipated in September 2009.

Agency Name: National Park Service
Project Name: Rehabilitation of the Yosemite Valley Loop Road
Description: The Yosemite Valley Loop Road is a historic feature in Yosemite National Park, first built as a stage coach road in 1872. The initial pavement was laid in 1909, and culverts were first installed a year later beneath stretches of Southside Drive. Spot repairs have been made along the roadway as required over time. However, much-needed comprehensive maintenance/repair of the roadway and associated drainage structures has not been performed for many decades. Since 1980, annual visitation to Yosemite National Park has averaged 3.4 million people, 95 percent of which is focused in Yosemite Valley. Dramatic scenery, the Merced Wild and Scenic River, and diverse recreational opportunities draw visitors to the Valley year round, making it one of the most heavily developed areas of the park. As a result, the Yosemite Valley Loop Road experiences the heaviest traffic volumes of any area in Yosemite National Park. Automobiles make up the majority of the volume, but tour buses and public transportation vehicles also contribute to Yosemite Valley traffic. Bus transportation in Yosemite National Park includes regional public transportation, charter and tour bus operators, concessioner-operated tours, and shuttle bus services provided by the park concessioner. With the exception of shuttle bus services in Tuolumne Meadows and between the Mariposa Grove and Wawona, nearly all park buses travel to, from, and within Yosemite Valley.

The purpose of this project is to repair and resurface existing roadway pavement, rehabilitate or replace adjacent drainage features (e.g., culverts, diversion ditches, and headwalls), and improve the condition of adjacent roadside parking along approximately 12.5 miles of the Yosemite Valley Loop Road in Yosemite Valley. No roadway widening (outside of the original road prism width of 22 feet), realignment, or changes to vehicular or pedestrian circulation patterns, as called for in the Final Yosemite Valley Plan Supplemental Environmental Impact Statement, will be undertaken.

The need for this project is evidenced by the poor condition of the existing road surface and associated drainage features; major maintenance repairs have not been undertaken for many years. Numerous existing culverts are undersized, in disrepair, and/or ineffectively located to capture peak seasonal run-off. In addition, informal roadside parking along stretches of the Yosemite Valley Loop Road presents visitor safety and resource impact concerns.

Agency Name: National Park Service
Project Name: Tunnel View Overlook Rehabilitation
Description: The Tunnel View scenic overlook is a historic site located adjacent to Wawona Road. This overlook affords expansive views of Yosemite Valley, El Capitan, Bridalveil Falls, and Half Dome that have captured the awe of visitors for nearly 75 years. Tour buses, tram tours, and single-family vehicles bring an estimated 5,000 to 7,000 people to the site per day during the height of the tourist season. The Tunnel View Overlook Rehabilitation project will remedy long-standing vehicle-to-vehicle and vehicle-to-pedestrian safety issues, correct drainage deficiencies, provide clear circulation patterns for pedestrians and vehicles, enhance and maintain viewing opportunities for visitors, provide accessibility to viewing areas for visitors with disabilities, correct safety problems associated with the Inspiration Point

trailhead, and address sanitation issues. The Finding of No Significant Impact for the Tunnel View Overlook Rehabilitation Environmental Assessment was signed on December 12, 2007.

Agency Name: National Park Service
Project Name: Tuolumne Meadows Concept Plan
Description: The Tuolumne Meadows, at an elevation of 8,600 feet, is the Sierra's largest subalpine meadow. Current facilities in the Tuolumne Meadows area include a 304-site campground, a visitor center, a service station, a 104-bed lodge, food services, government and concession stable operations, employee housing, a wastewater treatment plant, and several administrative buildings. These facilities support approximately 5,000 park visitors and 200 park staff daily from May through October. Although improvement or relocation has been considered for many of these facilities, no comprehensive plan exists for the entirety of Tuolumne Meadows to determine the desired extent and location of development. A Concept Plan will define management objectives, including resource protection goals for the entire area, and will identify boundaries for specific types of development. This will allow implementation of management objectives and appropriate facility construction as incremental funding becomes available.

The environmental compliance process for the Tuolumne Meadows Concept Plan is currently in progress.

Agency Name: National Park Service
Project Name: Tuolumne Wild and Scenic River Comprehensive Management Plan
Description: The development of the Tuolumne Wild and Scenic River Comprehensive Management Plan will bring the park into compliance with the Wild and Scenic Rivers Act, and can be used to guide actions and evaluate the potential impacts of proposed improvement projects within the river corridor. In addition, the watershed on the Tuolumne Wild and Scenic River covers over 50 percent of Yosemite's back-country areas and Wilderness. This plan would be a comprehensive tool for watershed planning and management of sensitive areas within the Tuolumne River watershed. In addition, this plan would include much needed natural and cultural data that have not been previously compiled for the river corridor and its watershed. These data would be used to create effective and modern management tools, such as river protection overlays, and much needed compliance necessary for managing resources and visitor use in the entire Tuolumne Meadows area as well as the Tuolumne River corridor. The plan would also be an important tool for examining many outstanding issues with the complicated management of the Hetch Hetchy Reservoir, including water quality management and watershed issues with the City of San Francisco.

The development of the Tuolumne Wild and Scenic River Comprehensive Management Plan Environmental Impact Statement is currently in progress.

Agency Name: National Park Service
Project Name: Utilities Master Plan/East Yosemite Valley Utilities Improvement Plan
Description: The existing utility infrastructure serving Yosemite Valley was identified in the Yosemite Valley Plan as a potential problem due to its age, condition, inadequate capacity, inaccessibility to future facilities, and inappropriate location in environmentally sensitive areas.

The National Park Service completed a Utilities Master Plan for the east Yosemite Valley in 2003. This plan incorporated information on existing utility conditions and required repairs identified in the Yosemite Valley Sanitary Sewer Capital Improvement Plan, completed in 2002. The Utilities Master Plan assessed the current condition of utilities (water, wastewater, electric, and communications) in the Valley and the future Valley utility needs based on facilities proposed in the Yosemite Valley Plan. The Utilities Master Plan was developed to allow efficient relocation and upgrading of utility systems to provide for utility needs while reducing long-term environmental impacts from utility repair and maintenance activities.

An Environmental Assessment for the Utilities Master Plan was completed in June 2003, and a Finding of No Significant Impact was signed in October 2003. Implementation of the utility improvements will occur in three phases over ten years. Construction of phase 1 of the improvements began in 2005. The remaining phases of this project will commence following resolution of the Merced River Comprehensive Management Plan planning process.

Agency Name: National Park Service
Project Name: Yosemite Lodge Area Redevelopment
Description: This project is tiered off the Yosemite Valley Plan. The project collectively known as the Yosemite Lodge Area Redevelopment includes four separate actions as described in the General Management Plan and the Yosemite Valley Plan: redevelopment of Yosemite Lodge, redesign of Camp 4, relocation of North side Drive, and design of the Indian Cultural Center (this action is described further as a separate project). All actions occur in the Yosemite Lodge area of Yosemite Valley, and include the following:

- Yosemite Lodge will be changed from a motel-type establishment to one with more of a park lodge-type environment.
- Yosemite Lodge facilities in the river protection zone and the floodplain will be removed.
- Camp 4 will be redesigned to accommodate the expansion and improvements called for in the Yosemite Valley Plan.
- Northside Drive in the Yosemite Lodge and Camp 4 area will be relocated south of the lodge to reduce conflicts between vehicles and pedestrians, and to provide safer pedestrian access between the lodge and the Lower Yosemite Fall area.
- Through a cooperative agreement with the American Indian Council of Mariposa County, Inc., an Indian Cultural Center will be established at the site of the last historically occupied Indian village in Yosemite Valley (just west of Camp 4 and Yosemite Lodge). See the project description below.

