National Park Service
U.S. Department of the Interior

SOUTHEAST UTAH GROUP:
Arches National Park, Canyonlands National Park,
Hovenweep National Monument and Natural Bridges National Monument.

Exotic Plant Management Plan
Environmental Assessment/Assessment of Effect
February 2009

Salt Creek in Canyonlands National Park, Riparian Area with Tamarisk

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Environmental Assessment/Assessment of Effect

February 2009

Exotic Plant Management Plan

Southeast Utah Group

SUMMARY

Exotic plants occupy approximately 2.6 million acres in the national park system, reducing the natural diversity these places were set aside to protect. At the Southeast Utah Group Parks (SEUG), the National Park Service proposes to use a proactive, integrated approach to manage exotic plant infiltration and establishment. The SEUG consists of Arches and Canyonlands National Parks and Hovenweep and Natural Bridges National Monuments.

This environmental assessment examines in detail two alternatives: No action and the National Park Service preferred alternative. The preferred alternative includes the judicial use of mechanical, cultural, chemical, and biological control techniques, based on a thorough analysis of the problems and a balanced approach to solutions.

Currently, there are 92 exotic plant species found within the four park units of the Southeast Utah Group. Most of these plants are innocuous additions that have currently accounted for the degradation of some native species and can become future problems. This plan proposes to treat approximately 21 of these species because they are exotic, aggressive, and can have detrimental effects on native communities. Other species may be treated in future years if time, funding, thorough analyses, and scientific knowledge show that doing so will truly help the ecosystem and is feasible.

In this plan, the environmental consequences of each of these alternatives are evaluated. The impacts to physical, biological and cultural resources, Wilderness, and the human environment are also analyzed. The assessment of effect of exotic plant treatments on cultural resources is also analyzed.

PUBLIC COMMENT

We welcome your comments on this Exotic Plant Management Plan and Environmental Assessment/Assessment of Effect (EPMP EA/AEF). This EPMP EA/AEF is available online on the National Park Service Planning, Environment, and Public Comment website at http://parkplanning.nps.gov under Canyonlands NP/Southeast Utah Group. A hardcopy of the plan will be available at the Grand County Library as well as the Southeast Utah Group Headquarters building. The public review period will be open for 30 days; comments are due by March 6, 2009. To comment, please document comments online, or write to this address: Superintendent, Attn: Exotic Plant Management Plan, Southeast Utah Group, 2282 West Resource Blvd., Moab, Utah 84532-3298 or email: CANY_superintendent@nps.gov.

Please note that names and addresses of people who comment become part of the public record. **If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment.** We will make all submissions from organizations, businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses available for public inspection in their entirety.

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List of Abbreviations

ACHP	Advisory Council of Historic Properties
AEF	Assessment of Effect
APHIS	Animal and Plant Health Inspection Service
ARCH	Arches National Park
ATV	All Terrain Vehicle
BLM	Bureau of Land Management
BMP	Best Management Practice
CANY	Canyonlands National Park
CE	Categorical Exclusion
DOI	Department of Interior
ESA	Endangered Species Act
EPMP	Exotic Plant Management Plan
EPMT	Exotic Plant Management Team
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
HOVE	Hovenweep National Monument
IPM	Integrated Pest Management
I & M	Inventory and Monitoring Program
MSDS	Material Safety Data Sheet
NABR	Natural Bridges National Monument
NEPA	National Environmental Policy Act
NHPA	National Historical Protection Act
NPS	National Park Service
SEUG	Southeast Utah Group
SHPO	State Historic Preservation Office
USACE	U. S. Army Corps of Engineers
USEPA	U. S. Environmental Protection Agency
USFWS	U. S. Fish and Wildlife Service
USFS	U. S. Forest Service

Definitions
Several terms are defined to facilitate understanding of this EPMP EA/AEF:

Native Plant – The NPS defines native plants as all species that have occurred or now occur as a result of natural processes on lands designated as units of the national park system. Native species in a place are evolving in concert with each other (NPS 2006). A goal of the NPS is to perpetuate native plants and animals as part of the natural ecosystem.

Exotic Plant – The NPS defines exotic species as those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Because exotic species did not evolve in concert with the species native to the place, it is not a natural component of the natural ecosystem at that place (NPS 2006).

Invasive Exotic Plant - An aggressive exotic plant that is known to displace native plant species in otherwise intact native vegetation communities. Invasive exotic species are unwanted plants that are harmful or destructive to humans or other organisms. Not all

exotic plants are invasive. This plan addresses only those exotic plants that are determined to be invasive.

State Listed Noxious Weeds – Exotic plants prohibited or restricted by Utah state law. Many of the exotic plants known to occur in the SEUG parks fall into this category (please refer to Table 1-1 on page 10). Transporting seed or parts of these plants or allowing them to seed on one's property is prohibited.

Integrated Pest Management (IPM) - *also referred to as Integrated Weed Management (IWM*) - A decision-making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage, by cost effective means, while posing the least possible risk to people, resources, and the environment (NPS 2003).

IPM Control Techniques defined:

Biological: Deliberately introducing insects, mammals or pathogens to stress exotic plants.

Chemical: Applying herbicides according to label requirements to kill or severely stress exotic plants.

Cultural: Cultural control can have a variety of interpretations within IPM. Some managers define it as referring to actions taken that require change in human behavior or thought processes. This definition more closely describes this document's use of prevention strategy implementation and therefore is further expressed as Best Management Practices (BMPs) under prevention techniques. For purposes of this document, cultural control is defined as providing competition, stress, or control of exotic species through the use of prescriptive fire, or by establishing native, desirable vegetation through various means (e.g. restoration, re-vegetation, etc.).

Mechanical/Manual: Using your hands and/or mechanical or simple tools to uproot or remove the above ground portion of plants by mowing, digging, pulling, and cutting seed heads and plants.

Prevention: Preventing or reducing the likelihood of future weed infestation establishment.

Eradicate – Completely eliminating all weed plants, including live roots, rhizomes, and seeds. Eradicating a weed species within a management area is very difficult unless it is present in small populations or numbers.

Suppress – To reduce abundance of a weed species, typically as measured or estimated in terms of canopy cover or plants density.

Contain – To confine an infestation so it does not expand, but does not usually mean reducing the current infestation.

CHAPTER 1- PURPOSE AND NEED

1.1 INTRODUCTION

The National Park Service (NPS) proposes to implement an Exotic Plant Management Plan (EPMP) for the park units of the Southeast Utah Group (SEUG) to control exotic or non-native plants in the four park units that comprise the SEUG. See Figure 1 for location of these units within Utah and Colorado. These park units include:

1) Arches National Park (ARCH)
2) Canyonlands National Park (CANY)
3) Hovenweep National Monument (HOVE)
4) Natural Bridges National Monument (NABR)

The NPS has prepared this Environmental Assessment/Assessment of Effect (EA/AEF) in compliance with the National Environmental Policy Act (NEPA), §106 of the National Historic Preservation Act and other relevant Federal and State laws to determine the most appropriate and safe methods for implementing an "integrated" treatment of noxious or exotic weeds. The intent of this project is to manage exotic plants to reduce their negative effects on native plant communities and other natural and cultural resources within these park units. This Southeast Utah Group Exotic Plant Management Plan and Environmental Assessment/ Assessment of Effect (EPMP/EA/AEF) was developed to reduce the negative environmental effects of exotic plants.

For the purposes of this document the term "weed" will refer to alien plants whose presence and/or introduction does or is likely to cause economic or environmental harm, or harm to human health (Executive Order 13112, 1999). Exotic plants are species that occur outside of their native ranges as a result of direct or indirect human actions. Exotic plants replace native plant communities, degrade wildlife habitats, and reduce the biological diversity of ecosystems.

This chapter describes the scope, purpose, and need for this project. A summary of the history of each park unit and associated exotic plant management issues is also provided. This chapter is organized into the following sections:

1.2 Purpose for Taking Action
1.3 Need for Taking Action
1.4 Relationship to Other Park Plans and Projects
1.5 Appropriate Use
1.6 Background and History of Each Park Unit
1.7 Scoping
1.8 Impact Topics Selected for Analysis
1.9 Impact Topics Considered, but Eliminated from Further Analysis

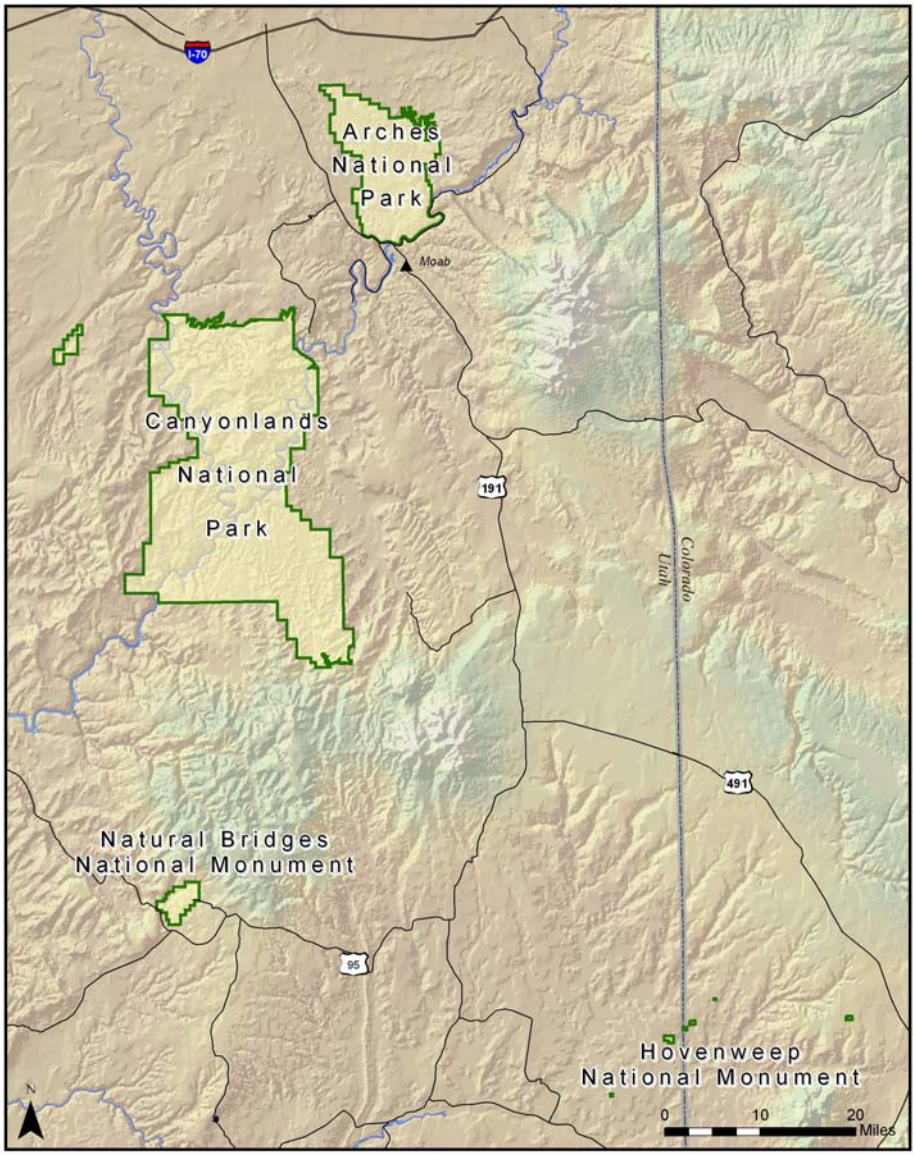


Figure 1. Location of the four park units of the Southeast Utah Group.

This document discloses the planning and decision-making process and the direct, indirect, and cumulative environmental impacts of weed treatments that would result from the proposed action and alternatives. This analysis of environmental consequences was prepared to adequately understand the consequences of the impacts of the proposed action and to involve the public and other agencies in the decision-making process. In implementing this proposal, the NPS will comply with all applicable laws and executive orders. Appropriate federal, state, and local agencies have been contacted for input, review, and permitting in coordination with legislative and executive requirements.

This EPMP EA/AEF is prepared in accordance with regulations of the Council on Environmental Policy Act (CEQ) (40 CFR 1500 et seq.) and part 516 of the U.S. Department of the Interior's Departmental Manual (516 DM). The National Environmental Policy Act (NEPA) is the basic national charter for environmental protection; among other actions it calls for examination of impacts on components of affected ecosystems. §106 of the National Historic Preservation Act of 1966 (as amended through 2000) mandates that Federal agencies take into account the effects of their actions on properties listed or eligible for listing in the National Register. The Southeast Utah Group Parks are developing an Assessment of Effect in conjunction with this EPMP EA/AEF to meet its obligations for NEPA and under §106, in accordance with the Advisory Council on Historic Preservation's regulations implementing §106 (36 CFR 800.8, Coordination With the National Environmental Policy Act).

This EPMP EA/AEF includes an analysis of potential impacts of each proposed treatment on various resource categories. The broad nature of this EPMP EA/AEF will allow parks to implement individual actions at each park unit included in this EPMP EA/AEF document. For future exotic plant management actions, parks would use the decision making tree "Confirm Compliance of Treatment Method with an Existing NEPA document" in Appendix A to determine the NEPA compliance needed. For actions that are consistent with those evaluated in this EPMP EA/AEF, the NEPA process would often end with a memo to file.

1.2 PURPOSE FOR TAKING ACTION

The purpose of this EPMP EA/AEF is to use an integrated approach to eradicate, contain, control, and prevent targeted weeds within the park units of the SEUG. The desired goal is to contain or control the spread of exotic species, and eradicate species that are the most exotic and pose the greatest threat to the biological diversity within SEUG park units, and prevent any new weeds from becoming established. The resulting pro-active management of these plants will promote the ecosystem health of the park's diverse native communities by maintaining and improving native forbs and grass species, increasing the regeneration of native cottonwoods and willows in riparian corridors, and ultimately preventing the loss of wildlife habitat and species diversity.

Under DO-12, "purpose" is defined as a statement of goals and objectives that the NPS intends to fulfill by taking action. Under this definition, the objectives of this EPMP are to:

1. Restore native plant communities to reduce the need for ongoing exotic plant management.
2. Prevent unacceptable levels of exotic plant damage, using environmentally sound, cost effective management strategies that pose the least possible risk to people, park resources, and the environment.
3. Develop an EPMP/EA/AEF that provides the necessary environmental compliance for exotic plant management treatments at the four SEUG park units.

4. Standardize exotic plant management at parks so their actions can be more effectively implemented by park managers and explained to the public.

1.3 NEED FOR TAKING ACTION

Under DO-12, "need" is described as an existing condition that should be changed, problems that should be remedied, decisions that should be made, and policies or mandates that should be implemented. Under this definition, the following needs have been identified for this project:

Existing conditions that should be changed:

- A comprehensive exotic plant management plan is needed to reduce the threat of exotic plants to these natural and cultural resources, including cultural landscapes, at the four park units of the SEUG.

Problems that should be remedied:

- An EPMP/EA/AEF is needed to achieve compliance with NEPA for future exotic plant management projects. Resource managers need access to more exotic plant management tools. This EPMP/EA/AEF will provide clearance for a number of treatment options, thus resource managers will be able to select and implement the most appropriate management approach in the future.

Decisions that should be made:

- A comprehensive evaluation of potential impacts associated with exotic plant management is needed to educate resource managers of the potential effects of various treatment methods. Resource managers also need standardized best management practices (BMPs) to mitigate potential impacts associated with management.
- Management activities need to be standardized among parks so that treatment methods can be more effectively implemented.
- A standardized decision-making process is needed so that management decisions can be easily communicated and justified to the public. A standardized process would also help park managers and their staff to educate the public about exotic plant management programs.

Policies or mandates that should be implemented:

- An EPMP/EA/AEF is needed to ensure that relevant policies and mandates are implemented.

1.3.1 Southeast Utah Group Needs

Controlling exotic plants in parks is one of the most serious cultural and natural resource protection challenges facing park managers. In the park units of the SEUG there are currently no planning documents that outline how to manage exotic plants or how to prioritize and plan control projects. Up to now, the SEUG park units have completed exotic plant surveys and mechanical control of some exotic plant species, but there has never been a comprehensive plan for vegetation management.

Out of the approximately 800 plant species found in the Southeast Utah Group parks, approximately 96 species are not native to this region. Experience in other parts of the country demonstrated that many exotic plants have the ability to eliminate all native plants within a given area in from 3-10 years (Sheley & Petroff 1999, Lesica & Shelley 1996, Tyser & Key 1988). Many exotic species can pose a serious threat to ecosystem diversity and have a high potential to harm native plants and wildlife, especially threatened, endangered and sensitive species.

Tamarisk, Russian olive, Russian thistle, the knapweeds, cheatgrass, and perennial pepperweed have established in many sectors of the SEUG park units and are of particular concern because of their aggressiveness and ability to eventually eliminate many other native plants. These exotic weeds often alter physical environmental conditions and/or natural disturbance regimes that allow the exotic plants to spread further and form exclusive monocultures. It has been documented that exotic weeds can alter the following environmental conditions: soil temperature, soil salinity, water availability, nutrient cycles, nutrient availability, native seed germination, infiltration and runoff of precipitation, and fire severity and frequency (DiTomaso 2000, Sheley & Petroff 1999, Belnap 1995).

Other common weeds of less environmental consequence in the SEUG include African mustard, tumbling mustard, the pigweeds, lambsquarters, halogeton, white sweet clover, yellow sweet clover, storksbill, crested wheatgrass, redtop, red brome, and bur buttercup. The effects of weed populations on native plants include a decline in ecosystem diversity and health, increases in bare soil resulting in declines in watershed condition, a decrease in the overall capacity of the land to support wild ungulates, and a reduction in the quality of habitat for many wildlife species that require native plants for either cover or food (Trammell & Butler 1995)

There have been 96 exotic plant species found within SEUG (Moran 2008); these can be found in Table 1-1. Twenty of these exotics are listed on the Utah and/or Colorado State Noxious Weed Lists (see Appendix B). It is mandated by law (Utah Noxious Weed Act of 1989 and Colorado Noxious Weed Act of 1996) that, if found, these noxious plants must be controlled due to their destructive capabilities towards human, animal and natural ecosystem health. Other than these twenty species, SEUG also considers a number of other exotics harmful to the natural diversity and integrity of SEUG resources.