An Environmental Assessment was prepared for this project in September 2003, and a Finding of No Significant Impact was issued in February 2004. Construction activity will commence following resolution of the Merced River Comprehensive Management Plan planning process.

Agency Name: National Park Service
Project Name: Yosemite Museum Master Plan
Description: The Yosemite Valley Museum Master Plan is a joint project of the National Park Service and the Yosemite Fund to provide locations and conceptual designs for facilities housing museum exhibits, storage, work spaces, a library, archives, and museum collections of Yosemite National Park. The master

plan must also address the potential reintegration of Valley museum collections with collections at several locations outside of Yosemite Valley, including El Portal and Wawona. The environmental compliance process for the Yosemite Museum Master Plan is in progress.

Agency Name: National Park Service
Project Name: Yosemite Valley Shuttle Bus Stop Improvements
Description: This project consists of the preparation of preliminary design plans, environmental compliance documents, and construction drawings; the construction of six 10-foot by 80-foot concrete braking pads; and the rehabilitation or replacement of 94,000 square feet of asphalt road approaches. Construction has begun on this project.

Regional

Agency Name: California Department of Transportation
Project Name: Invasive Plant Control
Description: The California Department of Transportation (Caltrans) controls invasive plants along rights-of-way in several areas adjacent to Yosemite National Park. Yellow star-thistle is controlled along Highway 120 in Tuolumne County outside the park using the herbicide Transline (clopyralid). Caltrans does not currently use herbicides along Highway 140 within the Merced River Corridor. Additionally, Caltrans works with individual county agricultural commissioners to respond to reports of invasive plants within the Caltrans rights-of-way.

Agency Name: Mariposa County
Project Name: Invasive Plant Control
Description: Mariposa County actively controls several species of invasive plants in areas adjacent to the park. Mariposa County treats yellow star-thistle with a combination of mechanical, biological, and herbicide control techniques. Herbicides include Transline (clopyralid), Milestone® (aminopyralid), Roundup® (glyphosate), Rodeo® (glyphosate), and Accord (glyphosate). Yellow star-thistle control occurs in several locations throughout the county, and includes the Merced River Canyon up to the park boundary. Other priority species under county control are Iberian star-thistle and diffuse knapweed.

Agency Name: U. S. Forest Service, Inyo National Forest
Project Name: Invasive Plant Control
Description: Very few invasive plant populations are known to occur in areas adjacent to Yosemite National Park. Dandelion, cheatgrass and *Lotus corniculatus* are manually treated in areas near the park. A single spotted knapweed was found in 2000 along Highway 120 east of the park boundary near the Tioga Pass Resort. The Inyo National Forest is currently in the process of developing an Invasive Plant Management Plan and Environmental Assessment.

Agency Name: Tuolumne County
Project Name: Invasive Plant Prevention and Control
Description: Priority invasive plant populations in Tuolumne County include yellow star-thistle, Canada thistle, spotted knapweed, and diffuse knapweed. Isolated populations of knapweeds are currently pulled by hand. A population of spotted knapweed exists near Camp Mather. There are also small isolated populations of Canada thistle on Evergreen Road at the Diamond O campground that are treated with

glyphosate in the form of Rodeo® and Aquamaster. Tuolumne County is currently seeking funding to begin treatment of yellow star-thistle along Highway 120 outside of Yosemite National Park in cooperation with Caltrans.

Agency Name**:** Interagency
Project Name: Weed Management Area: Mariposa, Madera, & Fresno Counties Sierra-San Joaquin Noxious Weed Alliance
Description**:** Weed management areas are local organizations that bring together landowners and managers (private, city, county, State, and federal) in a county, multi-county, or other geographical area to coordinate efforts and expertise against common invasive weed species. The weed management area functions under the authority of a mutually developed Memorandum of Understanding, and is subject to statutory and regulatory weed control requirements. To date, groups in California have been initiated by either the leadership of the county agricultural commissioner's office or a federal agency employee. Weed management areas are unique because they attempt to address agricultural (regulatory) weeds and "wildland" weeds under one local umbrella of organization. It is hoped that participation will extend from all agencies and private organizations. Weed management areas have printed weed identification/control brochures; organized weed education events; written and obtained grants; coordinated demonstration plots; and instituted joint eradication, mapping, outreach, and other effective weed management projects.

Past Actions

Agency Name: National Park Service
Project Name: Cascades Diversion Dam Removal
Description: The Cascades Diversion Dam was located on the main stem of the Merced River at the far west end of Yosemite Valley. The dam was a timber "crib" structure with associated concrete abutments. Removing the dam was part of the overall intent of the Merced Wild and Scenic River Comprehensive Management Plan and Final Environmental Impact Statement and the Yosemite Valley Plan to restore free-flowing conditions to the Merced Wild and Scenic River. In its deteriorated condition, the dam presented a significant public health and safety hazard due to the potential for uncontrolled collapse. Cascades Diversion Dam was located adjacent to El Portal Road. Removal of the structure and related facilities was completed in 2004.

Agency Name: National Park Service
Project Name: Cook's Meadow Ecological Restoration
Description: This project is restoring a dynamic and diverse wetland ecosystem. The Cook's Meadow restoration project involves the following actions:

- Filling four drainage ditches created by early Euro-American settlers
- Removing a raised, abandoned roadbed and a trail that bisected the meadow
- Reconstructing the trail on an elevated boardwalk that now allows water to flow freely and reduces foot traffic on sensitive meadow plants
- Installing culverts under Sentinel Road to direct runoff into the meadow and restore the natural flow of water from the Merced River during seasonal periods of high water

- Reducing non-native plant species encroaching on native species by using manual, mechanical, and chemical control methods

This project was completed at the end of 2005, and ongoing monitoring will continue.

Agency Name: National Park Service
Project Name: Curry Village Employee Housing
Description: This project includes the design and construction of new employee housing and related facilities to accommodate approximately 217 concessioner employees in the area west of Curry Village in Yosemite Valley. This housing will replace concessioner housing lost in the January 1997 flood. The employee housing units have been designed in accordance with the character of the area, with particular focus on the Curry Village Historic District. The scope of this housing project includes providing parking and access, an employee wellness center, concessioner housing, management offices, maintenance facilities, postal facilities, and housing-related storage. The compliance for this project was completed in 2004, and construction was completed in 2007.

Agency Name: National Park Service
Project Name: El Portal Road Improvement Project – Park Boundary to Cascades Diversion Dam
Description: This federal jurisdiction transportation project, which was located entirely within Yosemite National Park boundaries, involved road improvements to 6.5 miles of El Portal Road, from the Yosemite National Park boundary in El Portal to just east of the intersection with Big Oak Flat Road. The project improved access to Yosemite Valley and reduced safety concerns. El Portal Road is a primary route for visitors accessing Yosemite Valley, and is the shortest all-weather route to the Valley. It also serves as the primary commuting route for park employees living in El Portal, Midpines, and Mariposa. The project was completed in 2000.

Agency Name: National Park Service
Project Name: Fire Management Plan/Environmental Impact Statement
Description: The Yosemite National Park Fire Management Plan/Environmental Impact Statement guides the implementation of a complex fire management program. The program includes wildland fire suppression, wildland fire used to achieve natural and cultural resource benefits, fire prevention, prescribed fire, fire ecology research, and the use of mechanical methods to reduce and thin vegetation in and around communities.