Table 1-1. EXOTIC PLANT LIST OF SEUG AND THOSE PROPOSED FOR TREATMENT

Common Name	Scientific Name	Present in SEUG units	Proposed for Treatment

Common Name	Scientific Name	Present in SEUG units	Proposed for Treatment
African mustard	*Malcolmia africana*	A,C,H,N	
Alfalfa	*Medicago sativa*	A,C,H	
Alyssum	*Alyssum alyssoides*	C	
Annual wheatgrass	*Eremopyrum triticeum*	A, C	
Asparagus	*Asparagus officinalis*	A,C,H	
Barbwire tumbleweed	*Salsola paulsenii*	C	
Black locust	*Robinia pseudoacacia*	A	
Blue mustard	*Chorispora tenella*	A,C	
Broadleaf plantain	*Plantago major*	A,C	
Buffalobur	*Solanum rostratum*	C	
Bulbous bluegrass	*Poa bulbosa*	C,N	
Bull thistle	*Cirsium vulgare*	A,C	
Bur buttercup	*Ranunculus testiculatus*	A,C,H,N	
Burdock	*Arctium minus*	A,C,H	
Canada bluegrass	*Poa compressa*	N	
Canada thistle	*Cirsium arvense*	C,H,N	
Carolina poplar	*Populus x canadensis*	A,C	
Cheatgrass	*Bromus tectorum*	A,C,H,N	
Chicory	*Cichorium intybus*	H	
Chufa flat-sedge	*Cyprus esculentus*	A	
Clasping pepperweed	*Lepidium perfoliatum*	A, C, H	
Common catalpa	*Catalpa bignonioides*	A	
Common cocklebur	*Xanthium strumarium var. canadense*	A,C,H,N	**X**
Common dandelion	*Taraxacum officinale*	A, C, H, N	
Common horehound	*Marrubium vulgare*	A,C,H,N	**X**
Crested wheatgrass	*Agropyron cristatum*	A,C,H,N	**X**
Cultivated rye	*Secale cereale*	A	
Curly dock	*Rumex crispus*	A, H	
Dalmatian toadflax, broad-leaved	*Linaria dalmatica*	A, H	
Desert wheatgrass	*Agropyron desertorum*	A	
Diffuse knapweed	*Centaurea diffusa*	C	**X**
English plantain	*Plantago lanceolata*	A	
European wintercress	*Barbarea vulgaris*	C	
Field bindweed	*Convolvulus arvensis*	A,C,H,N	**X**
Falseflax	*Camelina microcarpa*	H	
Five-hook smotherweed	*Bassia hyssopifolia*	A,C,N	
Flixweed	*Descurainia sophia*	A,C,H	
Garden orach	*Atriplex hortensis*	H	
Giant ragweed	*Ambrosia trifida*	H	
Halogeton	*Halogeton glomeratus*	A,C,H	
Houndstongue	*Cynoglossum officinale*	A	
Intermediate wheatgrass	*Elymus hispidus*	C	
Japanese brome	*Bromus japonica*	C,H,N	
Johnson grass	*Sorghum halepense*	C	
Kentucky bluegrass	*Poa pratensis*	A	
Knotweed	*Polygonum aviculare*	N	
Lambsquarter	*Chenopodium album* var. *album*	A,C,N	
Licorice	*Glycyrrhiza glabra*	C	

Common Name	Scientific Name	Present in SEUG units	Proposed for Treatment
London mustard	*Sisymbrium irio*	N	
Musk mustard	*Chorispora tenella*	A,H	
Musk thistle	*Carduus nutans*	C	
Oats	*Avena fatua*	H,N	
Orchard grass	*Dactylis glomerata*	A,N	
Peach	*Prunus persica*	C	
Perennial pepperweed	*Lepidium latifolium*	A, C	**X**
Pitseed goosefoot	*Chenopodium album* var.*berlandieri*	A, H	
Prickly Lettuce	*Lactuca serriola*	A,C,H,N	
Puncturvine/Goathead	*Tribulus terrestris*	A,C,H,N	**X**
Purple amaranth	*Amaranthus cruentus*	H	
Purple loosestrife	*Lythrum salicaria L.*	A	**X**
Purslane	*Portulaca oleracea*	A,C	
Rabbit barley	*Hordeum murinum*	A,C	
Rabbitfoot grass	*Polypogon monspeliensis*	A,C,N	
Red brome	*Bromus rubens*	C,H,N	
Red mulberry	*Morus rubra*	A	
Redroot pigweed	*Amaranthus retroflexus*	N	
Redtop	*Agrostis stolonifera*	A,C,H,N	
Ripgut brome	*Bromus diandrus*	A,C	**X**
Russian knapweed	*Centaurea repens*	A,C,H	**X**
Russian olive	*Elaeagnus angustifolia*	A,C	**X**
Russian thistle	*Salsola tragus*	A,C,H,N	**X**
Saltcedar/Tamarisk	*Tamarix chinensis*	A,C,H,N	**X**
Siberian elm	*Ulmus pumila*	A, C	**X**
Smooth brome	*Bromus inermis*	C,H,N	
Spiny sow-thistle	*Sonchus asper*	A,C,H,N	
Spotted knapweed	*Centaurea maculosa*	A	
Storksbill	*Erodium cicutarium*	A,C,H,N	
Summer-kochia	*Bassia scoparia*	A,C	
Tall wheatgrass	*Elymus elongates*	C	
Timothy	*Phleum pratense*	A,C,N	
Tumble pigweed	*Amaranthus albus*	A,C,H,N	
Tumbling mustard	*Sisymbrium altissimum*	A,C,H,N	
Tumbling orach	*Atriplex rosea*	C	
Umbrella mallow	*Malva neglecta*	C,H	
Water bent	*Polypogon semiverticillatus*	C,N	
Water speedwell	*Veronica anagallis-aquatica*	A,N	
Watercress	*Nasturtium officinale*	A, N	
Wheat	*Triticum aestivum*	A	
White mulberry	*Morus alba*	A,C	
White poplar	*Populus alba*	A,C,N	
White sweet clover	*Melilotus albus*	A,C,H,N	**X**
Willowweed	*Polygonum lapathifolium*	A	
Winged pigweed	*Cycloloma atriplicifolia*	A, C	
Woolly mullein	*Verbascum thapsus*	A, C, H	
Yellow salsify	*Tragopogon dubius*	A,C,H,N	**X**
Yellow sweet clover	*Melilotus officinalis*	A,C,H,N	**X**

SEUG units: Arches National Park=**A**, Canyonlands National Park=**C**, Hovenweep National Monument=**H**, Natural Bridges National Monument=**N**

Twenty-one exotic weeds found in the SEUG parks, which may also be listed as a state noxious weed, have been targeted for control. A summary of each species can be found in Appendix C for habitats and treatment methods:

1. **Canada thistle** *(Cirsium arvense)*
2. **Common horehound** (*Marrubium vulgare*)
3. **Common cocklebur** (*Xanthium strumarium* var. *canadense*)*
4. **Crested wheatgrass** (*Agropyron cristatum)*
5. **Diffuse knapweed** (*Centaurea diffusa)*
6. **Field bindweed** (*Convolvulus arvensis)*
7. **Halogeton** *(Halogeton glomeratus)*
8. **Musk thistle** (*Carduus nutans)*
9. **Perennial pepperweed** (*Lepidium latifolium*)
10. **Puncturevine** (*Tribulus terrestris*)
11. **Purple loosestrife** (*Lythrum salicaria)*
12. **Ripgut brome** *(Bromus diandrus)*
13. **Russian knapweed** (*Centaurea repens*)
14. **Russian olive** (*Elaeagnus angustifolia*)
15. **Russian thistle** (*Salsola tragus)*
16. **Siberian elm** (*Ulmus pumila*)
17. **White sweet clover** (*Melilotus albus)*
18. **Tamarisk** (*Tamarix chinensis*)
19. **Tumble mustard (***Sisymbrium altissimum)*
20. **Yellow salsify** (*Tragopogon dubius*)
21. **Yellow sweet clover** *(Melilotus officinalis)*

* Native to N. America but invasive to SEUG

1.4 RELATIONSHIP TO OTHER PARK PLANS AND PROJECTS

Table 1-2, Relationship of EPMP/EA/AEF to Other Park Plans and Projects, shows the relationship of the proposed management decisions and actions to other federal, state, and local policies and plans.

Table 1-2. RELATIONSHIP OF SEUG/EPMP/EA/AEF TO OTHER PLANS

Park Unit	Policy Plan	Requirements/Goals/Objectives	Relationship
ARCH	General Management Plan 1989	Provides summaries of resource management plan principle proposals, estimate costs and needs for staffing and facilities.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the General Management Plan.
	Resource Management Plan 1996	Mitigate the impacts of exotic plants by feasible control methods wherever natural communities are threatened or where control methods are likely to be successful.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the Resource Management Plan

Park Unit	Policy Plan	Requirements/Goals/Objectives	Relationship
	Fire Management Plan 2005	Provides guidance to allow individual burns to be used for disposal of vegetative debris that is infeasible to dispose of by other means.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the Fire Management Plan
CANY	General Management Plan 1977	Provides summaries of resource management plan principle proposals, estimate costs and needs for staffing and facilities.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the General Management Plan.
	Resource Management Plan 1995	Control exotic plants by feasible control methods wherever natural communities are threatened or where control methods are likely to be successful and with consideration for cultural landscape values.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the Resource Management Plan
	Fire Management Plan 2005	Provides guidance to allow individual burns to be used for disposal of vegetative debris that is infeasible to dispose of by other means.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the Fire Management Plan
HOVE	General Management Plan	A Draft General Management Plan is currently being written.	The EPMP/EA/AEF will be consistent with the overall management directions and specific management requirements of the General Management Plan.
	Fire Management Plan 2005	Provides guidance to allow individual burns to be used for disposal of vegetative debris that is infeasible to dispose of by other means.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the Fire Management Plan
NABR	General Management Plan 1997	Protect and preserve the natural and cultural environments; to permit biological, geological and other natural processes to continue with a minimum of human disturbance.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the General Management Plan.
	Resource Management Plan 1996	Mitigate the impacts of exotic plants by feasible control methods wherever natural communities are threatened or where control methods are likely to be successful.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the Resource Management Plan
	Fire Management Plan 2005	Provides guidance to allow individual burns to be used for disposal of vegetative debris that is infeasible to dispose of by other means.	The EPMP/EA/AEF is consistent with the overall management directions and specific management requirements of the Fire Management Plan

1.5 APPROPRIATE USE

Sections 1.4 and 1.5 of *NPS Management Policies* (2006) direct that the National Park Service must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. A new form of park use may be allowed within a park only after a determination has been made in the professional judgment of the park manager that it will not result in unacceptable impacts.

Section 8.1.2 Of *NPS Management Policies* (2006:98) *Process for Determining Appropriate Uses*, provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for

- consistency with applicable laws, executive orders, regulations, and policies;
- consistency with existing plans for public use and resource management;
- actual and potential effects on park resources and values;
- total costs to the service; and
- whether the public interest will be served.

Park managers must continually monitor all park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it. More information on the definition of unacceptable impacts as cited in §1.4.7.1 of *NPS Management Policies* (2006:12) can be found in the *Environmental Consequences* chapter of this plan.

SEUG proposes a proactive approach to managing exotics plants. If left unchecked, exotics plants could spread to unmanageable levels and cause long-term harm to the park's natural and cultural resources. This plan provides the blueprint for managing exotic plants, while fulfilling the NPS mandate of protecting and preserving natural resources and the human environment. The plan's primary objectives are to eradicate, significantly reduce or contain populations of 20 species of exotics that may invade the parks in the future. The proposed plan is consistent with each park's general management plan and other related plans. With this in mind, the NPS finds that implementing an exotic plant management plan is both necessary and an acceptable use for the Southeast Utah Group parks.

1.6 BACKGROUND AND HISTORY OF EACH PARK UNIT

The following sections provide a brief description, history, and describe the purpose of each SEUG park unit, followed by a summary of exotic plant management at each of the parks. Exotic plant management issues and current control strategies for each park unit are also described. Figure 1 shows the location of each park unit in the SEUG area. Table 1-3 includes a summary of current exotic plant management priorities at each park unit. With regards to the Green and Colorado River corridors, many non-native plant species are found and some areas are profoundly populated with exotics, but until more thorough mapping of these plants can be completed, priority sites will be burn areas and areas heavily used by visitors. Other species may become management priorities in the

future. A summary of each exotic species discussed in this document is provided in Appendix C.

Table 1-3. SUMMARY OF CURRENT EXOTIC PLANT MANAGEMENT PRIORITIES

ARCHES	CANYONLANDS	HOVENWEEP	NATURAL BRIDGES
VC Complex: *Punctureveine, Russian thistle*	Salt Creek-near gate: *Tamarisk*	Square Tower: *Tamarisk*	Entrance Area: *Common horehound*
Willow Springs: *Tamarisk*	NEEDLES Main Park Road: *Crested Wheatgrass*	Goodman Point: *Canada thistle, Musk thistle*	Entrance Road to the Monument: *Tumble mustard*
Courthouse Wash: *Tamarisk, Siberian Elm, Russian olive*	Upheaval Bottom: *Tamarisk*	Hackberry: *Tamarisk*	Armstrong Canyon Bottom: *Tamarisk*
Salt Valley Wash: *Tamarisk, Russian knapweed*	East side of Green River (park boundary to Queen Anne Bottom): *Russian Knapweed*		White Canyon Bottom: *Crested wheatgrass*
Winter Camp Wash: *Tamarisk*	ISKY Entrance Road: *Crested wheatgrass, Intermediate Wheatgrass*		
Wolfe Ranch: *Tamarisk, Russian knapweed*	Green River Overlook: *Halogeton*		
Upper Salt Wash: *Tamarisk* *Russian knapweed*	Willow Flat Area: *Halogeten*		
Lost Spring Canyon: *Tamarisk*	Aztec Butte: *Diffuse knapweed*		
Cottonwood Canyon: *Russian knapweed, Yellow sweetclover*	Anderson Bottom: *Russian knapweed*		
Cordova Canyon: *Russian knapweed, Yellow sweetclover*	Tuxedo Bottom: *Russian knapweed*		
Fish Seep Draw: *Tamarisk*	Turks Head Bottom: *Perennial pepperweed*		
Park Main Roadside (south of Courthouse Wash): *Punctureveine*	Green River Corridor Sites: >50 scattered *Russian olives.*		
	Spanish Bottom: *Russian knapweed, Perennial pepperweed, Punctureveine.*		
	Squaw Flat Campground: *Crested wheatgrass* *Punctureveine, Field Bindweed* *Creasted Wheatgrass*		

1.6.1 Arches National Park (ARCH)

Size
76,519 acres (30,979 hectares)

Park History and Purpose of ARCH
Arches National Monument was established by Presidential Proclamation No. 1875 on April 12, 1929. The monument was specifically set aside due to its outstanding and unusual geologic features. The proclamation states that the monument was established "to protect extraordinary examples of wind erosion in the form of gigantic arches, natural bridges, "windows", spires, balanced rocks and other unique wind-worn sand-stone formations, the preservation of which is desirable because of their education and scenic value". Geologic research has since established that water is the primary agent of erosion involved, although wind does play a role.

In 1938 the monument was enlarged to include a number of historic and prehistoric cultural sites. Later boundary adjustments were made on November 15, 1938; July 26, 1960; January 21, 1969; November 12, 1971. In 1971 the designation for Arches was changed from a National Monument to a National Park and the acreage was also increased to 73,379 acres (29,708 hectares). In 1999, the Lost Spring section was added to the park, which increased the total area by 3,100 acres to 76,519 acres.

Location
Arches National Park is located in southeast Utah along and north of the Colorado River in Grand County, see Figure 3. The park is five miles (8.3 kilometers) north of Moab, Utah, 100 miles (166.7 kilometers) west of Grand Junction, Colorado, and 240 miles (400 kilometers) southeast of Salt Lake City, Utah. The park is readily accessible by major travel routes such as Interstate I-70 located 20 miles (33.3 kilometers) north of the park headquarters; Utah Highway 191 runs from Interstate I-70 south to Moab and accesses the park entrance road.

The area surrounding the park (Grand County) is sparsely populated with a density of two people per square mile (0.8 people per square kilometer). Tourism is currently the most important economic activity.

Elevation
The elevation within the park ranges from approximately 4,000 feet in the canyons to 5,200 on the rims.

General Description
Arches National Park has the largest concentration of natural stone arches in the world. Examples of developing, complete, and collapsed arches are all evident within the 114 square miles of the park. Several arches are particularly noted for their outstanding size and erosional history. Landscape Arch is probably the longest natural stone arch in the world. Delicate Arch, a freestanding arch carved from what was once a freestanding fin, is internationally recognized.

The park is 16 miles (26.7 kilometers) from north to south and 8 miles (13.3 kilometers) from east to west. There are a total of 76,519 acres (30,979 hectares) of land within the legislative boundaries of the park. The topography of the area is diverse, ranging from open flats to steep-walled cliffs. The area has been greatly affected by geologic activity associated with the salt intrusions of the Paradox formation and the landscape has been carved by the effects of wind and water and preserved by the arid climate and lack of earthquake activity. This has produced a landscape dominated by red sandstone formations such as arches, fins, balanced rocks, mesas, canyons and spires. Major topographic features of Arches National Park are Courthouse Wash, Courthouse Towers, The Windows Section, Salt Valley, Klondike Bluffs, Devil's Garden and the Fiery Furnace. Some of the more famous geologic structures in the park are Landscape Arch, Delicate Arch, Tower Arch, the Marching Men, Skyline Arch, the Three Gossips, the Three Penguins, the Windows, the Parade of Elephants, Balanced Rock and the Great Wall. There are more than 2,000 catalogued arches within the park that have a span greater than three feet.

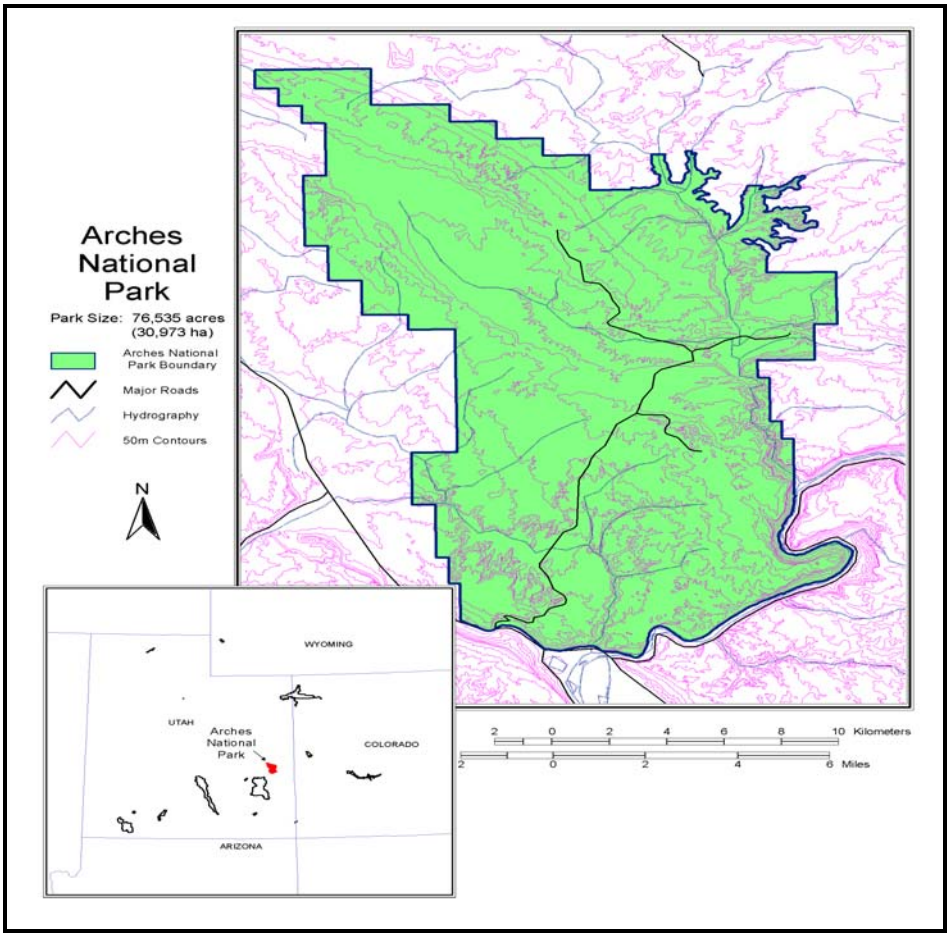


Figure 2. Map and Location of Arches National Park.