One goal of the program is to reduce the threat of wildland fire to public safety and to the park's wildland urban interface communities, as well as to its natural and cultural resources. Another goal is to return the influence of natural fire to park ecosystems so that they are restored to, and maintained in, as natural a condition as possible.

The Fire Management Plan/Environmental Impact Statement reduces risk to park wildland urban interface communities within 6 to 8 years of implementation, and restores park ecosystems within 15 to 20 years. Some of the work will involve mechanical methods to reduce the risk of unwanted wildland fire in and adjacent to wildland urban interface communities. The primary methods of reducing wildland fire risk and restoring park ecosystems will be prescribed. The Record of Decision for the Yosemite National Park Fire Management Plan/Environmental Impact Statement was signed in March 2004.

Agency Name: National Park Service
Project Name: Happy Isles Fen Habitat Restoration Project
Description: The Happy Isles Fen is a two-acre wetland immediately west of the Happy Isles Nature Center in east Yosemite Valley. In 1928, the National Park Service filled in about three additional acres of the fen to create a parking lot. The asphalt parking lot was removed in 1970, although imported fill remained. The area impacted by parking lot construction was restored to wetland conditions by removing imported fill and associated upland vegetation, and revegetating with native wetland plants.

Agency Name: National Park Service
Project Name: Lower Yosemite Fall Project
Description: This project consists of improving and rehabilitating the physical infrastructure at the 56-acre Lower Yosemite Fall area. The project work includes rebuilding/rehabilitating trails; removing several trail segments; rebuilding/rehabilitating five pedestrian bridges; constructing one new pedestrian bridge; removing one pedestrian bridge; removing the existing parking area and revegetating it to natural conditions; constructing a new shuttle bus stop; replacing/relocating the restroom; creating new access points; fabricating and installing new directional signs; creating a meeting area for groups; restoring portions of forest and creekside habitat to natural conditions; installing amenities such as bike racks, picnic tables, public telephones, trash cans, and wayfinding signs; enlarging the viewing areas near the base of the fall; and providing educational exhibits. This improvement project will enhance a world-class visitor experience, create a loop trail system that is fully accessible to people with mobility impairments, reduce the perception of crowding and congestion at main views and along the trail, and improve the hydrology of the braided stream system by replacing the narrow bridges that impede the natural streamflow. To address removal of the tour bus loading/unloading and parking area from the Lower Yosemite Fall area, replacement loading/unloading and parking spaces will be provided for tour buses. Long-term tour bus loading and unloading would occur at the future new transit center in Yosemite Village. This project was completed in 2005.

Agency Name: National Park Service
Project Name: Merced River Ecological Restoration at Eagle Creek
Description: Eagle Creek flows into Yosemite Valley immediately west of the Three Brothers rock formations and joins the Merced River about 0.5 mile downstream from Yosemite Lodge. The creek banks of the reach of Eagle Creek between Northside Drive and the Merced River are badly eroded and only sparsely vegetated, partly due to trampling by pedestrians. The eroded riverbank was recontoured, and then revegetated; the trampled river terrace was decompacted; and fences were constructed to direct visitors to sandbars for river access. The ecological restoration effort involved the following:

- Plug remaining portions of abandoned sewage lines with concrete, and remove the manhole and the concrete structure that crosses the creek bed
- Restore the eroded creek channel using methods previously tested on the banks of the Merced River (restoration techniques require building up the bank with willow cuttings, woody debris, rock, and mulch)
- Revegetate the bank of Eagle Creek with native shrubs, cuttings, and seeds
- Redirect visitors to access the river in a more appropriate location that will not cause bank impacts

This project was completed in 2003.

Agency Name: National Park Service
Project Name: Yosemite Valley Plan
Description: The National Park Service Pacific West Regional Director signed the Record of Decision for the Final Yosemite Valley Plan and its Supplemental Environmental Impact Statement on December 29, 2000. The purpose of the Yosemite Valley Plan is to present a comprehensive management plan for Yosemite Valley—from Happy Isles at the east end of the Valley to the intersection of the El Portal and Big Oak Flat Roads near the Cascades area at the west end. It also presents actions in adjacent areas of the park and the El Portal Administrative Site that directly relate to actions proposed in Yosemite Valley. The specific purposes of the Yosemite Valley Plan within Yosemite Valley are to:

- Restore, protect, and enhance the resources of Yosemite Valley
- Provide opportunities for high quality, resource-based visitor experiences
- Reduce traffic congestion
- Provide effective park operations, including employee housing, to meet the mission of the National Park Service

The Record of Decision was signed in December 2000.

Appendix N: DRAFT Wilderness Minimum Tool Requirement Analysis the Invasive Plant Management Plan for Yosemite National Park

The National Park Service proposes to implement the Invasive Plant Management Plan in Yosemite National Park. The purpose of this appendix is to: 1) determine whether the alternatives proposed are appropriate or necessary for administration of the area as Wilderness, and do not pose a significant impact to Wilderness resources and character; and 2) if the plan is appropriate or necessary in Wilderness, ensure that techniques and equipment minimize impacts to Wilderness resources and character.

About 94 percent of Yosemite National Park is designated Wilderness. Most of the designated Wilderness in Yosemite is free from the impacts of invasive plants; the intention of the plan is to keep Wilderness and other intact areas free from invasive plants. The most effective and efficient strategy for keeping invasive plants out of the Wilderness and averting the need for larger scale control efforts, is to detect invasive plants early and initiate measures to keep new invasive plant propagules from entering the Wilderness. All of the alternatives in the Invasive Plant Management Plan incorporate early detection and early control of invasive plants. The No Action alternative proposes a variety of techniques for invasive plant control, excluding herbicide use. Alternatives 2 and 3 propose a variety of invasive plant control techniques, including herbicide use in specified situations.

Step 1 - Determine Whether the Proposed Action Takes Place in Designated Wilderness (or a Potential Wilderness Addition)

The proposed action takes place in designated Wilderness and potential Wilderness additions.

Areas of Concern. The following areas in the Yosemite Wilderness currently contain the greatest concentrations of invasive non-native plants:

- Merced River corridor from Little Yosemite Valley to Merced Lake
- Little Yosemite Valley up toward Half Dome
- Hetch Hetchy Reservoir to Beehive Spring
- Pate Valley
- Rancheria Falls and Tiltill Valley
- Miguel Meadows Rancheria Falls

Species of Concern. Of the 177 invasive plant species found in Yosemite, 33 species are found in Wilderness (see Table N-1). Of these 33 species, the following 6 are targeted for removal: Bull thistle (*Cirsium vulgare)*, Velvet grass *(Holcus lanatus),* Himalayan blackberry *(Rubus discolor)*, Common dandelion *(Taraxacum officinale)*, Common mullein *(Verbascum Thapsus)*, and Yellow salsify (*Tragopogon dubius)*. An alert will be maintained for the following highly invasive species that are not currently found in the Yosemite Wilderness: Italian Thistle, (*Carduus pycnocephalus),* Perennial pepperweed *(Lepidium latifolium),* Yellow star-thistle (*Centaurea solstitialis)*, and Spotted knapweed (*Centaurea maculosa)*. Program managers will update this list as invasion patterns change.

Step 2 - Determine Whether the Proposed Action is Required for the Administration of the Yosemite Wilderness

Invasive plants have adverse effects on core Wilderness values, including Wilderness character, wildness, and natural processes. Invasive plants affect the natural qualities of Wilderness, and can directly compete and displace native plants, or cause changes in biological diversity, the food base for wildlife species, and soil conditions. The proposed action would advance efforts to prevent invasive plants from entering the Wilderness, detect priority invasive plant populations early that have made their way into the Wilderness, and treat invasive plants effectively, before they can spread and require larger control efforts. These efforts are crucial for the administration of the natural attributes of Wilderness in Yosemite National Park.