Arches National Park is largely covered by exposed bedrock, weakly developed soils and sand dunes. The park was established because of its unique geologic features, in

particular the massive, spectacular natural rock arches formed in the Entrada Sandstone. The geology of Arches National Park is largely determined by the collapsed salt anticline in Salt Valley and to a lesser extent by the collapsed Moab and Cache Valley anticlines. There are ten major sedimentary formations exposed in the park ranging in age from the Pennsylvanian Paradox Formation to the Cretaceous Mancos Shale. In stratigraphic order, formations include Paradox, Honaker Trail, Cutler Group, Moenkopi, Chinle, Wingate Sandstone, Kayenta, Navajo Sandstone, Entrada, Morrison, Cedar Mountain, Dakota Sandstone and Mancos Shale. The Paradox Formation of salt and gypsum evaporates is a highly plastic formation which has formed the salt anticlinal structures in the park, which collapsed when ground water eroded the salt. The Navajo and Entrada Sandstones crop out over most of the park's surface, with the Entrada forming the majority of the outstanding geologic features. The cliff-forming Wingate Formation exposed along the Colorado River forms the south boundary of the park. Together with the associated Kayenta, Chinle and Moenkopi formations, it forms impressive eight hundred foot cliffs.

Several areas of pictographs and petroglyphs are found within the park. Two archeological surveys have been made in the park and approximately 239 sites have been documented. The Courthouse Wash Rock Art Panel is listed on the National Register of Historic Places. The panel represents the easternmost known occurrence of the Barrier Canyon Style.

Physical remains of early ranching and mining pursuits, as well as traces of pioneer routes, exist within the park.

Climate
The climate of Arches National Park is arid. It is characterized by hot, dry summers and cool to cold winters. From 1980 to 2007, the average annual precipitation of the area is 8.87 inches. Mean annual temperature is 56 degrees Fahrenheit (13.3 degrees Celsius) and the extreme temperatures are -16 degrees Fahrenheit (-26.7 degrees Celsius) and 112 degrees Fahrenheit (44.4 degrees Celsius) (Brough et al. 1987). Potential evapotranspiration exceeds precipitation, making effective soil moisture a critical environmental factor. Rainfall generally falls every month of the year, with monthly rainfall averaged since 1980 ranging from .41 inches in June to 1.28 inches in October. Snow falls generally between November and March (WRCC 2008).

1.6.2 Canyonlands National Park (CANY)

Size
337,370 acres (136,587 hectares)

History and Purpose of CANY
Efforts to turn Utah's canyon country into a national park began about 1935 when Secretary of the Interior Harold Ickes proposed setting aside 7,000 square miles of southeast Utah as Escalante National Monument. This effort was doomed by opposition

from state commercial interests and the demands of World War II (Smith 1991), but with the rise of the conservation movement in the 1960s, Senator Frank Moss, Secretary of the Interior Stewart Udall and locals such as Bates Wilson and Kent Frost took up the battle to preserve the "still untouched" canyon country near the confluence of the Green and Colorado Rivers. Their efforts resulted in congress and President Lyndon B. Johnson setting aside Canyonlands National Park on September 12, 1964. As stated in Public Law 88-590, Canyonlands was established "...to preserve an area in the State of Utah possessing superlative scenic, scientific, and archeological features for the inspiration, benefit, and use of the public...". This is the overriding legal mandate which guides the resource management program of the park today.

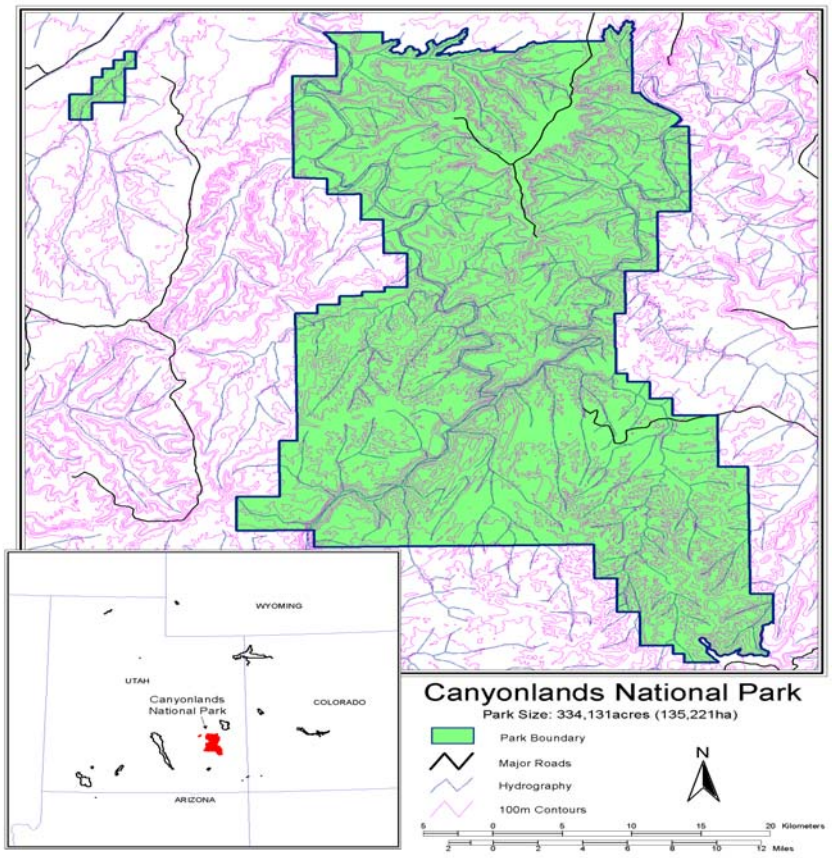


Figure 3. Map and Location of Canyonlands National Park

Location

Canyonlands National Park is located in southeast Utah along the Colorado and Green Rivers in Grand, Garfield, San Juan and Wayne Counties, see Figure 2. The park is southwest of Moab, Utah, 100 miles (166.7 kilometers) west of Grand Junction, Colorado, and 240 miles (400 kilometers) southeast of Salt Lake City, Utah. Parts of the park are readily accessible by major travel routes such as Interstate I-70 and Utah Highway 191.

The area surrounding the park is sparsely populated with a density of approximately two people per square mile (0.8 people per square kilometer). Tourism is currently the most important economic activity.

Elevation
The elevation within the park ranges from approximately 3,750 feet on the Colorado River south of Cataract Canyon to 7,180 feet above Big Pocket in the Needles District.

General Description
Canyonlands National Park has been expanded since it was originally established in 1964 to its present size of 337,370 acres centered around the confluence of the Green and Colorado Rivers. The rivers divide the park into three geographical districts: the Island in the Sky District is the triangle of land between the two rivers, the Needles District lies east of the Colorado River and the Maze District lies to the west of the Colorado and Green Rivers. The Horseshoe Canyon Detached Unit is managed as part of the Maze District. In addition, the Green and Colorado River corridors are managed as a separate River District of the park. In summary, the park is divided into the Island in the Sky, Maze, Needles and River districts.

From prehistoric Native Americans searching for chert outcrops, through the geological investigations of John Wesley Powell and other turn-of-the-century explorers, to uranium miners of the 1950s, the geologic resources of Canyonlands have been of major interest and importance. As a result of these explorers, miners and recreationists, geological publications on the park are widely available (Baars and Molenaar 1971; Huntoon, Billingsley and Breed 1982; Mutschler 1969) and the geological resources of the park are well-known.

For park visitors, probably the two most important geological features of the park are the uniquely banded red and white sandstone of the Cedar Mesa Formation (exposed in the Needles and Maze Districts) and the White Rim Sandstone exposed in the Island in the Sky District.

The incredible features of the park are the remote mesas, buttes, and deep canyons cut by the Green and Colorado Rivers and their tributaries. The park's name, Canyonlands, is derived from the geology term "Canyon Lands", which is defined as the province south of the Uinta Basin and between the High Plateaus on the west and the Rocky Mountains to the east. As explained by Stokes (1988), the park lies at the rugged and remote heart of the Canyon Lands section of the Colorado Plateau physiographic province in southeast Utah. The park is characterized by sedimentary rock, which has been deformed by anticlines, synclines and monoclines. Uplift of the Colorado Plateau and concurrent water erosion have produced the extensive, deep canyon systems which are the defining features of the park and of the physiographic section (Lammers 1991).

There are five major sedimentary formations exposed in the park ranging in age from the Pennsylvanian Paradox Formation to the Jurassic Navajo Sandstone. In stratigraphic order, formations include Paradox, Honaker Trail, Cutler Group, Moenkopi, Chinle,

Wingate Sandstone, Kayenta, and Navajo Sandstone. The Paradox Formation of salt and gypsum evaporates is a highly plastic formation which has formed the salt anticlinal structures and grabens in the park, which collapsed when ground water eroded the salt.

Climate
The climate of Canyonlands National Park is arid. It is characterized by hot, dry summers and cool to cold winters. Temperatures in the park vary with altitude and latitude (Brough et al. 1987). In the Needles District at an elevation of 5,040 feet the average maximum temperature is 68.30 F, the average minimum is 37.80 F. The average annual precipitation is 8.62 inches.

In the Island in the Sky at an elevation of 5,930 feet the average maximum temperature is 64.10 F, and the average minimum temperature was 42.20 F. Temperatures can reach as high as 1100 F and as low as -160 F. The normal annual precipitation is 9.27 inches.

Potential evapotranspiration exceeds precipitation, making effective soil moisture a critical environmental factor. Precipitation peaks occur in March and August. Snow falls between November and March.

1.6.3 Hovenweep National Monument (HOVE)

Size
784.3 acres (317.5 hectares)

Park History and Purpose of HOVE
Hovenweep National Monument was first established by Warren G Harding in 1923 by Presidential Proclamation 1654 (42 Statute 2299). The Proclamation states in part, "Whereas, there are in southwestern Colorado and southeastern Utah four groups of ruins, including prehistoric structures, the majority of which belong to unique types not found in other National Monument's, and show the finest prehistoric masonry in the United States; and …. It appears that the public good would be promoted by preserving these prehistoric remains as a National Monument with as much land as may be necessary for the proper protection thereof, … that there is hereby preserved, subject to prior valid claims and set apart as a National Monument to be known as Hovenweep National Monument …"

Subsequent Presidential Proclamations 2924, April 29, 1951; 2998, November 20, 1952, 3132, April 6, 1956; and Public Land Order 2604, February 5, 1962, added other areas and adjusted the boundaries of the monument. Given the proclamations listed above and the Organic Act of August 25, 1916 (Public Law 235, 39 Stat. 535) the National Park Service's mandate is to preserve and protect the cultural and natural resources associated with the six ruin groups, and to assist visitors in understanding the life and culture of the prehistoric inhabitants and their adaptation to the environment.

The resource values at HOVE consist of significant cultural resources and their associated pristine natural settings. The Cajon, Square Tower, Holly, Hackberry/Horseshoe, and Cutthroat units contain clusters of Ancestral Puebloans pueblos and towers situated near permanent springs at canyon-head locations on Cajon Mesa. These canyon rim towers and villages are the best preserved and protected, most visually striking, and accessible examples of 13the century Ancestral Puebloan architecture and community locations within the San Juan River Basin. Other archeological sites representative of paleo–Indian, archaic, and early Puebloan occupation are also found here. These five units are significant because of the large number of structures possessing a high degree of physical and locational integrity. In addition, the towers are noteworthy because of their many stylistic variations.

The Goodman Point unit consists of an immense pueblo in the Montezuma Valley, being excavated for the first time over just the last few years. These remains reflect its position as a regional center for the Mesa Verde Ancestral Puebloans, and it is the one of the best preserved sites in the West. It is the first archeological site set aside by the federal government, on September 13, 1889, and represents one of the largest 13th century villages in the San Juan Basin. These villages contain elements of public architecture such as great kivas, plazas, reservoirs, enclosing walls, etc.

Hovenweep also contains some of the best examples in the nation of ancient astronomical calendars that mark important seasonal events using architecture, rock art, and sunlight.

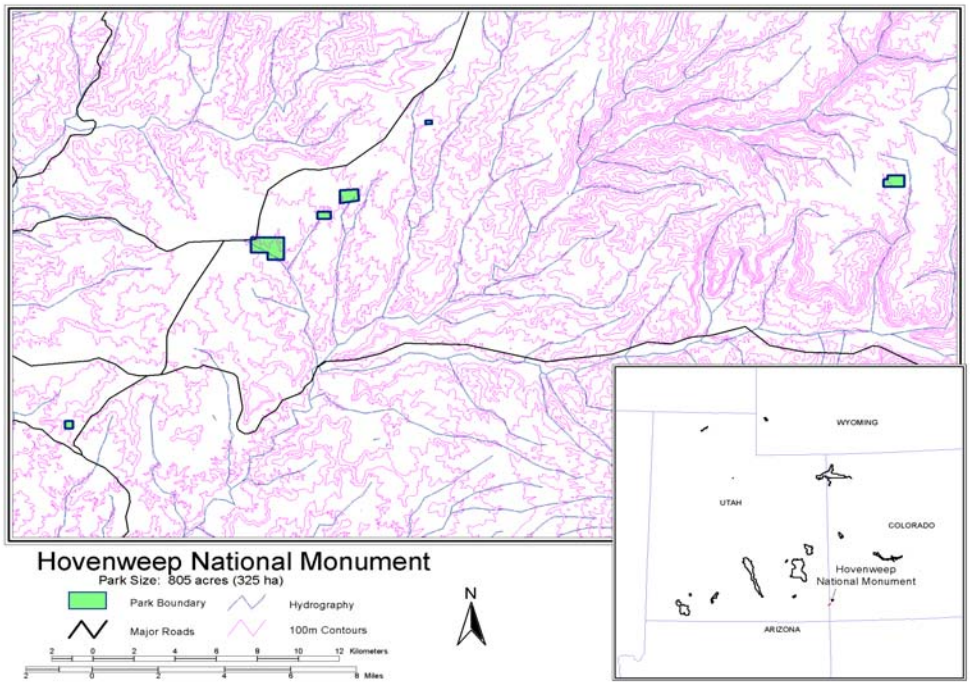


Figure 4. Location of Hovenweep National Monument.

Location

Hovenweep National Monument contains six distinct units situated in the Four Corners area, see Figure 5. The Square Tower and Cajon units are located in San Juan County,

Utah. The Goodman Point, Hackberry/Horseshoe, Holly, and Cutthroat units are located in Montezuma County, Colorado.

Elevation
The elevation within the monument varies from 5,200 feet at the Cajon unit to 6,760 at the Goodman point unit.

General Description
The natural environment at Hovenweep is characterized by rugged topography, with small canyons divided by narrow mesa tops. The primary geologic formation is Cretaceous age Dakota Sandstone. Shallow to deep aeolian soils are found on the mesa tops, with shallow colluvium on the canyon slopes, and shallow to deep alluvium in the canyon bottoms. While permanent water sources are limited, a few springs and seeps located in the canyon-heads produce water year-round. Residual water trapped in potholes or flowing in washes after rains or snow melt is seasonally available. Five of Hovenweep's six units are on Cajon Mesa, which covers approximately 500 square miles on the Colorado-Utah border near Four Corners. Although the topography is fairly uniform, variations in rainfall, soil type, and plant associations occur through minor elevation and drainage pattern differences. The northern half of the mesa is higher, cooler, and wetter supporting a pinyon-juniper forest. This part of the mesa is the most productive today growing dry land pinto beans, winter wheat, and alfalfa. Most of Hovenweep's units are in the juniper-sage and sage areas in the mid-section of the mesa.

Climate
The climate in this high desert environment is dry, with an average of 12 inches of precipitation per year. Temperatures range from winter lows of –10 to 0 degrees F to summer highs averaging 100 to 105 degrees F, with a mean annual temperature of 52 degrees F.

1.6.4 Natural Bridges National Monument (NABR)

Size
7,445.49 acres (3010.3 hectares)

Park History and Purpose of NABR
Established in 1908, Natural Bridges National Monument is Utah's oldest National Park area. A total of 120 acres were originally set aside around each of the three bridges based on President Theodore Roosevelt's original Proclamation No. 804, April 16, 1908, 35 Statute 2183. The main purpose for the monument was stated by President Roosevelt as follows:

> "Whereas, a number of natural bridges situated in southeastern Utah having heights more lofty and spans far greater than any heretofore known to exist, are of the greatest scientific interest, and it appears that the public interests would be

> promoted by reserving these extraordinary examples of stream erosion with as much land as may be necessary for the proper protection thereof..."

Later, the monument was enlarged to encompass 2,420 acres containing the three natural bridges, prehistoric structures, and cave springs, as stated in President William H. Taft's Proclamation No. 881, September 25, 1909, 36 Statute 2502:

> "...at the time this monument was created nothing was known of the location and character of the prehistoric ruins in the vicinity of the bridges, nor of the location of the bridges and prehistoric cave springs, also hereby reserved..."

The same area was resurveyed, and set aside by President Woodrow Wilson's Proclamation No. 1323, February 11, 1916, 39 Statute 1764:

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

In August of 1962, President John F. Kennedy's Proclamation No. 320 withdrew 320 acres of land around Snow Flat Spring Cave and Cigarette Spring Cave from the monument since these caves: "...no longer contain features of archeological value and are not needed for the proper care, management, protection, interpretation, and preservation of the monument." In this proclamation, he expanded the size of the monument, reiterated the public and scientific communities' interest in the preservation and protection of the bridges and prehistoric sites, and he set forth the main management objectives for the monument.

Location

The monument is located in San Juan County, Utah, 120 miles (200 kilometers) south of Moab, Utah (Figure 4). The area is accessible via Utah Highway 95 which connects Blanding, Utah with Hanksville, Utah. Blanding, Utah (population 3,100) is the nearest population center, located 40 miles (65 kilometers) east of the monument. The surrounding area (San Juan County) is sparsely populated, with a density of less than 1.5 people per square mile (0.6 people per square kilometer). The area surrounding the monument has never been settled by Anglos and has been used only for extensive livestock grazing and minor mining activities.

Elevation

The elevation within the monument varies from approximately 5,700 feet in the canyons to 6,400 on the rims.

General Description

Nowhere else are three such extraordinary natural bridges found in such close proximity to one another. These three bridges show three different stages of development from

youth (Kachina), to maturity (Sipapu), to old age (Owachomo). Together with the canyons in which they formed, these three bridges are excellent examples of the result of an entrenched meander stream system.

The monument was also created because of its well-preserved Ancestral Puebloan standing architecture. While archaeologists now recognize that these structural sites are common throughout the region, the presences of the well-preserved structural sites, as well as a range of archaeological sites from archaic through historic times make the monument highly significant.

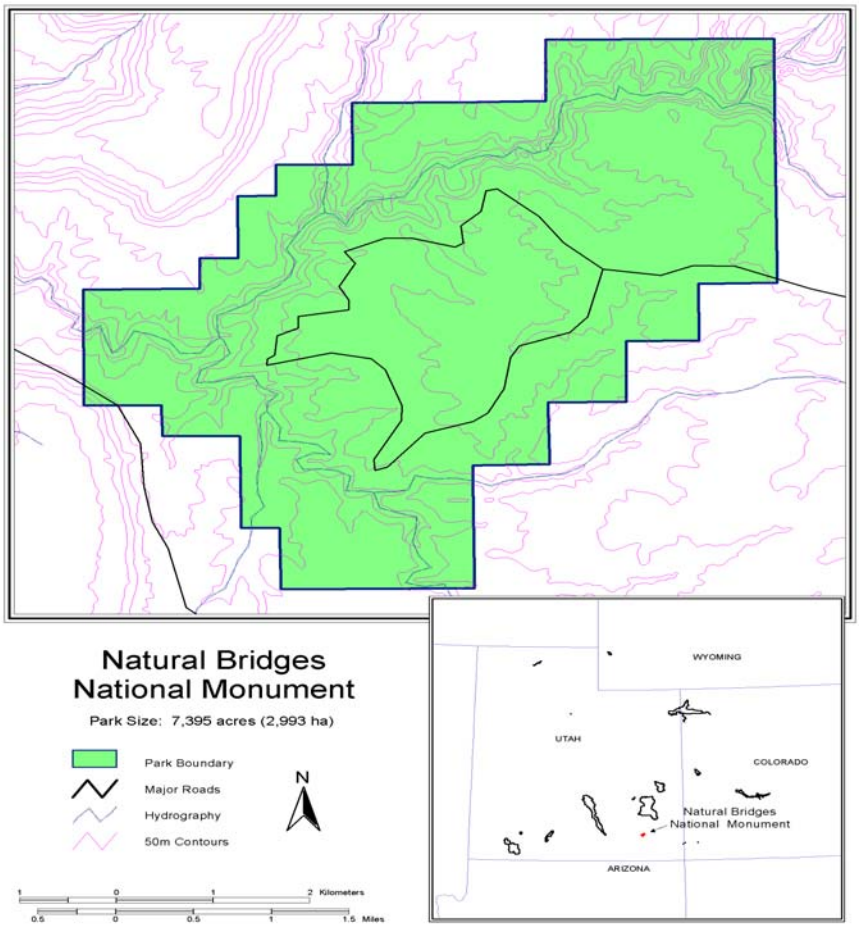


Figure 5. Map and Location of Natural Bridges National Monument.