Table N-1: Invasive Plant Species in Yosemite National Park Wilderness
(targeted species are in bold)

• *Aira caryophyllea*	European hairgrass	• *Poa annua*	Annual bluegrass
• *Agrostis gigantea*	Redtop	• *Poa bulbosa*	Bulbous bluegrass
• *Agrostis stolonifera*	Creeping Bent Grass	• *Poa compressa*	Canadian bluegrass
• *Avena* sp.	Wild oat	• *Poa pratensis*	Kentucky bluegrass
• *Bromus diandrus*	Ripgut grass	• ***Rubus discolor***	**Himalayan blackberry**
• *Bromus tectorum*	Cheat grass	• *Rumex acetosella*	Sheep sorrel
• *Chenopodium album*	Lamb's quarters	• *Rumex crispus*	Curly dock
• ***Cirsium vulgare***	**Bull thistle**	• *Sisymbrium altissimum*	Tumble mustard
• *Cynosurus echinatus*	Hedgehog dogtail	• *Sonchus* sp.	Sow thistle
• *Erodium cicutarium*	Storksbill	• *Spergularia rubra*	Purple sand-spurrey
• ***Holcus lanatus***	**Velvet grass**	• ***Taraxacum officinale***	**Common dandelion**
• *Hordeum marinum*	Mediterranean barley	• ***Tragopogon dubius***	**Yellow salsify**
• *Hypochaeris glabra*	Smooth cat's-ear	• *Trifolium repens*	White clover
• *Lactuca serriola*	Prickly lettuce	• *Urtica urens*	Dwarf nettle
• *Leucanthemum vulgare*	Ox-eye daisy	• ***Verbascum thapsus***	**Common mullein**
• *Phleum pretense*	Timothy grass	• *Vulpia myuros*	Foxtail fescue
• *Plantago lanceolata*	English plantain		

Step 3 - Determine if Objectives of the Invasive Plant Management Plan Can Be Met With Actions Outside of Wilderness or Potential Wilderness

Actions must take place within Wilderness or potential Wilderness to meet the objectives of the Invasive Plant Management Plan, as one goal of the plan is to prevent invasive plants from spreading into uninfested areas of the park, including Wilderness.

Step 4 - Develop a List of Options to Meet the Objectives of the Plan; Include Ways to Reduce or Mitigate the Impacts of Each Alternative

The most effective and efficient strategy for keeping invasive plants out of the Wilderness is to detect invasive plants early and initiate measures to keep new invasive plant seeds and propagules from entering the Wilderness. Invasive plant species make their way into the Wilderness via humans in a variety of ways: hikers may carry invasive plants seeds on their boots, socks, and other gear; pack-stock users may carry invasive plant seeds on their gear or stock feed and manure; and fire fighters may bring in seeds with their

gear. Currently, the park provides information to Wilderness users on how they can prevent invasive plants from entering the Wilderness by cleaning shoes, clothing, camping gear, and other items before entering the Wilderness. Stock users are encouraged to use weed-free feed while visiting Yosemite's Wilderness.

All of the alternatives in the Invasive Plant Management Plan emphasize early detection and prevention; the alternatives vary in the methods of controlling invasive plants. There are three main control options for removing invasive plants from designated Wilderness:

- Non motorized control techniques (also known as manual control): hand pulling, lopping, severing plant from root crown with a shovel, removing root mass by shovel or trowel, mowing using a scythe or grass whip, or flaming. These actions are prescribed under all of the alternatives in the Invasive Plant Management Plan.
- Motorized control techniques (also known as mechanical control): gas powered weed whacker (string or blade). These actions are prescribed under all of the alternatives in the Invasive Plant Management Plan.
- Herbicide application: cut-and-daub or backpack spraying. This action is allowed under Alternatives 2 and 3 of the Invasive Plant Management Plan for selected species that meet size and location requirements.

Option 1 – Use Non-Motorized Techniques to Remove Invasive Plants (Manual Control)

Option 1 utilizes manual techniques with hand tools such as shovels and loppers to remove invasive plants. Work crews would hike or backpack throughout areas of concern following "Leave No Trace" protocols in work and camp settings. Additional logistical support provided by stock or humans would be considered when distances are greater than a two-day hike to the work area, or a volunteer group is being utilized for weed removal. For all invasive plant species, work crews would remove flowering heads and bag, carry, and dispose of the plants in a closed dumpster. Work crews may also burn flowering heads in pre-existing fire-rings. Once the flowering head is removed, the body of the plant would be severed from the roots at the root crown or pulled to remove the root. In the case of Himalayan blackberry (or other species with similar growth characteristics), the entire root mass would be removed and burned on site in a pre-existing fire ring.

Mitigation

- Crews would follow Leave No Trace camping and work protocols.
- Crews would rove and change their camp locations frequently and not create a long-term base camp.
- Crews would camp in areas that have a durable surface such as decomposing granite, bare ground, or granite slabs.
- Crews would educate the public regarding their work.
- The park would provide information at the visitor center and trail heads regarding invasive non-native plant issues in Wilderness and the importance of controlling these species.

- Each area would be surveyed prior to work activities to determine that eradication would not damage sensitive species, as well as biological, physical, cultural and aesthetic resources in the area. Eradication techniques would be modified to protect those resources.
- Crews would be limited to legal group size limits—15 in trailed areas, 8 in off-trail areas.
- Crews would be supported by pack-stock only when more than two days would be required to travel to a work area.

Option 2 – Use Manual and Motorized Techniques to Remove Invasive Species (Mechanized Control)

In addition to the manual techniques used in Option 1, work crews would use motorized equipment such as a gas-powered weed whacker to remove invasive plants. Motorized equipment would be used in situations where it is required for immediate and effective invasive plant control of rapidly spreading invasive plants. Motorized equipment would only be used if it would preclude the need for larger, more invasive control actions in the near future.

Mitigation

- Mitigation measures would be the same as under Option 1.
- Work would occur during the middle of the day, when hikers are more likely to be moving through an area and not camping in the area.

Option 3 – Use Non-Motorized and Motorized Techniques to Remove Invasive Plants, as Well as Herbicides

In addition to the manual and mechanical techniques used under Option 2, herbicide use would be considered in certain situations to control invasive plant populations. Herbicides would be used where they would be the only effective tool to keep rapidly spreading invasive plant populations in check, and use of the herbicide would preclude larger, more invasive control efforts in the future. In addition, invasive plant populations must meet the thresholds and conditions for herbicide use outlined in Alternatives 2 and 3 of the Invasive Plant Management Plan. Glyphosate and aminopyralid are the only herbicides that would be used.

Mitigation

- Mitigation measures would be the same as under Option 1.
- Work would occur during the middle of the day, when hikers are more likely to be moving through an area and not camping the area.
- Work crews would follow the Herbicide Use Protocol in the Invasive Plant Management Plan.