A high desert riparian environment combined with a year-round supply of standing water (the result of numerous seeps) creates a unique biological climate where relict species (Douglas fir) maintain a foothold and where moist alcoves shelter hanging garden communities. It is here that rare plants (such as the Kachina daisy) find refuge, and other water-loving flora thrives in riparian corridors that also provide food, shelter, and travel paths for wildlife. The monument provides a breeding ground for peregrine falcons, is

home to at least 15 species of bats, and has extensive public lands surrounding it that are candidates for Wilderness designation.

Pristine air quality ensures extensive vistas and combined with the absence of artificial light provides outstanding opportunities to view night skies. The absence of human-generated sound leaves the visitor to confront the natural silence that is the hallmark of canyon country.

The monument was also established to preserve outstanding Ancestral Puebloan cultural remains located throughout the monument. The cultural resources of Natural Bridges are outstanding and the monument provides the opportunity, found in few other places, to study the interaction among indigenous cultural groups. There are numerous sites with religious and historical significance to Native Americans.

The monument preserves one of the few locations of a very rare plant, the kachina daisy (*Erigeron kachinensis*). Natural Bridges contains an outstanding example of an ephemeral desert stream. The ecological processes and biological diversity of this area are found in few other places.

The monument contains two major canyons, White and Armstrong, which are deeply incised into the Cedar Mesa sandstone. The vegetation of the area is predominately pinyon-juniper woodland, a vegetation type common to most of southeast Utah at elevations of approximately 4,000 to 8,000 feet (1220-2440 meters). Riparian vegetation occupies the surface water drainages and small pockets of Douglas fir and associated mesic vegetation grow in sheltered areas along the canyon rims. The fauna of the monument is typical of the Cedar Mesa area of southeastern Utah. Large mammals commonly seen are mule deer, coyote and desert cottontail. Conspicuous birds are the common raven, turkey vulture, red-tailed hawk and scrub jay. A variety of lizards can be seen during the warmer months, and the monument is home to both prairie rattlesnakes and midget faded rattlesnakes.

1.7 SCOPING

Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in an environmental assessment. The staff of Southeast Utah Group Parks conducted internal scoping in March 2004. This interdisciplinary process defined the purpose and need, identified potential actions to address the need, determined what the likely issues and impact topics would be, and identified the relationship, if any, of the proposed action to other planning efforts at the SEUG.

During the initial planning phase of this project, we reviewed the various approaches that the SEUG park units were taking toward obtaining compliance with National Environmental Policy Act (NEPA) for exotic plant management. Also reviewed were the Environmental Screening Forms completed by the parks for this project. In general, parks were using Categorical Exclusions (CE) to cover current and past exotic plant

management activities. According to NPS Director's Order 12 (DO-12), a CE can be used to cover proposed exotic plants management actions that result in the:

> *"Removal of individual members of a non-threatened or non-endangered species or populations of pests and exotic plants that pose an imminent danger to visitors or an immediate threat to park resources."*

Many exotic plant management actions met these criteria, did not result in any expected impacts, and were therefore covered under a CE. However, under categorically exclusions the cumulative impacts of the treatments where difficult to assess and in some instances, the proposed treatment methods at some park units could not be covered under a CE because of potential impacts, issues, or concerns.

Because some activities could not be covered under a CE, and because several parks had the same need to conduct additional environmental analysis the NPS has identified a need to prepare one multi-park EPMP EA/AEF. This EPMP EA/AEF could effectively evaluate the potential effects of various exotic plant treatments at all the park units of the SEUG. The EPMP EA/AEF process would also provide members of the public with the opportunity to participate in the planning and environmental analysis process.

During internal scoping meetings, it was determined that the EPMP/EA/AEF should not be so specific or complicated that it is no longer useful. The document also should not be so restrictive that it prevents site-specific exotic plant management actions from being implemented on a case-by-case basis. In general, it is agreed that this plan should:

- Include common treatment methods currently used at each park unit, as well as any methods that could be used in the foreseeable future.
- Account for any activities (such as various application methods) associated with each treatment method.
- Be flexible to allow for treatment of additional exotic plants in the future (including exotic plants that currently do not occur in a park unit or are currently not being managed).
- Mitigate potential impacts to resources.
- Be both integrated and adaptive.
- Be specific enough to address site-specific issues at each park.
- Be general (broad) enough to address exotic plant management actions without becoming too restrictive, and
- Be flexible enough to allow for future use of treatment actions that are not currently being used by resource managers.

The scope of this EPMP/EA/AEF is to develop a long-term management plan that would reduce the impacts of (or threats from) exotic plants to native plant communities and other natural and cultural resources, including cultural landscapes, at the four park units located in the SEUG. Because this project involves multiple parks, the approach is to develop a general plan that provides resource managers with multiple treatment options for exotic plant management. Resource managers can select the most appropriate

treatment option or combination of treatments included in the EPMP/EA/AEF to minimize potential impacts and maximize overall management success.

This plan covers activities to manage exotic plants within the SEUG park unit boundaries on NPS. Park unit boundaries are park boundaries that have been legislated by Congress. No exotic plant management activities will be conducted by the NPS in areas located outside of SEUG park unit boundaries under this EPMP/EA/AEF. In summary, exotic plant management activities must occur within park unit boundaries and must involve NPS resources to be within the scope of this EPMP/EA/AEF. Exotic plant management in areas located outside of SEUG park unit boundaries is beyond the scope of this EPMP/EA/AEF.

Only plants defined as "exotic plants" will be managed under this EPMP/EA/AEF. "Native plants" will **not** be managed under this EPMP/EA/AEF. Native plants are defined as those species that "have occurred or now occur as a result of natural processes on lands designated as units of the national park system" (NPS 2006:44). For this project, exotic plants are defined as:

> *"Those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as non-native, alien, or exotic species. Since an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place"* (NPS 2006:44).

Each plant species that meets this definition is subject to management under this EPMP/EA/AEF. However, not all plants defined as "exotic plants" will necessarily be managed. Under NPS policy (NPS 2006:47, Section 4.4.4.), an exotic plant must also meet several criteria to be managed:

> *"All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed - up to and including eradication - if (1) control is prudent and feasible and (2) the exotic species:*
>
> - Interferes with natural processes and the perpetuation of natural features, native species or natural habitats; or
> - Disrupts the genetic integrity of native species; or
> - Disrupts the accurate presentation of a cultural landscape; or
> - Damages cultural resources; or
> - Significantly hampers the management of a park or adjacent lands; or
> - Poses a public health threat as advised by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Program); or
> - Creates a hazard to public safety."

Only exotic plants that meet the above NPS definition and criteria will be managed under this EPMP/EA/AEF.

For species that meet these criteria, management priorities will be assigned to each exotic plant. Exotic plants will then be managed according to relative management priority. In accordance with NPS policy, relative management priorities will be determined as follows (NPS 2006: 47, Section 4.4.4.2):

> *"Higher priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled. Lower priority will be given to exotic species that have almost no impact on park resources or that probably cannot be successfully controlled."*

Public Scoping
Public scoping for this project was formally initiated on June 25, 2008 with the release of a public scoping letter and briefing statement (see Appendix D for the text of both). The letter was sent to various agencies, tribal governments, and organizations. The public scoping letter described information on the scope of the proposed action; the purpose, need, and description of the proposed action; and opportunities to provide comments, including dates and times for planned open house meetings. The letter solicited the public's concerns, viewpoints, and comments regarding the planning and implementation of the proposed project. No comments were received.

1.8 IMPACT TOPICS SELECTED FOR ANALYSIS

After scoping, issues and concerns were organized into impact topics to facilitate the analysis of environmental consequences, which allows for a standardized comparison between alternatives based on the most relevant information. The impact topics were identified on the basis of federal laws, regulations, and orders; NPS *Management Policies*; and NPS knowledge of limited or easily impacted resources. This information will be used to analyze impacts against the current conditions of the project area in the *Environmental Consequences* chapter.

Geology
According to 2006 *Management Policies*, geological resources such as paleontological resources (fossils), including both organic and mineralized remains in body or trace form, will be protected, preserved, and managed for public education, interpretation, and scientific research (NPS 2006). Mechanical/manual control techniques may impact geological resources such as fossils. This topic will be retained for further analysis.

Soils
The 2006 *Management Policies* state that the National Park Service will strive to understand and preserve the soil resources of park units and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its

contamination of other resources. Mechanical and chemical treatments of exotic species have potential to have a measurable impact the soil resource especially on sensitive biological soil crusts. Removal and disruption of biological soil crusts could speed erosion rates, causing major long term loss of soils in some areas. Disruption of biological soil crusts could also increase opportunities for exotic plant species such as cheat grass to become established. This topic will be retained for further analysis.

Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 *et seq.*) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Further, the Clean Air Act provides that the federal land manager has an affirmative responsibility to protect air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts (EPA 2000). The spray of herbicides may have the potential to affect air quality as well as conducting pile burns and will be retained for further analysis.

Visual Resources

According to National Park Service's 2006 *Management Policies* and *Reference Manual 77*, integral vistas are protected through cooperative means. Use of exotic plant management treatments may have the potential to effect visual resources by impairing views with sights of cut and dead vegetation and improving views by opening up distant views and foregrounds. This topic will be retained for further analysis.

Vegetation

According to the National Park Service's 2006 *Management Policies*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2006). Proposed exotic plant treatments including mechanical and chemical treatments would impact the native plant communities of the parks. The removal of vegetation could speed erosion rates causing loss of soil and increase of flash flooding. This topic will be retained for further analysis.

Water Resources

National Park Service policies require protection of water quality consistent with the Clean Water Act. The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To enact this goal, the U.S. Army Corps of Engineers has been charged with evaluating federal actions that result in potential degradation of waters of the United States and issuing permits for actions consistent with the Clean Water Act. The U.S. Environmental Protection Agency also has responsibility for oversight and review of permits and actions, which affect waters of the United States. The use of herbicides may have the potential to contaminate ground and/or surface water and may have impacts to rivers, streams, and water quality. This topic will be retained for further analysis.

Wetlands and Floodplains
Executive Order 11990 *Protection of Wetlands* requires federal agencies to avoid, where possible, adversely impacting wetlands. Further, §404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge or dredged or fill material or excavation within waters of the United States. National Park Service policies for wetlands as stated in 2006 *Management Policies* and Director's Order 77-1 *Wetlands Protection*, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with DO 77-1 *Wetlands Protection*, proposed actions that have the potential to adversely impact wetlands must be addressed in a statement of findings for wetlands.

Executive Order 11988 *Floodplain Management* requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The National Park Service under 2006 *Management Policies* and Director's Order 77-2 *Floodplain Management* will strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's Order 77-2 *Floodplain Management*, certain construction within a 100-year floodplain requires preparation of a statement of findings for floodplains.

The use of herbicides may have the potential to contaminate ground and/or surface water and may have impacts to wetlands and floodplains. These topics will be retained for further analysis.

Wildlife
According to the National Park Service's 2006 *Management Policies*, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals (NPS 2006). The use of proposed control methods (especially herbicide use) may have the potential to affect wildlife. This topic will be retained for further analysis.

Threatened, Endangered and Species of Special Concern
The Endangered Species Act of 1973 (16 United States Code (USC) 1531 et seq.) requires an examination of the impacts of all federal actions on federally listed threatened or endangered species. National Park Service policy (2006) also requires examination of the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species. The proposed actions may have impacts to some of these species or their habitats. This topic will be retained for further analysis.

Wilderness
The National Park Service's 2006 *Management Polices* states that the park service will manage Wilderness for use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as Wilderness. The Wilderness Act of 1964 declares that Wilderness areas will be devoted to the "public purposes of recreation, scenic, scientific, educational, conservation and historical use" and includes the activity of exotic plant management. This topic will be retained for further analysis.

Archeological Resources
In addition to the National Historic Preservation Act and the National Park Service 2006 *Management Policies*, the National Park Service's Director's Order-28B *Archeology* affirms a long-term commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. §106 of the National Historic Preservation Act, as amended in 1992 (16 USC 470 *et seq.*); the National Park Service's Director's Order-28 *Cultural Resource Management Guideline*; and National Park Service *2006 Management Policies* require the consideration of impacts on archeological resources that are listed on or eligible to be listed on the National Register of Historic Places. The National Register is the nation's inventory of historic places and the national repository of documentation on property types and their significance. The above-mentioned policies and regulations require federal agencies to coordinate consultation with State Historic Preservation Officers regarding the potential effects to properties listed on or eligible for the National Register of Historic Places. As one of the principal stewards of America's heritage, the National Park Service is charged with the preservation of the commemorative, educational, scientific, and traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations. The SEUG parks contain an abundance of archeological resources that may experience minor to major impacts when exotic plant management treatments are implemented. This topic will be retained for further analysis.

Historic Structures
§106 of the National Historic Preservation Act, as amended in 1992 (16 USC 470 *et seq.*); the National Park Service's Director's Order-28 *Cultural Resource Management Guideline*; and National Park Service *2006 Management Policies* require the consideration of impacts on historic structures that are listed on or eligible to be listed on the National Register of Historic Places. The National Register is the nation's inventory of historic places and the national repository of documentation on property types and their significance. The above-mentioned policies and regulations require federal agencies to coordinate consultation with State Historic Preservation Officers regarding the potential effects to properties listed on or eligible for the National Register of Historic Places. The SEUG parks contain several historic structures that may experience minor to moderate impacts when exotic plant management treatments are implemented. This topic will be retained for further analysis.

Ethnographic Resources
Ethnographic resources are defined by the National Park Service as a "site, substance, 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" (Director's Order – 28). Although no formal survey has been conducted, the parks may have a number of resources that could be considered ethnographic. ARCH has identified Purple sage **(***Salvia leucophylla),* in consultation with the Uinta and Ouray Ute, as an example of an ethnobotanical resource with traditional cultural significance. At HOVE, tribal representatives, through consultation, have identified resources such as

seeps and springs that are associated with subsistence, religious, ceremonial, or other traditional activities. The National Park Service will continue to consult with these Native American tribes and copies of the EPMP EA/AEF will be forwarded to each consulted tribe or pueblo for review or comment. If subsequent issues or concerns are identified, appropriate consultations would be undertaken. Because potential exists for these ethnographic resources to be greatly impacted, this topic has been retained for further analysis.

Visitor Use and Experience

According to 2006 *Management Policies*, the enjoyment of park resources and values by people is part of the fundamental purpose of all park units (NPS 2006). The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, the National Park Service will provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. The National Park Service 2006 *Management Policies* also state that scenic views and visual resources are considered highly valued associated characteristics that the National Park Service should strive to protect (NPS 2006). Exotic plant management activities may prevent visitors from experiencing or enjoying all or parts of the parks for short periods of time; some areas of the parks may be closed due to treatments. Visitor surveys have identified natural quiet and solitude as high value experiences in the parks and the proposed alternatives may affect visitor's experience. This topic will be retained for further analysis.

Human Health and Safety

In accordance with 2006 *Management Policies* it states that the National Park Service and its concessionaires, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees. Employees and visitors may be exposed to herbicides through respiratory, dermal or dietary routes (touching or eating berries with residues). This topic will be retained for further analysis.

Soundscape

In accordance with 2006 *Management Policies* and Director's Order-47 *Sound Preservation and Noise Management*, an important component of the National Park Service's mission is the preservation of natural soundscapes associated with national park units (NPS 2006). The noise generated from mechanical treatment such as ATV mounted sprayers, chainsaws, and mowing equipment will affect the natural soundscape at the SEUG parks. This topic will be retained for further analysis.

Socioeconomics

NEPA requires an analysis of impacts to the human environment which includes economic and demographic elements in the affected area. Managers are concerned about the economic impact if exotic plants continued to spread within the SEUG parks. If visitors are made aware that herbicides are proposed for use in the parks, would it deter some people from visiting? This topic will be retained for further analysis.

1.9 IMPACT TOPICS CONSIDERED, BUT DISMISSED FROM FUTHER ANALYSIS

Some impact topics have been dismissed from further consideration, as listed below. During internal scoping, the park's interdisciplinary team conducted a preliminary analysis of resources to determine the context, duration, and intensity of effects that the proposal may have on those resources. If the magnitude of effects was determined to be at the negligible or minor level, there is no potential for significant impact and further impact analysis is unnecessary, therefore the resource is dismissed as an impact topic. If however, during internal scoping and further investigation, resource effects still remain unknown, or are more at the minor to moderate level of intensity, and the potential for significant impacts is likely, then the analysis of that resource as an impact topic is carried forward.

For purposes of this section, an impact of negligible intensity is one that is "at the lowest levels of detection, barely perceptible, and not measurable." An impact of minor intensity is one that is "measurable or perceptible, but is slight, localized, and would result in a limited alteration or a limited area." The rationale for dismissing these specific topics is stated for each resource.

Environmental Justice
Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-income Populations," 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. Implementing exotic plant management treatments will have no disproportionately high and adverse human health or environmental effects on minorities or low-income populations or communities. The exotic plant management plan will not impact the exclusion or separation of minority or low income populations from the broader community or disrupt community cohesiveness and economic vitality. This topic would have negligible effects. Therefore, environmental justice will not be addressed further as an impact topic.

Prime and Unique Farmlands
The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service, and is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. According to NRCS (NRCS 1989, 1993, 2003, 2003b), no soils in the project area are classified as prime and unique farmlands and would have negligible effects. Therefore the topic of prime and unique farmland will not be addressed as an impact topic.

Cultural Landscapes
Cultural landscapes are settings humans have created in the natural world. They reveal the ties between the people and the land. These ties are based on the need to grow food, build settlements, recreate, and find suitable land to bury their dead. They range from prehistoric settlements to cattle ranches, from cemeteries to pilgrimage routes. They are the expressions of human manipulation and adaptation of the land. Cultural Landscape Inventories have not been completed for each of the parks and after analyzing proposed actions of implementing exotic plant management treatments, treatments would contribute to, but not detract from, the integrity of a possible cultural landscape. However, some of these possible landscapes exhibit more of an ethnographic landscape and will be addressed under ethnographic resources. The impacts to cultural landscapes would be minor and this topic will not be addressed further as an impact topic.

Museum Collections
According to Director's Order 24, *Museum Collections,* the National Park Service requires the consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material), and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, National Park Service museum collections. The SEUG parks have museum collections stored in 9 facilities throughout the parks. Implementation of any of the alternatives considered in this document is expected to add less than minor amount of reports, plans, and data to be catalogued and/or archived. Since the impact on museum collections will be negligible this topic will not be addressed further as an impact topic.