Step 5: Determine the Effects of Each Option on Wilderness Health and Character

Option 1. Use Non-Motorized Tools to Remove Invasive Plants		
Effects on the Natural Attributes of Wilderness Character	**Effects on Solitude and Unconfined Recreation**	**Effects on Wildness and the Undeveloped Aspects of Wilderness Character**
Reduction in invasive plant populations. Minor soil disturbance. Increased size and abundance of native plant populations.	Short-term effects: The presence of work crews would decrease opportunities for solitude for other visitors. Work crews would increase imprint of human activity and management presence. Long-term effects: As ecological integrity returns, the human impact footprint in Wilderness would become less apparent.	Wildness, or the untrammeled quality of Wilderness, would be decreased during work activities. Evidence of invasive plant control work, such as pulled plants and disturbed soil, would be visible in the short term. Naturalness would increase as natural processes resume and signs of human-induced change are removed.
Option 2. Use Non-Motorized and Motorized Tools to Remove Invasive Plants		
Effects on the Natural Attributes of Wilderness Character	**Effects on Solitude and Unconfined Recreation**	**Effects on Wildness and the Undeveloped Aspects of Wilderness Character**
Reduction in invasive plant species populations. Increased size and abundance of native plant populations. Short-term minor soil disturbance. Long-term negligible beneficial impact on soil attributes, such as soil microorganisms and chemical and hydrologic cycles, as invasive plants are controlled.	Short-term effects: The presence of work crews would decrease opportunities for solitude for other visitors. Work crews would increase imprint of human activity and management presence. Noise and smells created from motorized tools would impact natural sounds and smells of Wilderness. Long-term effects: As ecological integrity returns, human impact footprint in Wilderness would become less apparent.	Wildness would decrease during work activities. Evidence of invasive plant control work, such as pulled plants and disturbed soil, would be visible in the short term. Naturalness would increase as natural processes resume. Wildness would increase with removal of human-induced change.
Option 3. Use Non-Motorized Methods, Motorized Tools, and Herbicides to Remove Invasive Plants		
Reduction in non-native species plant populations. Minor soil disturbance. Increased size and abundance of native plant populations. Short-term negligible adverse effect on soil quality. Long-term moderate beneficial impacts on soil microorganisms, soil chemistry, and hydrologic cycles as invasive plant populations are controlled and eradicated.	Short-term effects: The presence of work crews would decrease opportunities for solitude for other visitors. Work crews would increase imprint of human activity and management presence. Wildness would decrease during project due to noise and smell from motorized equipment. Long-term effects: As ecological integrity returns, human impact footprint in Wilderness would become less apparent.	Wildness, or the untrammeled quality of Wilderness, would be decreased during work activities. Wildness would decrease during project due to use of motorized tools and application of herbicide. Long term effects: Naturalness would increase as native plants and natural processes resume. Wildness would increase with removal of human-induced change.

Step 6 – Determine the Management Concerns of Each Option

Option 1. Use Non-Motorized Tools to Remove Invasive Plants	
Health and Safety Concerns	Societal/Economic/Political Concerns
There would be safety concerns associated with physical work in a remote setting. These concerns would be mitigated with proper training and supervision.	There could be positive perceptions of the National Park Service as actions protect the biological, physical, and experiential aspects of Yosemite Wilderness. There would be economic costs related invasive plant control actions. The program is currently funded through Yosemite Fund and the Centennial Challenge.
Option 2. Use Non-Motorized and Motorized Tools to Remove Invasive Plants	
Health and Safety Concerns	Societal/Economic/Political Concerns
There would be safety concerns associated with physical work in a remote setting. These concerns would be mitigated with proper training and supervision. The acts of carrying motorized tools and fuel over long distances would require additional training.	There could be positive perceptions of the National Park Service as actions protect the biological, physical, and experiential aspects of Yosemite Wilderness. There could be negative perceptions of the National Park Service due to use of motorized equipment in a Wilderness setting. There would be economic costs related to invasive plant control actions. The program currently is funded through Yosemite Fund and the Centennial Challenge.
Option 3. Use Non-Motorized Methods, Motorized Tools, and Herbicides to Remove Invasive Plants	
Health and Safety Concerns	Societal/Economic/Political Concerns
There would be safety concerns associated with physical work in a remote setting. These concerns would be mitigated with proper training and supervision. The acts of carrying motorized tools and fuel over long distances would require additional training. There could be additional hazards related to transporting, mixing, and applying herbicides in a remote setting.	There could be positive perceptions of the National Park Service as actions protect the biological, physical, and experiential aspects of Yosemite Wilderness. There could be negative perceptions of the National Park Service due to the use of motorized equipment and herbicides in a Wilderness setting. There would be economic costs related to invasive plant control actions. The program is currently funded through Yosemite Fund and the Centennial Challenge.

Step 7 – Evaluate the Options

Wilderness in Yosemite is largely free from the effects of invasive plants. The Invasive Plant Management Plan aims to protect Wilderness character by keeping invasive plants from spreading in Wilderness. All of the Alternatives in the Invasive Plant Management Plan emphasize early detection and prevention practices that would preclude larger, more invasive control actions in the future. Invasive plant control actions would restore and preserve areas of the Wilderness that have reduced biodiversity and impaired ecological function resulting from invasive plant populations.

This document also evaluates whether the techniques and equipment used to control invasive plants are the minimum required to preserve Wilderness character. Invasive plant removal techniques that use non-motorized methods, as described under Option 1, minimize negative effects on solitude in Wilderness. This control method would generally be the most appropriate method to protect the unique characteristics of Wilderness. Option 2 adds the use of motorized equipment, such as a gas-powered weed whacker, if it would prevent the intrusion of rapidly spreading invasive plants into the Wilderness and preclude larger invasive plant control efforts in the future. Motorized equipment would also be used if the size of the population to be controlled is too large for non-motorized techniques to be effective. Option 3 adds the use of herbicides if the park is unable to meet management objectives through other control methods, if invasive plant populations demonstrate a potential ecosystem-level threat to Wilderness

character, and the use of herbicides would prevent the intrusion of rapidly spreading invasive plants in Wilderness and preclude larger invasive plant control efforts in the future. In addition, control actions must meet the criteria for herbicide use outlined under Alternatives 2 and 3 of the Invasive Plant Management Plan.

Option 3 is the most efficient and effective method of keeping invasive plants out of Yosemite Wilderness and treating new infestations early and completely. Option 3 provides a range of tools for responding to a variety of potential invasive plant threats, and providing effective and thorough early treatments to prevent infestations from growing and integrating into natural habitats. Under Option 3, invasive plant removal using non-motorized equipment (manual control) is the preferred method of invasive plant control. Work crews would utilize motorized equipment only if manual control is ineffective at early prevention and control. Work crews would utilize herbicides as a last resort, and only if manual and mechanical control methods do not effectively control rapidly spreading invasive plant populations. In this latter case, herbicides may be the minimum tool required to control a fast-moving species with the potential to alter native plant communities and underlying soil composition. Glyphosate and aminopyralid are the only herbicides that would be used. Option 3 allows a full range of options for early and effective treatments to keep invasive plant populations small, before control efforts entail large amounts of soil and vegetation disturbance, and the presence of long-term workers compromise values of solitude and wildness for other Wilderness travelers. For these reasons, the tools and use criteria specified under Option 3 are the minimum tool required to meet management objectives for Wilderness in Yosemite.

Alternatives 2 and 3 in the Invasive Plant Management Plan would be consistent with Option 3 described in this Wilderness Minimum Tool Requirement Analysis. Actions in Wilderness under Alternatives 2 and 3 would be largely the same, as the additional invasive plants that would be treated with herbicides under Alternative 3 are generally found outside of Wilderness. The focus on early detection and prevention, and the control methods proposed under Alternatives 2 and 3 of the Invasive Plant Management Plan, are the minimum tool required to meet management objectives for Wilderness in Yosemite.

Mitigation

- Crews would follow “Leave No Trace” camping and work protocols.
- Crews would rove and change their camp locations frequently and not create a long-term base camp.
- Crews would camp in areas that have a durable surface such as decomposing granite, bare ground, or granite slabs.
- Crews would educate the public regarding their work.
- The park would provide information at the visitor center and trail heads regarding invasive non-native plant issues in Wilderness and the importance of controlling these species.
- Each work area would be surveyed before work activities commence to determine that eradication would not damage sensitive species or other biological, physical, cultural, and aesthetic resource in the area. Eradication techniques would be modified to protect those resources.
- Crews would be limited to legal group size limits—15 in trailed areas, 8 in off-trail areas.

- Crews would be supported by pack-stock only when more than two days would be required to travel to a work area.
- Motorized clearing would occur during the middle of the day, when hikers are more likely to be moving through an area and not camping the area.
- Work crews would follow the Herbicide Use Protocol in the Invasive Plant Management Plan.

Minimum Requirement Decision Process

Check one:

☐ The proposed action is a temporary one-time activity.
X The proposed action will be an ongoing long-term activity.

Reviewed By:

DRAFT - Intentionally left blank
Wilderness Manager Date

Approved By:

DRAFT - Intentionally left blank
Chief ranger Date

Approved By:

DRAFT - Intentionally left blank
Chief, Resources Management and Science Date

Approved By:

DRAFT - Intentionally left blank
Superintendent Date

Appendix O: Priority Invasive Plant Species Abstracts

Ailanthus altissima

Common Name: Tree-of-Heaven, Ailanthus
Family: Simaroubaceae
Listed: Cal-IPC (B)
Ailanthus (*Ailanthus altissima*) is a fast growing deciduous tree 30 to 65 feet tall, with gray bark (Bossard, Randall et al. 2000). It can grow in most environments and in inhospitable soil conditions below 6,000 feet (Joseph M. DiTomaso and Healy 2007). Ailanthus reproduces by seed and most readily vegetative root sprouts. Ailanthus can produce up to 1 million seeds a year, but seedling establishment in California is infrequent. Reproduction in California is primarily through root sprouts, and ailanthus can produce abundant sprouts, some up to 50 feet away from the nearest shoot, producing dense thickets over a large area that displace native vegetation, particularly in riparian zones. Ailanthus also produces chemicals that resist insects (Joseph M. DiTomaso and Healy 2007), and may contribute to the displacement of native vegetation and wildlife (Bossard, Randall et al. 2000).

Ailanthus is native to eastern China, and was widely planted until the 1890s during the California Gold Rush by Chinese miners (Bossard, Randall et al. 2000). Within California, Ailanthus is widely distributed, but is most common along the coast and in the Sierra Nevada foothills (Bossard, Randall et al. 2000).

In Yosemite National Park boundaries, Ailanthus is found near the Ansel Adams Gallery in Yosemite Valley and occasionally in the Merced River canyon near the park border. Ailanthus is well established just outside the park in El Portal. Control efforts have been limited to manual removal of trees (including seedlings and saplings) in the riparian corridor in El Portal.

Carduus pycnocephalus

Common Name: Italian thistle
Family: Asteraceae
Listed: Cal-IPC (medium); CDFA (C); USGS (1)
Italian thistle *(Carduus pycnocephalus)* is a winter annual broadleaf that grows up to six feet tall with spiny stems. Italian thistle grows along roadsides, pastures, and in waste areas at elevations up to 3,280 feet (Hickman 1993). Italian thistle only reproduces from seeds, and dominates sites by the blanketing effect of overwintering rosettes, severely reducing the establishment of other plants. The seeds disperse by animals fur and humans clothing, carried by ants, as a contaminant in hay and soil, and by vehicles and wind (Gerlach, Moore et al. 2003). Wind can carry seeds an average of 75 feet from the parent plant, and can travel more than 325 feet in strong winds. Italian thistle seeds remains viable in the soil over ten years (Bossard, Randall et al. 2000). Italian thistle grows in sandy to clay soils (Joseph M. DiTomaso and Healy 2007).

Italian thistle is native to the Mediterranean. It occurs throughout southern Europe, North Africa, and Pakistan. In North America, it is found in Oregon, Idaho, and California (Bossard, Randall et al. 2000). In California, it occurs in the southern North Coast and North Coast Ranges, Sierra Nevada Foothills, and

Central Western California bioregions (Hickman 1993). Its range in the Sierra Nevada seems to be increasing (Gerlach, Moore et al. 2003).

Italian thistle has been found in the El Portal administrative site near the community pool. It has also been found in Yosemite Valley at the Lower River Campground. National Park Service crews have worked with adjacent land management agencies (U.S. Forest Service and Bureau of Land Management) to reduce the potential spread of Italian thistle from adjacent public lands.

Centaurea maculosa

Common Name: Spotted Knapweed
Family: Asteraceae
Listed: CDFA (A); USGS (1); Cal-IPC (high)
Spotted knapweed *(Centaurea maculosa)* is a biennial to short-lived perennial that grows up to one meter tall (Joseph M. DiTomaso and Healy 2007) in disturbed sites, riparian areas, grasslands, wet meadows, and forests at elevations up to 9,800 feet (Gerlach, Moore et al. 2003). Spotted knapweed plants generally live three to seven years. Plants re-grow from the root crown. Reproduction is by seed, and plants are capable of producing 500 to 4,000 seeds per square foot per year. Seeds can remain viable in the soil for more than eight years. Most seeds are dispersed near the parent plant, but can be transported by people, wildlife, livestock, and vehicles, and in soil, crop seed, and contaminated hay. Spotted knapweed out-competes native plant species, reduces native plant and animal biodiversity, and decreases forage production for wildlife. It may degrade soil and water resources by increasing erosion, surface runoff, and stream sedimentation (Carpinelli 2003).

Spotted knapweed is native to central Europe. It now occurs in east to central Russia, Caucasia, and western Siberia. It is a widely distributed species reported to occur throughout Canada and in every state of the U.S. except Alaska, Georgia, Mississippi, Oklahoma, and Texas. It has been designated as a noxious weed in Arizona, California, Colorado, Idaho, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming (Carpinelli 2003). In California, it occurs in northwestern California, the Cascade Range, the Sierra Nevada, the northern Sacramento Valley, northern central western California, the southern Peninsular Ranges, the Modoc Plateau, and northeast of the Sierra Nevada bioregions (Hickman 1993).

In Yosemite, spotted knapweed has been found in Foresta, Yosemite Valley in the former Upper River Campground, and along the El Portal Road. Spotted knapweed has been manually removed from all known locations within Yosemite National Park and inholdings, with repeated follow-up.

Centaurea solstitialis

Common Name: Yellow Star-thistle
Family: Asteraceae
Listed: Cal-IPC (high); CDFA (C); USGS (1)
Yellow star-thistle *(Centaurea solstitialis)* is an winter annual, sometimes biennial, herbaceous plant growing up to 6.5 feet (Joseph M. DiTomaso and Healy 2007). It flowers from May to October, and the spread of yellow star-thistle is by seed. Each seedhead can produce from 35 to 80 seeds (Murphy and Ehrlich 1989), and seeds can remain viable in the soil for more than ten years (Gerlach, Moore et al. 2003).