Lightscapes or Night Sky
In accordance with NPS *Management Policies (2006),* the National Park Service strives to preserve natural ambient lightscapes, which are natural resources and values that exist in the absence of human-caused light. Exotic plant control activities will have not impact on natural lightscapes because all work will occur during daylight hours and would have negligible effects. Therefore, lightscape, or night sky, will not be addressed further as an impact topic.

Hazardous Materials
According to the EPA regarding hazardous materials (40 CFR 261.33) some herbicides can become hazardous waste when discarded. The parks will not purchase herbicides unless they will be used within the year of purchase and will use the entire product. If some product is leftover, SEUG donates the herbicide to the Grand County Weed Program. When disposing of the herbicide container the container is tripled washed and then punctured. Since the proposed action would not produce hazardous materials and would have negligible effects, this topic will not be addressed further as an impact topic.

Land Use
National Park Service *Management Policies (2006)* states, "…the Service will cooperate with federal agencies; tribal, state, and local governments; nonprofit organizations; and

property owners to provide appropriate protection measures. Cooperation with these entities will also be pursued, and other available land protection tools will be employed when threats to resources originate outside boundaries." However, the proposed action will not directly or indirectly affect park boundaries, zoning and/or land use outside the parks boundaries. Although the proposed action will have a minimal effect on any external threats to the park resources it will be minor to negligible impact. Therefore, land use will not be addressed further as an impact topic.

Park Operations

The proposed action would not significantly change overall park operations. The proposed action would enable the park to more effectively manage exotic plant populations. The Resource Management Program would need to maintain one subject-to-furlough (STF) lead biological technician and two seasonal biological technicians in order to effectively manage exotic plant populations and restore native populations in the long term. Because the proposed action would only have a minor or less than minor impact to the overall park operations, this topic will not be addressed further as an impact topic.

Relationships with Park Neighbors

The proposed action would not significantly change SEUG's overall relationship with neighbors. Exotic plant management treatments will be implemented within park boundaries and in relatively small site-specific areas. Broad based applications will not used. If there is potential for cross boundary effects, then an interagency agreement would be developed prior to implementation. The relationship with park neighbors would be minor to negligible and therefore, this topic will not be addressed further as an impact topic.

CHAPTER 2- ALTERNATIVES

This chapter describes the alternatives analyzed, including the preferred alternative and alternatives considered but eliminated from further analysis. Issues to be analyzed in detail in Chapter 4 are also described in this section. This chapter is organized into the following sections:

2.1 Alternative 1 - No Action Alternative, Continue with Current Management Programs
2.2 Alternative 2 - Preferred Alternative, Integrated Pest Management Plan
2.3 Best Management Practices
2.4 Other Alternatives Considered, But Dismissed from Further Analysis
2.5 Alternative Summaries
2.6 Environmentally Preferred Alternative

Alternatives were framed through discussions among the SEUG park staff with assistance from Intermountain Region Planning and Environmental Quality personnel. The alternatives cover the range of what is physically possible, acceptable by policy, and feasible for local managers; i.e. all reasonable alternatives. Criteria used in the selection of reasonable alternatives include:

- Potential for protecting the park's natural and cultural resources,
- Effectiveness, efficiency, and economy of eradicating or controlling exotic plant infestations
- Ability to ensure human safety

Two reasonable alternatives, or those alternatives that are economically and technically feasible, were then identified. These two alternatives were carried forward. Tables 2-6 through 2-8 provide a comparison of the two reasonable alternatives considered in the EPMP/EA/AEF with regard to project objectives, actions to accomplish those objectives and potential environmental impacts to resources.

Under both alternatives, this plan considers all treatment methods that are currently being implemented by SEUG park units, or that may be used in the foreseeable future. Proposed treatments include:

Cultural Treatments: Practices that promote the growth of desirable plants and reduce the opportunities for exotic plants to establish and grow. Examples include irrigation and seeding of native plant species.

Manual/Mechanical Treatments: Physical damage to or removal of part or all or of the plant. Examples include hand pulling, cutting, grubbing, haying, and mowing.

Biological Treatments: Biological control, or bio-control includes the use of "natural enemies", such as insects and microorganisms to reduce the abundance of an exotic plant. Natural enemies are usually imported from areas where the target exotic plant occurs as a native plant and are deliberately released into areas where the plant is exotic. Examples include plant-feeding insects such as Tamarisk leaf beetles (*Diorhabda elongata deserticola*) for tamarisk (*Tamarix* spp.), puncturevine weevils

(*Microlarinus spp*.) for puncturevine *(Tribulus terrestris)* and leaf beetles (*Galerucella* spp.) for purple loosestrife (*Lythrum salicaria*). Approved biological agents will be host-specific and have a negligible risk for becoming a pest.

Chemical Treatments: applying herbicides as prescribed by their labels, using a variety of application methods. Examples of application methods include portable sprayers, vehicles equipped with sprayers, and aerial application (helicopter and fixed wing).

Prescribed Fire Treatments: applying fire to a predetermined area to reduce the growth of exotic plants and to increase the growth of desirable plants. In this plan, prescribed fire treatments will be only be used to burn brush piles of exotic vegetative debris like tamarisk.

Individual treatments or combinations of those treatments would be implemented as appropriate to control and exotic plants in SEUG park units. Park would cooperate with state, county, private, tribal, and federal officials.

2.1 ALTERNATIVE 1 - NO ACTION ALTERNATIVE, CONTINUE WITH CURRENT MANAGEMENT PROGRAMS

Alternative 1 - ***No Action, Continue with Current Management Program*** - the no action alternative was considered because the current management practices for control of exotic plants experience varying measures of success and the methods used are viable actions for future management of exotic plants.

2.1.1 Compliance with Regulatory Measures

Under Alternative 1, parks would continue to manage exotic plants using current treatments. This would mean that exotic plant management activities would continue on a limited basis. Park resource managers would be limited to those treatment options that either qualifies as a CE or those treatments whose impacts have been previously addressed in other NEPA documents. Under DO-12, the only exotic plant management activities that are covered under a CE involve:

> *"Removal of individual members of a non-threatened/endangered species or populations of pests and exotic plants that pose an imminent danger to park visitors or an immediate threat to park resources*."

In addition to meeting this criterion, the proposed treatment must also have no measurable impacts to qualify as a CE. Measurable impacts are those that the interdisciplinary team determines to be greater than minor by the analysis process described in DO-12. For effects to be minor, a relatively small number of individuals/resources would be affected. Minor impacts typically require considerable scientific effort to measure, are limited to relatively few individuals of the populations, are much localized in area, and have barely perceptible consequences.

Any proposed treatments that were not covered under a CE or under another existing NEPA document would require preparation of additional NEPA documents, such as an EPMP EA/AEF or Environmental Impact Statement (EIS).

Guidance for management of exotic plants at each park is also provided under existing Resource Management Plans (RMPs). RMPs and General Management Plans (GMPs) identify the management objectives for various environmental resources within the park. A summary of existing plans that provide guidance on exotic plant management is provided in Table 1-3.

RMPs are required by current NPS Management Policies (NPS 2006). However, changes to these plans are necessitated by changes in the NPS planning process contained under current NPS Management Policies. Under the revised planning process, there is a large gap between the broad requirements of GMPs and the park strategic plans required for 5-year periods for any based-funded actions that fall under "foreseeable" park budgets. This gap is being addressed through the RSP, the Resource Stewardship Plan. The RSP will provide a mechanism to develop and document well-defined and integrated natural and cultural resource condition objectives and comprehensive strategies for meeting them to guide park management decision-making. The RSP will provide a linkage between the general, conceptual treatment of resources in GMPs and the specific, detailed activities described in park strategic or implementation plans.

2.1.2 Education Programs

Existing visitor awareness or public education activities would continue at each park. These programs provide general information on specific exotic plant management issues and strategies for controlling individual exotic plants. Parks would continue to offer some training on prevention or early detection and eradication of exotic plants.

2.1.3 Collaboration Measures

The four SEUG parks included in this EPMP/EA/AEF currently collaborate with one another on a limited basis as part of exotic plant management planning. Complementing park staff efforts, a Lake Mead National Recreation Area (LAME) Exotic Plant Management Team (EPMT), usually consisting of two seasonal employees has been a resource for each of the four parks over approximately the past 12 years. LAME employs the EMPT but each year, the SEUG parks submit requests to the LAME to address some of the individual park's exotic plant mapping and management needs. The EPMT then compiles and prioritizes these requests as a guide for the coming season.

All parks also collaborate with tribal and other federal officials and state, county, and private entities through the SEUG Resource Management Division.

2.1.4 Planning

Parks currently utilize an IPM approach for exotic plant management planning only on small parcels of land; however this plan is not formal and varies at each park. None of the SEUG parks

have standardized exotic plant management plans, but they do form yearly work plans for exotic species management.

In the years of 2003 through 2005, the Northern Colorado Plateau Inventory and Monitoring Network conducted an inventory of invasive non-native plants at each of the four SEUG parks. The primary objective of these projects was to document distribution and abundance of targeted exotic species across the range of habitats and areas of management concern in each park unit. Inventory efforts were concentrated on environments in which exotic invasives are most likely to be found: riparian zones, roadsides, and disturbed areas. (One exception is that the riparian zones of the Colorado and Green Rivers were not inventoried.) It was anticipated that information from this inventory would be useful in SEUG's ongoing efforts to improve strategic planning and to increase the effectiveness and efficiency of field operations associated with exotic plant management. Table 2-1 represents a summary of the total acres inventoried, the total number of targeted species found at each park unit, and the acres infested by exotic species.

Table 2-1. A SUMMARY OF THE 2003 INVASIVE NON-NATIVE PLANT INVENTORY REPORT

Park	Park Unit Acreage	Total Acreage Inventoried	Number of Exotic Species Targeted	Infested Acreage by Exotic Species
ARCH	76,519	8,166	11	748
CANY	337,598	25,160.9	14	774.5
HOVE	784.3	966*	11	16.87
NABR	7,636	2,070	6	2.45

*inventoried entire monument as well as some additional surrounding areas

For more site specific data and information, the complete Invasive Non-Native Plant Inventory reports for each park unit are located online at:

http://science.nature.nps.gov/im/units/ncpn/Inventory_Reports.cfm

SEUG staff used the same inventory methods in 2006 to inventory additional areas in Arches National Park (Moran 2007). They also began an effort to inventory the riparian zone along the Green River in 2008 (data pending).

2.1.5 Cultural Treatments

Cultural treatments are practices that promote the growth of desirable plants and reduce the opportunities for exotic plants to grow. Examples include irrigation and seeding of native plant species. Cultural treatment methods involve manipulating treatment areas to present exotic plants

with effective native competitors. Examples of cultural treatments that are implemented by the parks include:

- Prevention
- Reseeding and Planting
- Irrigation

Prevention
Preventing establishment is an economical way to manage exotic plants. All SEUG parks have some programs in place to limit the potential for introduction and expansion of exotic plants as a result of human activities.

Reseeding and Planting
Reseeding is used to encourage the re-establishment of native plants and to prevent the establishment of exotic plants. As part of restoring native plant communities, SEUG parks reseed areas that do not have adequate seed banks to recover naturally. SEUG parks also currently have policies requiring that weed-free forage be brought into parks for pack animals. There is also the requirement that other materials used for restoration, such as native seed, mulch, and compost, be "certified weed-free."

Irrigation
Irrigation is used on a limited basis to help native vegetation establish during dry periods. Cultural treatment is being used at all parks included in the EPMP/EA/AEF. These cultural treatment programs would continue under Alternative 1.

2.1.6 Manual/Mechanical Treatments

All SEUG parks currently use manual or mechanical treatments to control exotic plants. These mechanical treatment programs would continue under Alternative 1. Types of manual treatment include hand pulling and removal using small hand tools and shovels. Types of mechanical treatment include the use of weed whippers, mowers, chainsaws, and shovels. All parks use mechanical treatments in concert with other treatments, such as the use of herbicides.

Manual and mechanical treatments involve physical damage to or removal of part or all of the plant. Hand pulling is the primary manual treatment method. Mechanical treatments involve the use of tools to remove or physically damage exotic plants. Examples of mechanical treatments include using hand cutting (shovels and clippers), pulling tools (such as weed wrenches™) and power tools (such as weed whips or chainsaws). Any manual and mechanical methods are highly selective for individual plants. Both manual and mechanical treatments are used to treat individual plants or specific treatment areas. Manual or mechanical treatments may need to be performed several times during a season and are often used in concert with other treatment methods. For example, manual or mechanical treatments may be followed by application of herbicides or prescribed fire to treat re-sprouts and new seedlings.

Manual treatment can be used in any area. It is most effective for pulling shallow-rooted species. Manual pulling of deep-rooted species may require repeated treatment to effectively deplete the

root system. Portions of roots can break off, remain in the soil, and regenerate. Hand pulling is conducted by removing as much of the root as possible while minimizing soil disturbance.

Types of mechanical treatment currently used include using hand cutting tools, pulling tools, and power tools. Hand cutting tools are a treatment option for removing the aboveground portions of annual or biennial plants. Use of hand tools, such as trowels, shovels, and Pulaskis are simple forms of mechanical treatments. These tools are used to remove a larger portion of the root system or to sever the plant's taproot below the point where nutrients are stored. Efforts are made to collect viable seeds from plants that are cut, or to cut plants when seeds are not viable. Pulling tools are a treatment option for removing individual plants that are deep-rooted. Pulling tools are used to control small infestations, such as when an exotic plant is first identified in an area. These tools grip the weed stem and remove the root by providing leverage. Pulling tools are most effective on firm ground rather than soft, sandy, or muddy substrate (Tu et al. 2001).

Power tools, such chainsaws, are used to treat small to large infestations. Weed whips are used at small sites or sites that are inaccessible or are too rocky to be mowed. Power tools remove aboveground biomass, reduce seed production, and reduce plant growth. Power tools are useful for controlling annual plants before they set seed. Power tools are also used along with other treatments, such as chemicals or prescribed fire, to treat perennial exotic plants.

2.1.7 Biological Treatments

Biological treatments are commonly referred to as biological control, or bio-control. Biological treatments involve the use of "natural enemies" (including insects and microorganisms) to reduce the abundance of an exotic plant. Natural enemies are imported from areas where the target exotic plant occurs as a native plant. They are deliberately released into areas where the plant is exotic.

These natural enemies limit the growth or reproduction of exotic plants. Examples include plant-feeding insects such as flea beetles (*Aphthona lacertosa*) for leafy spurge (*Euphorbia esula*) and the Tamarisk leaf beetle (*Diorhabda elongata deserticola*) for tamarisk (*Tamarix chinensis*).

Flea beetles can kill leafy spurge as a direct or indirect consequence of larvae feeding on leafy spurge roots. Leaf beetle larvae feed on bud, leaf, and stem tissue of tamarisk. Biological control may be a long-term solution for controlling some exotic species that are too widespread for control by other means or for exotic plants that are readily invading a park. Biological control is best suited for infestations of a single, dominant exotic plant species that is not closely related to other native plant species.

Biological control agents are currently not used by the SEUG parks for management of exotic plants. However, the Tamarisk leaf beetle (*Diorhabda elongata deserticola*) has been released by the Grand County Weed Department, even though this beetle has not been approved for release on federal lands in Utah, in areas adjacent to CANY and ARCH and it has expanded into both parks.

2.1.8 Chemical Treatments

Using chemical treatments consists of applying herbicides as prescribed by their labels, using a variety of application methods. The primary application method use by SEUG parks is hand spraying or direct application using a small paint brush. Herbicides are most effective for treating pure stands of a single exotic plant species in areas where desirable plants are scarce or absent. Herbicides can also be used to treat small patches of exotic plants where hand pulling or cutting is not feasible (Colorado Natural Areas Program [CNAP] 2000:50). Parks are currently using a number of herbicides to treat exotic plants.

2.1.9 Prescribed Fire Treatments

Using prescribed fire treatments consists of applying fire to a predetermined area to reduce the growth of exotic plants and to increase the growth of desirable plants. Prescribed fires are most effective when the exotic plant is more susceptible to the effects of fire when compared with intermingled native plants (CNAP 2000). Prescribed fire may also be used to control exotic cool-season plants.

The SEUG Fire Management Plan 2005 does not include the use of prescribed fire per se as an exotic plant management tool. It does allow individual burns to be used for disposal of vegetative debris that is infeasible to dispose of by other means. This includes brush piles that accumulate from cutting and piling of exotic plants such as tamarisk (*Tamarix chinensis*) or Russian thistle (*Salsola tragus*).

Another treatment that is currently being used to control exotics is using a weed burner. This heat treatment technique uses a propane torch to burn individual or small populations of emerging plants, particularly punctureveine (*Tribulus terrestris*) and Russian thistle (*Salsola tragus*). This treatment is used around buildings and parking areas.

2.1.10 Monitoring and Record Keeping

Monitoring of treatment areas would continue at each park. Record keeping and reporting the use of herbicides would be in compliance with NPS guidelines.

All herbicides used by parks are registered by the U.S. Environmental Protection Agency. Parks also obtain approval from either the Regional or National IPM Coordinator before using an herbicide. A summary of herbicides being used at each park is provided in Table 2-2.

Table 2-2. SUMMARY OF HERBICIDES CURRENTLY BEING USED BY SEUG PARKS

Active Ingredient	Trade Names	Target Plants	Parks Currently using Product
Triclopyr amine	Garlon 4, Remedy, Tahoe 4E	Woody plants and broadleaf plants.	CANY, ARCH, NABR, HOVE

Active Ingredient	Trade Names	Target Plants	Parks Currently using Product
Glyphosate	Rodeo	Grasses, herbaceous plants, some broadleaf trees and shrubs.	CANY, ARCH, NABR, HOVE
Clopyrolid	Transline	Annual and perennial broadleaf herbs.	CANY, ARCH, NABR, HOVE
Imazapyr	Habitat	Annual and perennial grass, broadleaved weeds, brush, vines and deciduous trees.	CANY, ARCH, NABR, HOVE
Picloram	Tordon	Broadleaf herbs, vines, and woody plants.	CANY, ARCH, NABR, HOVE

2.2 ALTERNATIVE 2 - PREFERRED ALTERNATIVE, INTEGRATED PEST MANAGEMENT

Alternative 2 - Integrated Pest Management Plan - the preferred alternative, the NPS would use an Integrated Pest Management Plan (IPM) approach to control exotic plants at SEUG parks. The NPS has a mandate to preserve natural and cultural resources now and for future generations. The preferred alternative would assist parks in meeting this mandate by implementing effective IPM practices.

IPM is a decision-making process that supports the NPS mission by coordinating knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage, using environmentally sound, cost-effective management strategies that pose the least possible risk to people, park resources, and the environment. This process helps the resource manager determine whether the treatment is necessary and appropriate, where treatment should be administered, when treatment should be applied, and what strategies should be used for immediate and long-term results. IPM is done on a case-by-case basis, so that treatment strategies are tailored to local conditions. Each exotic plant's natural history is also evaluated before developing treatment strategies. The goal of IPM for this project is therefore to manage exotic plants and the environment to balance costs, benefits, public health, and environmental quality (McCrea and DiSalvo 2001:394).

IPM employs multiple integrated management practices rather than a single solution, wherever technically and economically feasible. An integrated approach is often more effective than a single type of treatment. Integrated management practices that would be included under the preferred alternative include:

- Compliance with Regulatory Measures
- Education Programs
- Collaboration Measures
- Planning

- Treatment Methods
    1) Cultural Treatments
    2) Manual/Mechanical Treatments
    3) Biological Treatments
    4) Chemical Treatments
    5) Prescribed Fire Treatments
- Monitoring and Record Keeping

Individual treatments or combinations of these treatments would be implemented, as appropriate, to control exotic plants in the SEUG parks. Each of these treatments is discussed in additional detail in the following sections.