Star-thistle produce two types of seeds, most lacking pappus bristle and some with pappus bristles that are wind dispersed. The plumeless seeds fall from the mother plant and create the invasional front commonly seen in disturbed areas (Joseph M. DiTomaso and Healy 2007) Seed dispersal mechanisms include animals, humans, vehicles, contaminated crop seed, hay or soil, and road maintenance. Yellow star-thistle invades and infests areas, choking out native plants, and reducing biodiversity, wildlife habitat, and forage (Murphy and Ehrlich 1989). It grows in disturbed areas around developments and grassy slopes in the chaparral/oak-woodland and mixed conifer zones at elevations up to 1,200 meters (Botti 2001).

Yellow star-thistle is native to the Mediterranean region of southern Europe, as well as northern Africa. It occurs in 41 states in the U.S. (with the exception of Maine, Vermont, five southeastern states, Alaska, and Hawaii). Yellow star-thistle is most concentrated in California, where the plant infests nearly 12 million acres of rangeland and wildland (Murphy 2003). It occurs in the California Floristic Province and Mojave Desert bioregions within the state (Hickman 1993), in which the largest populations are in the central and northern valleys and foothills, and it is extending its range into the central Sierra Nevada region (Gerlach et al. 2003).

In Yosemite National Park, yellow star-thistle is currently found in the El Portal administrative site. It been found and controlled in the past along El Portal Road, at the Foresta and McCauley Ranch, along the Wawona Road, along Tioga Pass Road, on Big Oak Flat Road, on Aspen Valley Road, and at Tuolumne Meadows.

Cirsium vulgare

Common Name: Bull thistle
Family: Asteraceae
Listed: Cal-IPC (medium); CDFA (NR); USGS (3)
Bull thistle (*Cirsium vulgare*) is a biennial that can grow up to 6.5 feet tall and reproduces only by seed. Generally, bull thistle remains as a rosette the first year; it flowers the second year, sets seed and dies. Some plants will flower their first year, while other plants may remain as a rosette for several years (Bossard, Randall et al. 2000) . Bull thistle grows in disturbed places around developments, along roadsides and in undisturbed often wet places, including marsh edges, coastal grasslands, meadows, and forest openings in the chaparral/oak-woodland and mixed conifer zones at elevations up to 6,500 feet (Botti 2001). Individual plants seed only once, but large plants can produces tens of thousands of wind-dispersed seeds. Bull thistle is a noxious plant that spreads aggressively; it competes with and displaces native species (Bossard, Randall et al. 2000).

Bull thistle is native to Europe, western Asia, and North Africa, and was likely introduced to North America as a seed contaminant around 1600. By 1925, bull thistle was reported from several locations in California (Bossard, Randall et al. 2000) . In California, it occurs in the California Floristic Province and Great Basin Floristic Province bioregions (Hickman 1993).

In Yosemite, bull thistle is common throughout middle elevations (below 8,500 feet) in both front-country and back-country areas. It is found in nearly all Yosemite Valley meadows, as well as along roadsides near Crane Flat, and in disturbed areas in the Mariposa Grove (Botti 2001).

Genista monspessulana

Common Name: French Broom
Family: Fabaceae
Listed: Cal-IPC (high); USGS (1); CDFA (C)
French broom *(Genista monspessulana)* is an upright evergreen shrub that grows up to 16.5 feet tall. French broom becomes reproductive at two to three years of age. It flowers from March to July, and seeds survive at least five years in soil. Seedlings and mature plants alike can easily re-sprout after cutting (Bossard, Randall et al. 2000) . French broom commonly grows in disturbed places at elevations up to 1,640 feet (Hickman 1993). French broom is considered an ecological threat for many reasons. French broom is a strong competitor and can dominate a plant community, forming dense monospecific stands that shade out tree seedlings and displace native plant and forage species. Its foliage and seeds are toxic; infestations of broom degrade wildlife habitat quality and displace native forage species. It burns readily and carries fire to the tree canopy layer, increasing both the frequency and intensity of fires. It can also change microclimate conditions at soil levels (Bossard, Randall et al. 2000).

French broom is native to Mediterranean Europe and northwest Africa. Within California, french broom occurs in the Outer North Coast Ranges, Inner North Coast Ranges, San Francisco Bay Area, Outer South Coast Ranges, southern Channel Islands, Western Transverse Ranges, and the Peninsular Ranges (San Diego County) bioregions (Hickman 1993). Within these bioregions, it is most widespread along the coast, suggesting that it is invading the areas around the Central Valley (Gerlach et al. 2003).

In Yosemite, French broom has been found in the past, and has been controlled along the El Portal Road in the Merced River Canyon, Arch Rock entrance station, Happy Isles, and the El Portal administrative site.

Holcus lanatus

Common Name: Velvet Grass
Family: Poaceae
Listed: Cal-IPC (medium); USGS (2)
Velvet grass (*Holcus lanatus*) is a tufted perennial with erect or decumbent stems that are 60 to 200 centimeters high and velvety hairy. Velvet grass flowers from June to August, and reproduces through seeds (Joseph M. DiTomaso and Healy 2007). Velvet grass seed dispersal mechanisms are wind and ingestion by birds and animals. Seeds are found in bird droppings, dung, mud, and soil, in which seeds remain viable for over ten years (Gerlach et al. 2003). Velvet grass grows in moist, disturbed places around developments in the mixed conifer zone at elevations up to 5,250 feet (Botti 2001). The fibrous roots are deep especially in low-nitrogen soils (Joseph M. DiTomaso and Healy 2007).

Velvet grass is native to Europe and cultivated as feed for livestock. In California, velvet grass occurs in the California Floristic Province, Great Basin Floristic Province, and Mojave Desert bioregions (Hickman 1993).

Within Yosemite, velvet grass occurs generally (but not always) in wet areas at mid elevations, and has been found in one location above 6,560 feet. It is found throughout Yosemite Valley, in Wawona, the

Mariposa Grove, Hodgdon Meadow, Foresta, and the Hetch Hetchy area, as well as in back-country locations such as Pate Valley and Tiltil Valley.

Humulus lupulus

Common Name: European hop, Common hop, hops
Family: Cannabaceae
Listed: none
Hops (*Humulus lupulus*) is a perennial herb with a twining stem. Plants grow in disturbed places, persisting from cultivated plants, at elevations up to 9,850 feet. Hops also reproduce vegetatively. Rhizomes can grow very quickly, allowing the plant to spread quickly and out-compete other species (Hickman 1993).

Hops is native to Eurasia and brought to the U.S. as a cultivar, often cultivated as an ornamental and major source of aroma and flavor of beer. In California, hops is found in the Outer North Coast Ranges, northern and central Sierra Nevada Foothills, South Coast, and Western Transverse Ranges (Hickman 1993).

Hops was likely introduced to Yosemite by early European settlers. In Yosemite Valley, hops is found in parts of Cooks Meadow and the Yosemite Falls areas. Hops has also been found at the Wawona golf course.

Lathyrus latifolius

Common Name: Perennial sweet pea, everlasting pea
Family: Fabaceae
Listed: USGS (1)
Perennial sweet pea (*Lathyrus latifolius*) is a perennial vine with robust stems that are distinctly winged. It reproduces by rhizomes vegetatively and by seed. Perennial sweet pea flowers from May to September. The fruiting pods and vegetation are toxic to livestock and humans, resulting in a degenerative motor neuron disorder (Joseph M. DiTomaso and Healy 2007).

Perennial sweet pea is native to Eurasia and northern Africa, and was likely introduced to the U.S. as an ornamental. It can be found throughout much of coastal and central California within the California Floristic Province (Hickman 1993).

Yosemite perennial sweet pea is known as an escaped ornamental in Yosemite Valley, El Portal, and Foresta.