2.2.1 Compliance with Regulatory Measures

Because of the multi-park nature of this project, the preferred alternative would include a broad analysis of potential impacts of various treatments on environmental resources. For future exotic plant management activities, parks would use the decision making tool "Confirm Compliance of Treatment Method with and Existing NEPA Document" in Appendix A to document NEPA compliance through this EPMP/EA/AEF.

In the future, resource managers could also prepare exotic plant management plans to address specific exotic plant management issues. Park-specific plans containing actions that are consistent with those evaluated in this EPMP/EA/AEF would document compliance with NEPA through this EPMP/EA/AEF using a memo to file. Park-specific plans containing exotic plant management treatments or having associated potential impacts that have not been considered in this EPMP/EA/AEF would require additional compliance with NEPA.

The preferred alternative would also help resource managers confirm compliance with regulatory measures using the Decision-making Tool. Applicable NPS policies and guidelines have been built into this tool. Through using this process and through collaboration with NPS Regional IPM and NEPA Coordinators, resource managers would be able to confirm that their proposed treatments meet the necessary NPS and NEPA environmental compliance requirements for protection.

2.2.2 Education Programs

One of the objectives of the EPMP/EA/AEF is to standardize exotic plant management at the four SEUG park units so each park's actions can be more effectively implemented and explained to the public. Education programs are a cost-effective exotic plant management strategy. Education of staff at each park and the public would help create an understanding of exotic plant management and promote acceptance of needed actions. Development of the EPMP/EA/AEF is an initial step in the education process because it provides a consistent approach for exotic plant management planning and decision-making. This plan also identifies educational programs that would be implemented by parks under the preferred alternative.

A variety of education programs would be implemented under the preferred alternative. These programs would include:

- Internal Training and Awareness
- Visitor Awareness and Public Education

Internal training and awareness programs would be developed at each park. These programs would be used to educate park employees and volunteers on exotic plant identification and exotic plant management programs. Through an effective education program, park staff would come to recognize potential exotic plant problems, allowing resource managers to take action before problems develop. Park staff that is informed about the objective of the exotic plant management program would also be more likely to support it. These programs may include training on how to identify exotic plants that are known to occur within the park and exotic plants of concern that have not yet been located within the park, but that could occur within the park in the future. During this training, employees and volunteers would be provided with a NPS point of contact for reporting the locations of new exotic plants or new infestations that are observed within the park. Training would also include an overview of the SEUG EPMP/EA/AEF to help staff and volunteers understand the decision-making process, what treatments are being used at that park and the justification for their use, and sensitive resource considerations. Other internal education programs would include:

- Incorporate exotic plant management information at all levels of NPS training, including planning/design, management, construction, interpretation, maintenance, law enforcement, and resource management
- Use established media (electronic media, publications, permits, and contracts) to educate NPS staff and commercial users about exotic plant management issues
- Interpret and communicate the results of the latest research on exotic plants to resource managers, interpreters, maintenance personnel, and others.

Visitor awareness and public education programs may also be developed under the preferred alternative. Park visitors and others concerned with management activities at any of the SEUG parks would be advised of IPM practices included in the EPMP/EA/AEF and the benefits of implementing these approaches to address specific exotic plant management issues. Parks may develop a variety of avenues to educate the public, including education programs, exhibits, and public outreach programs. These programs would be used to educate the public on:

- Exotic plant management planning
- Exotic plant management priorities within the park
- The potential threat of these plants to park resources
- Methods for preventing the introduction of exotic plants into the park
- Treatment methods used within the park to control exotic plants, and why these treatments were selected.

These programs would also include publication of press releases using local media and articles in park newsletters, bulletins, and on park websites. In the case of large-scale treatments, parks would provide information to park staff, residents of surrounding areas, and park visitors. In the

case of highly visible projects, formal interpretive programs or materials would be developed and press releases or briefings prepared. Some parks may also organize volunteer efforts to provide the public with "hands-on" opportunities to become involved in exotic plant management. Programs may also be developed for local schools to educate students on the threat and management of exotic plants. Under the preferred alternative, specific public awareness activities may also include:

- Create and disseminate, through all available local outlets, educational materials that increase awareness of, understanding of, and support for the full range of exotic plant management activities.
- Participate in or create local area field days and other types of meetings to highlight the exotic plant management plan or current exotic plant management projects.
- Encourage public support through volunteer exotic plant management projects and activities.

2.2.3 Collaboration Measures

Collaboration of exotic plant management activities with other entities is a key component of the preferred alternative. Collaboration would be an ongoing process that would build consensus with interested parties (including adjacent landowners), decision makers, technical experts, and the general public. Several types of collaboration would be conducted under the preferred alternative, including:

- Collaboration between the park, the general public, and neighboring landowners
- Collaboration between NPS resource managers and exotic plant management experts
- Collaboration between parks
- Collaboration with local, state, and federal officials involved in exotic plant management

Each park would collaborate with the general public to disseminate consistent information about current and proposed exotic plant management activities. Parks would also collaborate with neighboring landowners to disseminate information on the importance of and methods for managing exotic plants on their properties. To encourage collaboration, parks may conduct periodic exotic plant management meetings. These meetings could be used to inform the public of current and proposed management activities and exotic plant issues within the park. These meetings would be an opportunity for landowners to learn how they can help prevent the introduction of exotic plants into the park. These meetings would also provide a forum for the public to express concerns regarding current and proposed exotic plant management activities.

Ongoing collaboration with exotic plant management experts both within and outside the NPS would also be conducted on a regular basis. This level of collaboration is needed to help NPS resource managers keep informed on the latest exotic plant management technologies available. Such collaboration would also be an opportunity for individuals to share and learn from their exotic plant management successes and challenges.

Establishment of management partnerships are also encouraged under the preferred alternative to foster relationships between the public, private landowners, conservation groups, and county weed superintendents.

Under the preferred alternative, other collaboration activities may include:

- Work with universities, state and federal agencies, and private organizations to develop education programs and courses for resource managers and others responsible for managing exotic plants.
- Work with responsible agencies and the concerned public to incorporate exotic plant management techniques into herbicide applicator training courses.
- Participate in and conduct seminars or workshops on exotic plant management.
- Encourage NPS staff to join and participate in professional organizations or societies concerned with exotic plant management issues.
- Develop a model code of ethics concerning the use of plant materials through cooperative efforts with other concerned groups, industries, and agencies.
- Cooperate with other agencies to develop and disseminate educational materials (publications, posters, videos, and intranet) to the public, interested organizations, and agency employees.
- Work with the plant production industry to prepare educational materials that encourage the use of native plants and re-vegetation in landscaping.
- Develop collaborative groups that include multiple agencies and the public to assist with exotic plant management and to ensure that planning incorporates the concerns and issues of land managers and landowners with similar exotic plant management issues.

2.2.4 Planning

Under the preferred alternative, resource managers would use the following Decision-making Tool, developed specifically for the EPMP/EA/AEF, for exotic plant management planning. In using this tool, resource managers at each park would follow a standard decision-making process to identify exotic plants, determine exotic plant management priorities, identify and evaluate the efficacy and environmental effects of the proposed treatment, consider alternative treatments having less impacts, justify why a treatment was selected, and confirm compliance with applicable policies and regulations. Resource managers would also be able to use the results to explain to the public how each of these factors was accounted for in selecting treatment methods. Figure 6 provides an overview of the decision-making process and Appendix A includes the complete Decision-making Tool developed for the EPMP/EA/AEF.

The Decision-making Tool includes a series of five decision trees. These decision trees include:

- Identify Exotic Plants and Justify Management Needs
- Guidance for Setting Management Priorities
- Optimum Tool Analysis for Treatment Options
- Justify and Confirm Compliance of Chemical and Biological Treatments (with applicable policies and regulations)

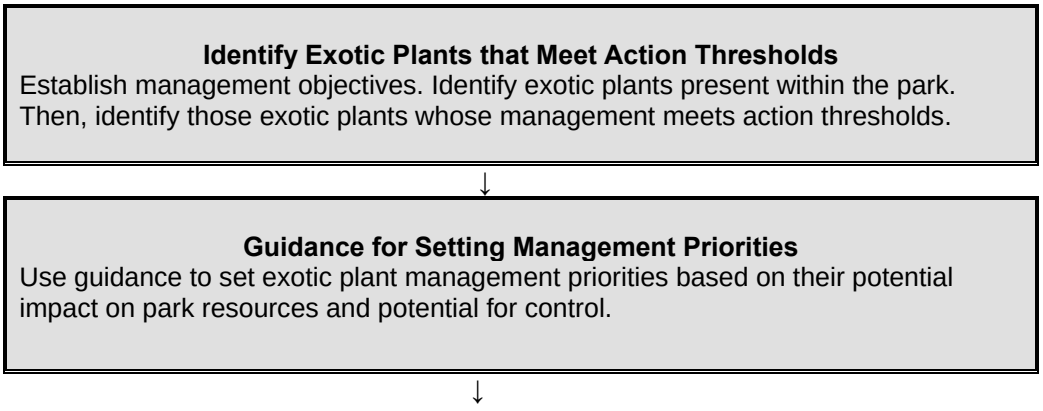
- Confirm Compliance of Proposed Treatment Method with NEPA

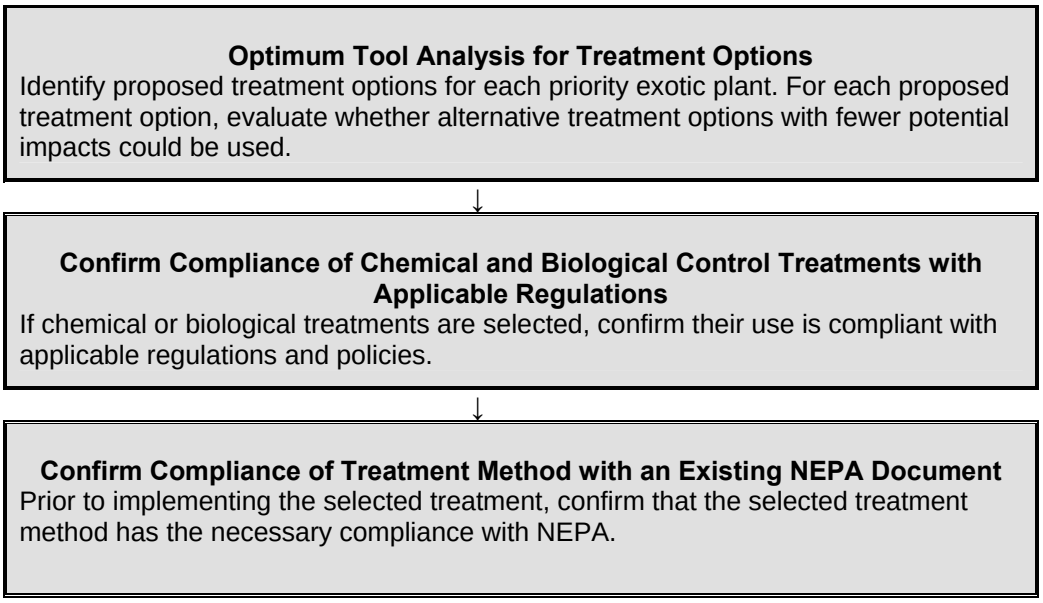
Identify Exotic Plants That Meet Action Thresholds
This decision tool is used to establish exotic plant management objectives and to identify exotic plants that meet at least one of the action thresholds. As part of initial exotic plant management planning, the resource manager would establish exotic plant management objectives. A management objective is a desired state of the system that the resource manager wants to achieve. Management objectives can be stated as general objectives or as specified numerical targets. Management objectives should, however, be measurable since they would be used to evaluate the effectiveness of various exotic plant management treatments. The general management objective for this project is to prevent unacceptable levels of exotic plant damage, using environmentally sound, cost-effective management strategies that pose the least possible risk to people, park resources, and the environment.

Under the preferred alternative, resource managers would also establish specific exotic plant management objectives for their park. These management objectives would be developed based on NPS policy, resource management objectives for the park, the size of the park, and the extent and type of exotic plant infestations within the park. If the extent and distribution of exotic plants are not known, additional data collection such as mapping may be required before management objectives can be established. Additionally, mapping must be repeated at some interval in order to catch new early infestations. The interval will vary depending on the area; park roadsides, for example, might be monitored most frequently, if they are the most likely location for new infestations. Some examples of past exotic plant management objectives established by parks include:

- Maintain native vegetation surrounding developed areas in its historic state.
- Treat 1-5 acres of exotic plants per year.
- Return vegetation to historic site conditions.
- Lessen the economic impact of priority exotic plants by eradicating small stands and containing, then controlling, larger stands.
- Identify and control occurrences of exotic plants by containing large populations and reducing or eliminating small populations.

Figure 6. SOUTEAST UTAH GROUP EXOTIC PLANT MANAGEMENT PLAN DECISION-MAKING TOOL OVERVIEW





Management objectives developed by each park should be specific so that the overall effectiveness of the exotic plant management program can be evaluated. Resource managers should also revise management objectives on a regular basis to address the ever-changing exotic plant management issues within their park.

Once management objectives are established, plant species lists for the park would be reviewed to identify exotic plants. Those plants that occupy or could occupy parklands directly or indirectly as the result of deliberate or accidental human activities are considered "exotic." Any plants that do not meet this definition are not exotic plants and would not be managed under the EPMP/EA/AEF.

In housing developments and cultural landscapes, exotic plants should also be evaluated to determine their cultural and/or historical significance and ethnographic value. Both cultivated and non-cultivated species may be historically appropriate or important ethnographic resources. Examples of exotic plants that meet or are managed for an identified park purpose:

- Historic cultivars - varieties of domestic, ornamental, or crop plants that may be genetically or morphologically distinct from common contemporary varieties, present in historic districts during periods of significance, and have been used historically.
- Introductions by indigenous peoples - plant species introduced or cultivated by indigenous peoples prior to the time of European settlement. These species occur because of human intervention, but have long histories on site.

Exotic plants within the boundaries of housing developments and cultural landscapes that do not pose a significant threat or nuisance to natural areas are exempt from management efforts under the EPMP/EA/AEF. These plants would be managed in accordance with NPS and park resource management guidelines. Exotic plants that pose a threat or nuisance to resources would be

further evaluated to determine whether management is prudent and feasible and whether their management is a priority.

NPS policy (NPS 2006) further restricts management to only those exotic plants whose management is prudent and feasible. The exotic plant must currently, or have the potential to, meet at least one of the following criteria: interfere with natural processes, disrupt the genetic integrity of native species, disrupt the accurate presentation of cultural landscapes, damage cultural resources, hamper the management of park or adjacent lands, pose a health hazard, or create a hazard to public safety. These criteria have been adopted as general "action thresholds" for this project. An action threshold is the point at which approved exotic plant management treatments are implemented because of current or potential levels of intolerable impacts to environmental resources. Determining whether an exotic plant meets an action threshold would be determined on a case-by-case basis, at the discretion of each park resource manager.

Guidance for Setting Management Priorities

This decision tool assists the resource manager in determining management priorities based on potential impacts to park resources and the potential for controlling the exotic plant. Exotic plants that are listed as county, state, or federal noxious weeds are considered a general management priority. Relative management priorities for each exotic plant (including noxious weeds) can be determined using either a quantitative or qualitative process. The NPS has developed a planning resource called the Alien Plant Ranking System to quantitatively determine exotic plant management priorities. However, some resource managers may not have enough information, data, or resources to use the Alien Plant Ranking System. To address this potential need, a qualitative system is also provided in this decision tool to allow resource managers to qualitatively determine exotic plant management priorities. Resource managers can use the Alien Plant Ranking System to sort exotic plants within a park according to the plant's current level of impact and its innate ability to become a pest. This information is then weighed against the perceived feasibility or ease of control. The Alien Plant Ranking System also helps the resource manager identify those species that are not presently a serious threat but have the potential to become a threat and, thus, should be monitored closely or managed aggressively before they become established. The potential cost of delaying any action is also considered in this analysis. The Alien Plant Ranking System can be downloaded at:

http://www.usgs.nau.edu/SWEPIC/aprs/downloads.html.

The qualitative ranking system was adapted from the *Handbook for Ranking Exotic Plants for Management and Control* (Hiebert and Stubbendieck 1993). Using this system, exotic plant management priorities are determined using four criteria:

- Current extent and distribution of exotic plant populations within the park
- Current and potential impacts of the exotic plant on environmental resources within the park
- Current and potential difficulty to control the exotic plant
- Value of habitat or resource being affected

The results of either the qualitative or quantitative rankings are used to determine relative management priorities. In accordance with NPS management policies (NPS 2006), highest priority is to manage disruptive exotic plants that have, or potentially have, a substantial impact on park resources, and can reasonably be expected to be controlled. Disruptive species typically have one or more of the following characteristics:

- Have community level or ecosystem level effects and significantly alter natural processes such as: fire regimes, nutrient cycling; hydrology, or successional patterns;
- Alter species composition and reduce populations of native species;
- Alter genetic variability through hybridization with native species;
- Affect localized resources, such as archaeological or scenic qualities.

Lower priority is given to innocuous exotic plants that have almost no impact on park resources or that probably cannot be successfully controlled. Innocuous species do not significantly harm park resources and are therefore usually a lower management priority. Most innocuous species do not invade native ecosystems without human-caused disturbance, and their populations generally do not expand within the park. Some innocuous species may invade native ecosystems, but do not displace native species to a significant extent. Whether a species is disruptive or innocuous depends on a number of factors, including the exotic plant's life history, environmental conditions, and the health of native ecosystems. An exotic plant may be disruptive in native ecosystems that are highly disturbed, but may be innocuous in a healthy native ecosystem. The ranking system allows the resource manager to account for each species' life history, environmental conditions, and the health of native ecosystems within their park when determining relative exotic plant management priorities.

Morse et al. (2004) have developed a system called *An Exotic Species Assessment Protocol: Evaluating Non-native Plants for their Impact on Biodiversity*. This tool could be used by parks to identify priority exotic plants on a more regional scale. NatureServe, in cooperation with TNC and the NPS, developed the Exotic Species Assessment Protocol as a tool for assessing, categorizing, and listing non-native exotic vascular plants according to their impact on native species and natural biodiversity in a large geographic area such as a nation, state, province, or ecological region. The protocol is designed to make the process of assessing and listing exotic plants objective and systematic, and to incorporate scientific documentation of the information used to determine each species' rank.

Priority treatment areas of each park unit were determined using the first two steps of the decision making tool process. These sites are targeted for control over the next 10 years approximately and the maps of each park unit with treatment areas are in Appendix F.

Optimum Tool Analysis for Treatment Options

The Optimum Tool Analysis for Treatment Options decision tool is used to identify a proposed treatment option and to assess whether there are alternative cost-effective treatment options available that would result in lower impacts. The optimum tool analysis process is based on the concept of Minimum Requirement Decision Guide that is used by the NPS to evaluate activities in Wilderness areas. An optimum tool is a use or activity, determined to be necessary to accomplish an essential task, which makes use of the least intrusive treatment, agent, or

application method that would achieve the management objective. This is not necessarily the same as the term "primitive tool," which refers to the actual equipment or treatment method that makes use of the simplest available technology (i.e., hand tools). In contrast to the primitive tool concept, the optimum tool analysis also considers whether the treatment is cost-effective. At the beginning of this decision tool, the resource manager identifies a proposed treatment option that is feasible given potential costs, available resources, potential impacts and effectiveness, and applicable regulations and policies. The next step is to consider whether there are any other treatment options, treatment agents, or application methods available that would result in lower impacts when compared to the proposed treatment option given potential costs, available resources, impacts, and effectiveness. If there are no other feasible options available, the resource manager selects the proposed treatment. However, if the resource manager identifies an alternative treatment that has lower impacts and that is feasible, the alternative treatment option is selected.