Lepidium latifolium

Common Names: Perennial Pepperweed, slender perennial peppercress
Family: Brassicaceae
Listed: Cal-IPC (high); CDFA (B)
Perennial pepperweed *(Lepidium latifolium)* has multiple stems and grows in erect colonies up six feet tall from a semi-woody stem base. It flowers from June to August, and produces small, flattened pods. Perennial pepperweed rarely produces seedlings in the field, and the seeds lack a hard seed coat and lose

viability rapidly. The plant mainly propagates clonally from its brittle rhizome-like vigorously creeping roots that can penetrate to depths of ten feet, and new plants spring from root sections as small as two inches. Perennial pepperweed is highly competitive and spreads quickly (Joseph M. DiTomaso and Healy 2007). Water acts as the main mechanism for root dispersal. Perennial pepperweed can invade a wide range of habitats, including riparian areas, wetlands, marshes, and floodplains at elevations up to 6,250 feet. It adapts readily to natural and disturbed wetlands. As it establishes and expands, the plants create large monospecific stands that displace native plants and animals. It also adversely affects food quality and nesting habitat for native birds (Boelk 2003).

Perennial pepperweed is native to Eurasia. Infestations have been reported in coastal, intermountain, and mountainous areas in New England, and all the states west of the Rocky Mountains except Arizona. It also occurs in Canada and Mexico (Boelk 2003). In California, perennial pepperweed occurs throughout the state, except in the Klamath and Desert ranges (Hickman 1993).

In Yosemite, perennial pepperweed has been found in Foresta.

Leucanthemum vulgare

Common Name: Ox-eye daisy
Family: Asteraceae
Listed: Cal-IPC (medium); USGS (1)
Ox-eye daisy (*Leucanthemum vulgare*) is a prostrate perennial herb with stems that sprout laterally from a creeping rootstock. Ox-eye daisy spreads both vegetatively and through seed production. Vegetative spread is accomplished through rhizomes (Bossard, Randall et al. 2000). Each plant can produces an abundant amount of seeds that can remain viable in soil for up to 39 years. Seeds disperse by adhering to animals, clothing, dung, hay, and wildflower mixes (Gerlach et al. 2003). Due to ox-eye daisy's prolific seed production and ability to spread through rhizomes, it can exclude other vegetation from an area, thereby decreasing biodiversity (Bossard, Randall et al. 2000). Ox-eye daisy grows in disturbed areas and around developments in meadows and grassy places in the mixed conifer zone at elevations up to 4,530 feet (Botti 2001). Ox-eye daisy often grows in poor soils, but it will thrive in moist clay soil conditions (Joseph M. DiTomaso and Healy 2007).

Ox-eye daisy is native to Europe, and escaped cultivation as an ornamental in all of the contiguous United States (Joseph M. DiTomaso and Healy 2007). In California, ox-eye daisy can be found in the North Coast Range and the Sierra Nevada (Bossard, Randall et al. 2000).

In Yosemite Valley, ox-eye daisy has been reported at the North Pines Campground, Yosemite Lodge, and Concession Stables. It is also widespread in Foresta and the Big Meadow area, as well as in Yosemite West.

Robinia pseudoacacia

Common Name: Black Locust
Family: Fabaceae
Listed: Cal-IPC (low)
Black locust is a fast growing tree that can reach 40 to 100 feet in height at maturity. Black locust reproduces vigorously by root suckering and stump sprouting to form groves (or clones) of trees interconnected by a common fibrous root system. Physical damage to roots and stems increases suckering and sprouting. Although black locust produces abundant seeds, they seldom germinate. Black locust populations easily spread into natural areas, where their shade reduces competition from other plants. Dense stands of black locust create shaded islands with little ground vegetation. Flowers of black locust compete with native plants for pollinating bees (Wieseler 2006). Black locust also inhabits roadsides, riparian areas, canyon slopes, disturbed woodlands, and floodplain forests. This species does not tolerate excessive shade and soil moisture (Joseph M. DiTomaso and Healy 2007).

Black locust is native to the southeastern United States. It is distributed outside of its native range in the United States in the northeastern and western states, as well as Texas (Wieseler 2006).

Black locust populations are found in Yosemite Valley between the chapel and Sentinel Bridge, in Cook's Meadow, the trailhead to Four Mile trail, along Southside Drive, along the Merced River near El Capitan Bridge, in Lower River Campground, in the Merced River Gorge, and along the Merced River in the El Portal Administrative Site.

Rubus discolor (R. armeniacus)

Common Name: Himalayan Blackberry
Family: Rosaceae
Listed: Cal-IPC (high); USGS (1)
Himalayan blackberry is a bramble-forming perennial that can grow up to several feet high. Stems are five-angled and have many prickles that are wide at the base, generally becoming somewhat curved. Flowering occurs from May through September. Himalayan blackberry reproduces both vegetatively and through sexual and asexual seed production. Vegetatively, Himalayan blackberry spreads through vigorous sprouting of roots and suckers; in addition, canes can root from its apices (Bossard, Randall et al. 2000) . Fruits are readily eaten, and the seeds disperse long distances within animal scat, especially that of birds (Joseph M. DiTomaso and Healy 2007). In 2005, fungal rust called *Phragmidium violaceum*, discovered on the Oregon coast, caused significant damage to Himalayan blackberry. This plant has currently spread to California, and may be found to be an effective bioagent against Himalayan blackberry (Joseph M. DiTomaso and Healy 2007). Strategies to control blackberry include cutting and burning of stems in the fall, which can prevent tip rooting; repeat cutting during flowering exhausts root stores. Goats can decimate new growth patches effectively. The most effective control strategy for blackberry is the use of systemic herbicide in the summer to early fall (Joseph M. DiTomaso and Healy 2007).

Blackberry is native to Armenia, and spread as a common garden escape in Eurasia, South Africa, Australia, the United States, and New Zealand (Joseph M. DiTomaso and Healy 2007). In western North America, Himalayan blackberry occurs from California to British Columbia. In California, it is found in

the Coast Ranges, the Central Valley, and the Sierra Nevada foothills and mountains (Bossard, Randall et al. 2000).

Within Yosemite, approximately 40 acres of Himalayan blackberry exist in Yosemite Valley; it occurs in meadows and other lightly forested, seasonally wet areas. Himalayan Blackberry also occurs in El Portal, at the Arch Rock entrance station, and is known to occur in at least one Wilderness location. It likely occurs in similar habitats throughout the park

Rubus laciniatus

Common Name: Cut-leaved blackberry
Family: Rosaceae
Listed: USGS (1)
Cut-leaved blackberry (*Rubus laciniatus*) is a bramble forming perennial that can grow up to 10 feet tall. Cut-leaved blackberry reproduces vegetatively and through both sexual and asexual seed production. Vegetatively, cut-leaved blackberry spreads through vigorous sprouting of roots and suckers. Fruits are readily eaten, and the seeds disperse long distances within animal scat, especially that of birds. Cut-leaf blackberry flowering occurs from May through July. Similar management strategies to control Himalayan blackberry are effective at controlling cut-leaf blackberry (Joseph M. DiTomaso and Healy 2007).

Cut-leaved blackberry is native to Eurasia, and was likely introduced to the U.S. as a food crop or an ornamental. In California, cut-leaved blackberry occurs in the Coast Range, the Central Valley, and the Sierra Nevada foothills and mountains (Hickman 1993).

In Yosemite, cut-leaved blackberry grows at mid elevations in disturbed areas, and is often associated with *Rubus discolor*. It is established in Yosemite Valley and the Wawona areas (Botti 2001).

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