Once a treatment method is selected, its compliance with NPS policies and NEPA is confirmed. Two separate decision trees are used to confirm compliance. If chemical or biological control treatments are selected, their compliance with applicable regulations and policies is confirmed. Compliance with NEPA is also confirmed. These two steps are accomplished using separate decision trees. If compliant, the resource manager then determines whether there are any sensitive resources located within the treatment area that could be affected by the proposed treatment. Examples of sensitive resources include threatened, endangered, or traditional use plants; historic structures with limestone grout, raptor nests, and cave resources. If sensitive resources are identified, the locations of these resources and appropriate buffer areas are delineated so they can be avoided. Once sensitive resources have been delineated, the selected treatment along with BMPs to mitigate potential impacts can be implemented.

Treated areas are then monitored to determine whether management objectives established during the initial planning stages were met. If management objectives were met, the resource manager documents the results of monitoring. The resource manager should, however, continue to consider other treatment options as they become available to identify other alternatives that might have even lower impacts.

If management objectives are not met, the selected treatment may be modified, or alternative treatments may be considered through adaptive management. The NPS must use adaptive management to fully comply with 40 CFR, which requires a monitoring and enforcement program to be adopted, where applicable, for any mitigation activity. Adaptive management [516 Departmental Manual (DM) 4.16] is a system of management practices based on clearly identified outcomes; monitoring to determine if management actions are meeting outcomes; and if not, facilitating management changes that will best ensure that outcomes are met or by reevaluating outcomes. Adaptive management recognizes that knowledge about natural resource systems is sometimes uncertain and is the preferred method of management in these cases.

Confirm Compliance for Chemicals and Biological Control Agents

If chemicals or biological control agents would be used, the resource manager must confirm that these treatments are justified and compliant with NPS policies using this decision tool. According to the NPS Management Policies (2006:48), a designated IPM specialist must first

determine that the use of a chemical or biological control agent is necessary. In addition, all other treatment options considered must be either not acceptable or not feasible. If the use of chemical or biological control agents has not been determined necessary, or if there are other treatment options that are acceptable or feasible, the resource manager returns to the Optimum Tool Analysis to consider these treatments further.

Chemicals

In accordance with NPS-77 (NPS 1991), only those herbicides that are registered by the USEPA can be used. Herbicides must also be used in accordance with product labels. Some herbicides have use restrictions that prohibit their use under certain conditions. Herbicides having use restrictions would only be used for sites that meet the conditions specified on the product label. If the herbicide is registered, and if there are no existing site conditions that would restrict its use, the next step is to submit a herbicide use request to the Regional and/or National IPM Coordinator. In general, herbicide use proposals from parks are submitted to the Regional IPM Coordinator, who is responsible for soliciting input from the National IPM Coordinator for cases where the Regional Coordinator does not have approval authority. Herbicide use requests that involve any of the following actions must be approved by a National IPM Coordinator (NPS 1991):

- Aquatic applications or situations in which the applied herbicide could reasonably be expected to get into waters or wetlands;
- Applications that may affect rare, threatened, or endangered species or associated critical habitat;
- The use of restricted-use herbicides as defined by the USEPA;
- Treatment areas are equal to or larger than four sections of land.

Director's Order-77-7 (DO 77-7) (in preparation) requires herbicide use request approval by a National IPM Coordinator for aerial application of herbicides. DO 77-7 also require approval by a National IPM Coordinator for application of 400 contiguous acres. This differs from current NPS-77 requirements, which requires National IPM Coordinator review of any treatments equal to or larger than four sections of land. Although the size limit of four acres proposed under DO-77 has not been finalized, it is being used by the NPS as the acreage above which approval from the National IPM Coordinator is required.

The Regional IPM Coordinator may approve other herbicide use requests that do not fall into these categories.

Once the herbicide use request has been approved, the resource manager may then purchase herbicides. However, according to NPS policy, no herbicides may be purchased unless they would be used within one year from the date of purchase (NPS 2006:48).

Biological Control Agents

Only biological control agents that have been approved by APHIS for release would be used under the preferred alternative. If a biological control agent has not been approved by APHIS, resource managers must consider other treatments using the Optimum Tool Analysis in

Appendix A. APHIS undergoes an extensive review process prior to approving any biological control agents for release in the U.S. The next step is to submit a biological control agent use request to the Regional IPM Coordinator. Once the biological control use request has been approved by the National IPM Coordinator, the resource manager can then identify a procurement source for the biological control agents. If biological control agents would be obtained from another state, a permit must be obtained from APHIS. Transportation and handling of biological control agents would comply with any conditions specified in this permit.

Confirm Compliance of Proposed Treatment Method with NEPA
This decision tool is used to confirm that the selected treatment method complies with NEPA. The resource manager would use an Environmental Screening Form to confirm that the selected treatment method has been considered in the EPMP/EA/AEF or under another current and up-to-date environmental document. The resource manager would ask the following questions for each proposed exotic plant management treatment:

- Is the selected treatment included in the EPMP/EA/AEF or another approved plan and accompanying NEPA document?
- Are the potential selected treatment impacts consistent with the EPMP/EA/AEF or the other NEPA document?
- Is the EPMP/EA/AEF or other NEPA document accurate and up-to-date?

Park-specific plans that include exotic plant management treatments and associated potential impacts considered in this EPMP/EA/AEF may not require additional compliance with NEPA. However, resource managers are encouraged to consult regularly with a Regional NEPA Compliance Specialist to confirm that the EPMP/EA/AEF or other existing documents have adequately addressed any NEPA requirements prior to implementing proposed treatments in the future. If the selected treatment(s) complies with the EPMP/EA/AEF or other NEPA document, resource managers should document this compliance using a memo to file (see Appendix A decision making tool “Confirm Compliance of Treatment Method with an Existing NEPA Document”).

If the proposed treatment method has not been addressed in the EPMP/EA/AEF or in another NEPA document, or if the document is out-of-date, preparation of a new NEPA document would be required to comply with NEPA. For example, new treatment methods other than cultural, mechanical, biological, chemical, and prescribed fire may become available that were not available at the time this document was prepared. Preparation of additional NEPA documentation may also be required in cases where the proposed treatment could not be covered using a CE.

Park-specific plans containing exotic plant management treatments or having associated potential impacts that have not been considered in this EPMP/EA/AEF would also require additional compliance with NEPA. Regardless of whether an independent plan is developed, any exotic plant management action and associated impacts not covered under this EPMP/EA/AEF would require additional compliance with NEPA (see Appendix A decision tool “Confirm Compliance of Treatment Method with an Existing NEPA Document”).

In addition to NEPA, other federal, state, and local laws may also have information requirements that overlap with NEPA. The compliance review should also confirm that proposed treatment has addressed these other requirements. Some of these additional requirements, as identified in DO-12, include:

1. ESA - Section 7 requires that a federal agency consult with the USFWS or the National Marine Fisheries Service on any action that may affect endangered, species, threatened species, or candidate species, or that may result in adverse modification of critical habitat.

2. E.O. 11988 and 11990, Floodplain Management and Wetland Protection – These executive orders direct NPS to avoid, to the extent possible, the long- and short-term adverse impacts associated with modifying or occupying floodplains and wetlands. They also require NPS to avoid direct or indirect support of floodplain or wetland development whenever there is a practical alternative.

3. National Historic Preservation Act (NHPA) §106 - §106 of NHPA requires federal agencies to consider the effects of their proposals on historic properties, and to provide state historic preservation officers, tribal historic preservation officers, and, as necessary, the Advisory Council on Historic Preservation a reasonable opportunity to review and comment on these actions.

4. E.O. 12898, Environmental Justice in Minority and Low-Income Populations - This executive order directs federal agencies to assess whether their actions have disproportionately high and adverse human health or environmental effects on minority and low income populations.

5. Secretarial Order 3175 and Environmental Compliance Memoranda (ECM) 95-2 – These memoranda require bureaus to explicitly address environmental impacts of their preferred alternatives on Indian Trust Resources in any environmental document.

These requirements have been addressed in the preparation of this document.

2.2.5 Treatment Methods

Under the preferred alternative, the following treatment methods are proposed to manage exotic plants. These treatments include:

- Cultural
- Manual/Mechanical
- Biological Control
- Chemical
- Prescribed Fire

Each of these treatments is discussed in the following sections.

Cultural Treatments

Cultural treatments are practices that promote the growth of desirable plants and reduce the opportunities for exotic plants to grow. Cultural treatment methods involve manipulating treatment areas to present exotic plants with effective native competitors. Examples of cultural treatments that may be implemented under the preferred alternative include:

- Prevention
- Reseeding and Planting
- Irrigation

Prevention

Preventing establishment is an economical way to manage exotic plants. Under the preferred alternative, the following prevention actions would be implemented:

- Any feed, forage, mulch, fill, gravel, and other like materials brought into a park should be certified free of exotic plant seed ("certified weed-free"). Certified weed-free hay is often smooth brome, crested wheat grass, and alfalfa, which are not native to this country. While certified weed-free hay may include exotics, it may be the best option available. However, parks will encourage the use of hay composed only of native forage. Weed-free hay that does not include exotic plants should be readily available.
- Sources of "clean fill" (weed-free) will be used, where available, if construction fill will be obtained from within parks. If not feasible, fill not designated as "clean fill" may be used but should be closely monitored for exotic plant growth. Construction equipment will otherwise avoid exotic plant infestations, to the extent feasible.
- Brush horses and pack animals thoroughly and have their hooves cleaned before entering a park.
- Feed horses and pack animals only food that is "certified weed free" starting 96 hours before entering a park.
- Any seed or plant materials used for restoration efforts within a park should be "certified weed-free".
- Require inspections and cleaning of contractors' and fire fighters' equipment, vehicles, and materials to prevent importation of nonnative plant seed or materials into a park.
- Require commercial users that disturb established vegetation to provide bonds that are retained until sites are returned to a specified condition.
- Develop BMPs to limit the amount and impact of ground-disturbing activities.
- Train park staff and volunteers on how to identify priority exotic plants. Park employees and volunteers should report any observations of exotic plants to the resource manager immediately. A phone number for the point of contact would be provided to staff and volunteers.
- Develop information for the public and park staff on exotic plants. This information may include signs, interpretive displays, brochures, and programs.

Reseeding and Planting

Reseeding is used to encourage the re-establishment of native plants and to prevent the establishment of exotic plants. Native shrubs or trees can also be replanted after exotic shrubs and trees are removed to help restore habitat structure. Unless native plants are reestablished, the removal of one exotic plant may result in the establishment of another undesirable exotic plant.

Reseeding will not be required in areas where native plant diversity is good within and surrounding treated infestations of exotics.

Under the preferred alternative, any planned in-park development or disturbance activities should be required to include sufficient time for plant salvage to be completed prior to disturbance. Any areas that are disturbed would be reseeded as soon as possible to facilitate the reestablishment of native plants. Restoration may also be necessary in dense infestation areas that no longer support native species or where viability of native species seed banks has been exhausted. Following treatment and removal of exotic plants, these areas will be reseeded using native plant materials. Any materials used in re-vegetation (including mulch and organic fertilizers) would be free of non-native plant seeds or materials. In addition, locally grown, native plant materials would be used where possible. All plant materials used would be "certified weed-free."

Irrigation

Irrigation may be used on a limited basis to help native vegetation become established during dry periods. However, no surface water depletions or accretions related to irrigation would occur under the preferred alternative. Because much of the SEUG area has been in a drought over the last several years, any projects that involve planting native shrubs or trees should also consider whether there would be adequate water to facilitate vegetation establishment. If drought conditions are forecasted, resource managers should delay the purchase and planting of shrubs to avoid the need for irrigation. Resource managers should also confirm that there is water available for irrigation should the need arise.

Manual and Mechanical Treatments

Manual and mechanical treatments would continue as described under Alternative 1 in Section 2.1. Mechanical treatments would continue to involve the use of tools to remove or physically damage exotic plants. Examples of mechanical treatments include using hand cutting (shovels and clippers), pulling tools (such as weed wrenches™), and power tools. Any manual and mechanical methods would be highly selective for individual plants. Both manual and mechanical treatments could be used to treat individual plants or specific treatment areas. Manual or mechanical treatments may need to be performed several times during a season and are often used in concert with other treatment methods. For example, manual or mechanical treatments may be followed by application of herbicides or prescribed fire to treat re-sprouts and new seedlings.

Mechanical treatments remove aboveground biomass and deplete nutrient reserves that are stored in root or rhizome systems. Once nutrient reserves are depleted, exotic plants become more susceptible to subsequent chemical or fire treatments. Following biomass removal, chemicals are often applied directly to the stumps to prevent suckering.

Activities with minimal surface disturbance, such as no-till drill seeding, might be used to reseed riparian and wetland areas in the future. Any activities that could disturb wetlands or waters of the U.S. would require separate consultation with the USACE to determine if a permit is needed.

Biological Control

Biological control relies on the use of other biological organisms to maintain pest populations below the action thresholds. In some cases, such as when native insects and herbivores are not maintaining exotic plants at acceptable levels, releases of biological control agents may be necessary. Release of biological control agents adhere to the following BMPs:

- Biological control agents should be released in each climatic zone that is occupied by the host so that the natural enemy has a chance to develop in all areas where the host occurs.
- The number of biological control agents released should account for the size and density of the treatment area and the number of agents required to maintain a viable biological control agent population.
- More than one release in an area may be necessary for successful establishment.
- Releases should be synchronized with the time period when the host is present.
- Biological control agents should be released at times of the day when they will not disperse from the treatment area.
- Surveys for biological control agents should be completed several times during the season to monitor biological control agents.

Under the preferred alternative, insects would be the primary biological control agent that would be used. SEUG parks who currently do not use these biological control agents could consider using them. Biological control agents that are proposed for use under the preferred alternative are summarized in Table 2-3.

Only biological control agents that have been approved by APHIS for release on federal lands in Utah and/or Colorado could be used under the preferred alternative. When considering the use of a new biological control agent, the resource management specialist would confirm that its use is necessary and that all other treatment options are either not acceptable or not feasible. In making this determination, resource managers are also encouraged to contact specialists at APHIS who have studied the biological control agent. The resource manager should confirm that use of the selected biological control agent is appropriate for their site, that it has the potential to be effective, and that populations would be viable. Taking these extra steps would help to ensure that the most appropriate and cost-effective biological control agent is selected.

Before a biological control agent is released, the resource manager would receive approval from the National IPM Coordinator to release the agent. If biological control agents would be obtained from another state, a permit, which has been reviewed by the State Entomologist, must also be obtained from APHIS. The transport, handling, and release of biological control agents would be in accordance with all permit conditions. Parks would use a standardized form to report annual releases of biological control agents to the Regional IPM Coordinators.

The release of tamarisk leaf beetles (*Diorhabda elongata deserticola*) is not currently permitted by APHIS in Utah. Therefore, if future activities include use of this biological control methodology, formal Section 7 consultation will need to be reinitiated.

Table 2-3. SUMMARY OF BIOLOGICAL CONTROL AGENTS PROPOSED FOR USE UNDER PREFERRED ALTERNATIVE

Targeted Plants	Biological Control Agent		Habitat	Mode of Action	Impact on Host
	Common Name	Scientific Name			
Tamarisk	Tamarisk Leaf Beetle	*Diorhabda elongata deserticola*	This beetle may not be able to establish where floods or permanent above-ground water do not permit pupation or over wintering.	Both adults and larvae feed on the foliage of tamarisk.	Beetle causes death of more plant tissue than it consumes. Damages tamarisk foliage by scraping tissue off leaves, causing twigs beyond this damage to turn yellow and eventually fall off.
Goathead/ Puncturevine	Puncturevine Seed Weevil	*Microlarinus lareynii*	Hot and dry conditions and only on puncturevine plants	Adults over winter in plant debris. Adults lay eggs in the immature burr or flower bud and the larvae feed on and destroy the seeds before they pupate and emerge as adults	This feeding prevents many seeds from germinating and severely impacts the plants.
	Puncturevine Stem Weevil	*Microlarinus lypriformis*	Hot and dry conditions and only on puncturevine plants	Adults over winter in plant debris and lay eggs in the undersides of stems, branches, and the root crown. The larvae tunnel in the pith where they feed and pupate.	Damage to the stems from both external adult feeding and internal larval activity shortens stem lengthening and ultimately delays or prevents the development of flowers and, subsequently, seeds.
Field Bindweed	Bindweed Gall Mite	*Aceria malherba*	Cultivated fields, roadsides, waste places. Grows best on moist fertile soils. Tolerates poor, dry, gravelly soils, but seldom grows in wet soils.	Mites cause galls to form on the leaves and stems of bindweed; During the winter these mites feed on root buds.	Feeding results in stunting of the plant, reduced flowering, and some reduction in the amount of bindweed.
	Field Bindweed Moth	*Tyta luctuos*	Cultivated fields, roadsides, waste places. Grows best on moist fertile soils. Tolerates poor, dry, gravelly soils, but seldom grows in wet soils.	Larvae feed on both leaves and flower buds.	Heavily defoliated plants may die or produce fewer shoots the following year.
Purple Loosestrife	Loosestrife Beetle	*Hylobius transversovittatus*	Sites without prolonged flooding are favored for weevil development.	Larvae live in the roots while adults feed on foliage.	Small roots can be destroyed within two years if infested by several larvae. Larger roots may die after several consecutive years of infestation.
	Golden loosestrife beetle	*Galerucella pusilla*	Readily establishes in infested areas that do not remain	Adults and larvae feed on buds and foliage.	Defoliates purple loosestrife so completely that plants are often

Targeted Plants	Biological Control Agent		Habitat	Mode of Action	Impact on Host
	Common Name	Scientific Name			
			flooded.		killed.
	Black-margined loosestrife beetle	*Galerucella calmariensis*	Continuously flooded habitats are not suitable for beetle survival.	Adults and larvae feed on buds and foliage.	Stunts plants and reduces seed production. Heavily defoliated plants may die or produce fewer shoots the following year.
Canada Thistle	Canada thistle stem-boring weevil	*Ceutorhynchus litura*	Favorable conditions include disturbed areas where Canada thistle is dense, and where plant is not stressed by grazing, flooding, mowing, or herbicides.	Adults feed on leaf and stem tissue. Larvae feed on stem and crown of the plant.	Departing larvae create an emergence hole below the soil surface, which provides access for small insects, other arthropods, nematodes, and pathogens.
Spotted Knapweed, diffuse knapweed	Blunt knapweed flower weevil	*Larinus obtusus*	More moist areas than *L. minutus* (see below)	One or two larvae destroy most of the developing seeds in the head.	Seed production is reduced.
	Lesser knapweed flower weevil	*Larinus minutus*	Hot and dry areas	Larvae feed on seeds, adults feed on rosette leaves.	Reduces seed production. Single larva can destroy an entire knapweed seedhead.
	Knapweed root weevil	*Cyphocleonus achates*	Prefers well-drained soils that lack dense vegetation other than knapweed.	Larvae mine and gall the central vascular tissue of the roots.	Newly hatched larvae mine into the root cortex. Feeding by older larvae causes damage to roots.
	Sulfer knapweed moth, yellow knapweed root moth	*Agapeta zoegana*	Favorable habitats are moderately humid and temperate and have an arid subcontinental climate.	Larvae damage their host plant by mining the roots.	Small plants are often killed by the feeding of the young larvae, larger plants will not flower.

Chemical Treatments

Chemical treatments involve applying herbicides as prescribed by their labels, using a variety of application methods. Herbicides are most effective for treating pure stands of a single exotic plant species in areas where desirable plants are scarce or absent. Herbicides can also be used to treat small patches of exotic plants where hand pulling or cutting is not feasible (Colorado Natural Areas Program (CNAP 2000).

Under the preferred alternative, herbicides would be applied a number of different ways. In most instances brushes or portable sprayers will be used, other possible methods include All-Terrain Vehicles (ATVs) equipped with sprayers, and aerial application (helicopter and fixed wing). Portable spot or wick applicators can be used to apply an herbicide directly onto a target plant. Power sprayers are portable, pressurized sprayers that can be used to treat small application areas. ATVs or helicopters can be equipped with either a boom or boomless applicator to rapidly treat large areas. A boom applicator is a long horizontal tube that is equipped with multiple spray heads. A boomless sprayer is designed to provide a full left to right hand spray pattern from a centrally mounted nozzle. An ATV can be mounted with two nozzles directly behind the ATV that can spray 15 feet in each direction. The boom is carried above the exotic plants, while spraying the herbicide. Spray mechanisms are equipped with flow regulators that control application rates. In the SEUG, a common application method for treating trees and shrubs is the "cut stump method." The tree or shrub is cut near the base of the trunk, and herbicides are sprayed or painted directly onto the cut stump.

Aerial application of herbicides would only be conducted for sites that meet one of the following criteria:

- The infestation covers a large area and would be most effectively treated from the air. There is no acre limit for using aerial application, however aerial application sites are typically over 20 acres and have fairly dense exotic plant coverage.

- The infestation covers a small area but can be successfully treated using a microfoil boom or similar apparatus that allows for a limited band of spray. A microfoil boom can be used to spray widths as small as 12 feet, effectively treating small infestations. Microfoil booms are designed specifically to minimize herbicide drift.

- The infestation is very remote and treatment using other application methods would require an inordinate amount of time for crews to arrive and apply ground treatment.

- The infestation is located on rough, steep terrain that prevents ground application and is too dangerous for employees on foot.

Under the preferred alternative, the use of herbicides would be considered only after alternative manual/mechanical, cultural, or biological control treatment methods have been ruled out using the Optimum Tool Analysis. Under some circumstances, herbicides may be the only feasible option for treating an exotic plant. Herbicides selected for treatment would be known to be effective on the target exotic plant and known to have a minimal effect on the environment. To minimize potential environmental effects, herbicides would be selected based on the presence of

non-target plants (including sensitive, traditional use plants), soil texture, depth and distance to water, and environmental conditions.

Under the preferred alternative, resource managers may use the Relative Aquifer Vulnerability Evaluation (RAVE) system to assess the potential risk for ground water contamination resulting from the use of herbicides. Use of the RAVE model or other appropriate model is encouraged in areas where leaching to ground water is possible. RAVE is a numeric scoring system that is relatively simple to use, and allows resource managers to quantitatively evaluate the potential for an herbicide to contaminate ground water. The RAVE system can also be used for insecticides, fungicides, and rodenticides. However, only herbicides would be used under the preferred alternative.

The RAVE system includes a model that addresses irrigation systems developed by Montana State University (MSU 1990) and one that addresses natural precipitation systems developed by the Forest Service (USDA Forest Service 1992). Both models are included as tools in Appendix G. The original RAVE system, titled "RAVE: Relative Aquifer Vulnerability Evaluation," was developed by the MSU Extension Service (MSU 1990). This system was developed for farming situations that use irrigation. Under the EPMP/EA/AEF, the original RAVE system could be used for situations where parks irrigate areas that are also chemically treated. The Forest Service has modified this original RAVE system so it can also be used for non-irrigated areas that only receive natural precipitation. This version of the RAVE system is titled RAVE: Relative Aquifer Vulnerability Evaluation (as adapted from Montana Department of Agriculture and Environmental Management Division) (USDA Forest Service 1992). This version of RAVE would be used by parks for those areas that only receive natural precipitation and do not receive supplemental irrigation. Appendix G also includes a supplemental table to be used with either RAVE system. This table, developed by Gerald McCrea (Regional IPM Coordinator for the Intermountain Region) provides additional information on herbicides that would be used under the preferred alternative.

To determine the potential for ground water contamination, the RAVE system considers several factors: irrigation practice, depth to ground water, distance to surface water, percent organic matter, herbicide application frequency, herbicide application method, herbicide leachability, and topographic position. Values are assigned to each of these factors and then totaled. The total value is then compared to a "scorecard interpretation scale" to determine the potential for ground water contamination by an individual herbicide. Higher scores indicate a higher vulnerability of ground water to herbicide application. If an herbicide is determined to have a high potential for ground water contamination, an alternative herbicide or alternative application method is selected and results are compared. The alternative that has the lowest potential for ground water contamination and that has an acceptable score is then selected. Approval by the Regional IPM Coordinator is also required. In some cases, herbicide soil mobility data are available which has enabled the establishment of herbicide-specific buffer zones. In such cases, these data could be used instead of the RAVE model, as it is based on research data rather than modeling.

Only those herbicides that have been registered by the US EPA would be used under the preferred alternative. When considering the use of a chemical treatment, the resource

management specialist would confirm that its use is necessary and that all other treatment options are either not acceptable or not feasible. The resource manager should also confirm that use of the selected herbicide is appropriate for the site and that it has the potential to be effective on the target species. Taking these extra steps would help to ensure that the most appropriate and cost-effective herbicide is selected.

Herbicides are classified according to their mode of action, which is determined by the active ingredients. Active ingredients that may be used under the preferred alternative are summarized in Table 2-4. Common trade names are provided in parentheses after the active ingredient. This is not a comprehensive list of trade names, and under the EPMP/EA/AEF, any registered herbicide trade name that contain the active ingredients listed in Table 2-4 may be used. Herbicides containing active ingredients that are not listed on Table 2-4 may also be used under the EPMP/EA/AEF. However, the use of any herbicide must meet all conditions outlined in this document and must also be approved by the Regional or National IPM Coordinator.

An adjuvant is a substance added to an herbicide to aid its action, but has no herbicide action by itself. Some herbicides require the addition of an adjuvant to work effectively. Surfactants are adjuvants used in conjunction with herbicides to increase absorption. A surfactant is a surface active ingredient that lowers surface tension of the solvent in which it is dissolved or the tension between two immiscible liquids. Safety procedures and MSDS's must be kept on site for all adjuvants used under the EPMP/EA/AEF.

Table 2-4. SUMMARY OF ACTIVE INGREDIENTS FOR PROPOSED HERBICIDES

Active Ingredients	Registered Use	Target Plants	Mode of Action	Method of Application
Aminopyralid (Milestone)	General Use	Annual, biennial and perennial broadleaf weeds and woody plants.	Translocates throughout the entire plant and accumulating in meristematic tissues, including the roots. It disrupts plant growth metabolic pathways affecting the growth process of the plant.	Aerial spraying, spraying from a truck, backpack or handheld sprayer, foliar spray, spot treatments.
Clopyralid (Curtail, Transline, Reclaim, Lontrel, Redeem)	General Use	Annual and perennial broadleaf herbs, especially knapweeds, thistles, and other members of the sunflower, legume, and knotweed families	Absorbed by the leaves and roots of the exotic plant and moves rapidly through the plant. It affects plant cell respiration and growth.	Aerial spraying, spraying from ground equipment.
Glyphosate Products (Roundup Pro, Roundup Ultra, Rodeo, GlyPro, Accord, Glyphomax, Touchdown)	General Use	Grasses, herbaceous plants including deep rooted perennial exotic plants, brush, some broadleaf trees and shrubs, and some conifers. Does not control all broadleaf woody plants.	Absorbed by leaves and rapidly moves through the plant. It acts by preventing the plant from producing an essential amino acid. This reduces the production of protein in the plant, and inhibits plant growth.	Aerial spraying, spraying from a truck, backpack or handheld sprayer, wipe application, frill treatment, cut stump treatment.

Active Ingredients	Registered Use	Target Plants	Mode of Action	Method of Application
Imazapic (Plateau, Cadre, Plateau Eco-Paks)	General Use	Annual and perennial broadleaves and grasses	Inhibits the production of some amino acids, which are necessary for protein synthesis and growth.	Aerial spraying, spraying from ground equipment or a handgun sprayer.
Imazapyr (Arsenal, Habitat)	General Use	Annual and perennial grass, broad-leaved weeds, brush, vines, and deciduous trees.	Absorbed by leaves and roots, moves rapidly through plants. Disrupts photosynthesis and interferes with cell growth and DNA synthesis.	Ground or aerial foliage spray, basal bark and stem treatment, cut stump treatment, tree injection.
Picloram (Tordon, Grazon PC, Tordon K, Tordon 22K)	Restricted Use*	Broadleaf herbs, vines, and woody plants (especially leafy spurge).	Absorbed through plant roots, leaves and bark. It moves both up and down within the plant, and accumulates in new growth. It acts by interfering with the plant's ability to make proteins and nucleic acids.	Broadcast or spot treatment as foliar (leaf) or soil spray, basal spot treatment, tree injection, frill treatment, stump treatment, basal bark treatment, low volume dormant stem spray, by air as broadcast or low volume dormant spray.
Triclopyr (Garlon products)	General Use	Woody plants and broadleaf plants.	Disturbs plant growth. It is absorbed by green bark, leaves and roots and moves throughout the plant. Accumulates in the meristem (growth region) of the plant.	Ground or aerial foliage spray, basal bark and stem treatment, cut surface treatment, tree injection.

* All formulations that may be broadcast on soil or foliage are classified as “restricted use” herbicides. Sale and use of these herbicides are limited to licensed herbicide applicators or their employees, and only for uses covered by the applicator's certification. The restricted use classification is due to picloram’s mobility in water, combined with the extreme sensitivity of many important crop plants to damage.

Each herbicide varies in terms of its chemical and biological behavior in the environment. Factors that affect herbicide behavior in the environment include herbicide properties, soil characteristics, and climatic conditions. Factors that influence the behavior of herbicides in the environment are summarized below. This summary is based on information provided by Miller and Westra (1998) in “*Colorado State University Fact Sheet: Herbicide Behavior in Soils*”.
Acid or base strength - refers to whether a herbicide has basic, acidic, or non-ionizable properties. This factor determines the ability of a herbicide to exist in soil water or be retained onto soil solids. In general, herbicides whose pH is close to the pH of soil are strongly retained and are not subject to runoff, erosion, and/or leaching. In contrast, herbicides whose pH is not close to that of the soil are less strongly retained and are subject to runoff, erosion, and/or leaching. These herbicides are also more available for plant uptake than those herbicides that are strongly retained onto soil solids.

- Water solubility - refers to how readily an herbicide dissolves in water and determines the extent to which an herbicide is in the solution (water) phase or the solid phase. An herbicide that is water soluble generally is not retained by soil.

- Volatility - refers to the tendency of an herbicide molecule to become a vapor. Herbicides with high vapor pressures are likely to escape from the soil and volatilize in the atmosphere.

- Soil retention - is an index of the binding capacity of the herbicide molecule to soil organic matter and clay. In general, herbicides with high soil retention are strongly bound to soil and are not subject to leaching. Those not exhibiting high soil retention are not strongly bound and are subject to leaching.

- Soil persistence - refers the longevity of a herbicide molecule, typically expressed in terms of a half-life, as determined under normal conditions in the region where the herbicide would be used.

These factors influence the environmental fate and effects of an herbicide, including its residual soil activity, persistence, volatilization, water solubility, and potential for leaching into ground water. Table 2-5 summarizes potential environmental fate and effects of herbicides that may be used under this alternative.

Once an herbicide has been selected, the resource manager would submit an herbicide use request using the Intranet-based IPM System. In general, the Regional IPM Coordinator would be responsible for reviewing and approving proposed herbicide uses. However, review and approval from a National IPM Coordinator would be required for herbicide uses that involve: aquatic applications or situations in which the applied herbicide could reasonably be expected to get into waters or wetlands; herbicide uses that may affect rare, threatened, or endangered species or associated critical habitat; herbicide use involving aerial application; herbicide use on 400 or more contiguous acres, use of a restricted-use herbicide as defined by the USEPA would be used. The only restricted use herbicide currently being used by parks is picloram. All formulations that contain picloram and that may be broadcast on soil or foliage are classified as “Restricted Use” herbicides. Sale and use of these herbicides are limited to licensed herbicide applicators or their employees, and only for uses covered by the applicator's certification. A National IPM Coordinator must approve the use of picloram prior to its purchase and use.

Table 2-5. PROPOSED HERBICIDES AND THEIR ENVIRONMENTAL FATE AND EFFECTS.

Active Ingredient	Persistence in Soil	Residual Soil Activity	Volatilization and Potential By-Products from Burning	Solu-bility	Potential for Leaching	Surface Waters	Toxicity
Aminopyralid (Milestone)	Half-life can range from 32-533 days with a typical time of 103 days.	Soil microorgisms and sunlight break down aminopyralid	No information is available on potential by-products from burning.	Not available	Moderate potential to leach through soils and contaminate groundwater.	Reduced run-off potential because of its low use rate. Surface water breakdown in less than 24 hours.	**Soil microorganisms-** no information is available. **Plants-** Contact with non-target plants may injure or kill plants especially leguminous trees. **Aquatic animals-**Practically non-toxic to slightly toxic to aquatic invertebrates. Practically non-toxic to fish. **Terrestrial animals-** Practically non-toxic to mammals and birds **Human health-**EPA toxicity level IV. Classified as "not likely" to be carcinogenic to humans.
Clopyralid (Curtail, Transline, Reclaim, Lontrel, Redeem)	May be present in anaerobic soils or soils with low microorganisms. Half-life is 15-287 days.	Active in soil, is usually absorbed from soil by plants. Soil microorganisms break down Clopyralid.	Does not evaporate easily. No information is available on potential by-products from burning.	Highly soluble in water.	Because clopyralid is highly soluble in water, does not absorb to soil particles, and is not readily decomposed in soils, it may leach into ground water. Ground water may be contaminated if clopyralid is applied to areas where soils are very permeable and water table is shallow.	Because clopyralid is highly soluble in water, there is potential for surface waters to be contaminated if clopyralid is applied directly to bodies of water or wetlands.	**Soil microorganisms** - no information is available. **Plants** - contact with non-target plants may injure or kill plants. **Aquatic animals** - low toxicity to fish and aquatic invertebrate animals. Clopyralid does not bio-accumulate in fat tissues. **Terrestrial animals** - low toxicity to birds and mammals. Not toxic to bees. **Human Health-** EPA Toxicity level IV. This herbicide is not classified as a carcinogen, teratogen, mutagen, or reproductive inhibitor. No reports of acute poisoning in humans have been found. Clopyralid can cause severe eye damage, so properly fitted goggles are mandatory for applicators.
Glyphosate Products (Roundup Pro, Roundup Ultra, Rodeo, GlyPro, Accord, Glyphomax, Touchdown)	Half-life can range from 3 to 130 days. Soil micro-organisms break down glyphosate. Surfactant in Roundup has a half-life of less than 1 week.	Generally not active in soil. It is not usually absorbed from the soil by plants.	Does not evaporate easily. Major products from burning treated vegetation include phosphorus pentoxide, acetonitrile, carbon dioxide, and water. None of these com-pounds is known to be a health threat at levels that would be found in a vegetation	Dis-solves easily in water.	The potential for leaching is low. Glyphosate and the surfactant in Roundup are strongly absorbed by soil particles. Half-life for glyphosate in water ranges from 35 to 65 days. The surfactant half-life ranges from 3 to 4 weeks.	Very low concentrations of glyphosate have been observed in surface water following heavy rains, up to 3 weeks after application.	**Soil microorganisms** - Glyphosate and the surfactant have no known effects on soil microorganisms. **Plants** - Contact with non-target plants may injure or kill plants. **Aquatic animals** - Glyphosate is no more than slightly toxic to fish, and practically non-toxic to aquatic invertebrate animals. It does not bio-accumulate in fish. The Accord and Rodeo formulations are practically nontoxic to freshwater fish and aquatic invertebrate animals. The Roundup formulation is moderately to slightly toxic to freshwater fish and aquatic invertebrate animals.

Active Ingredient	Persistence in Soil	Residual Soil Activity	Volatilization and Potential By-Products from Burning	Solu-bility	Potential for Leaching	Surface Waters	Toxicity
			fire.				**Terrestrial animals** - Glyphosate is practically nontoxic to birds and mammals. It is practically non-toxic to bees. **Human Health**- EPA Toxicity level IV. Glyphosate is not classified as a carcinogen, teratogen, mutagen, or reproductive inhibitor. Most reports impacts to humans have involved skin or eye irritation while mixing and loading.
Imazapic (Plateau, Cadre, Plateau Eco-Paks)	Half-life can range from 120- 140 days. It binds weakly to moderately with most soil types. Adsorption increases with decreasing soil pH and increase-ing clay and organic matter.	Moderately persistent.	Does not volatilize from the soil surface and photolytic break down on soils is negligible.	Soluble, but not degraded in water.	Has not been found to move laterally with surface water. Breaks down rapidly in aqueous solution, with a half-life of 1 or 2 days. Has limited horizontal mobility (6 to 12 inches; up to 18 in sandy soils).	Is rapidly degraded by sunlight in aqueous solution, but is not registered for use in aquatic systems.	**Soil microorganisms** - no information is available. **Plants** – contact with non-target plants may injure or kill plants. **Aquatic animals** – moderately toxic to fish. **Terrestrial animals** – low toxicity to birds and mammals. Does not bio-accumulate in animals, and is rapidly excreted in urine and feces. **Human Health**- EPA Toxicity level IV. Imazapic is not classified as a carcinogen, teratogen, mutagen, or reproductive inhibitor. If ingested, imazapic is rapidly excreted in the urine and feces and does not bioaccumulate.
Imazapyr (Arsenal, Habitat)	May be broken down by exposure to sun-light. Soil micro-organisms contribute to breakdown of imazapyr.	Imazapyr can remain active in soil for 6 months to 2 years.	Does not evaporate easily.	Soluble in water.	Imazapyr has a low potential for leaching to ground water.	Imazapyr may move from treated areas to streams. Most movement of imazapyr was found in runoff from storms. Use of a stream-side management zone can significantly reduce the amount of off-site movement in stream-flow. Half-life in water is about 4 days.	**Soil microorganisms** - has very little effect on soil microorganisms. **Plants** - non-toxic to conifers, but is toxic to many other non-target plants. **Aquatic animals** - Imazapyr and its formulations are low in toxicity to invertebrates and practically non-toxic to fish. Imazapyr is not expected to build up in aquatic animals. **Terrestrial animals** - practically non-toxic to mammals and birds. It is of low toxicity to bees. Imazapyr is rapidly excreted by animals. **Human Health**- EPA Toxicity level III. Triclopyr does not cause birth defects or cancer, and has little or no effect on fertility or reproduction. The exposure levels a person could receive from routine operations are below the levels shown to cause harmful effects in laboratory studies. If ingested, imazapyr is rapidly excreted in the urine and feces and does not bioaccumulate.
Picloram (Tordon, Grazon	Long-term build up of picloram in	Picloram can stay active in soil for a	Does not evaporate easily. Burning	Dissolves readily in	Picloram can leach into ground water under	Picloram can be carried by surface	**Soil microorganisms** - Picloram has very low toxicity to soil microorganisms at up to 1,000

Active Ingredient	Persistence in Soil	Residual Soil Activity	Volatilization and Potential By-Products from Burning	Solu-bility	Potential for Leaching	Surface Waters	Toxicity
PC, Tordon K, Tordon 22K)	soil generally does not occur. Sun-light and micro-organisms in the soil break down picloram. Alkaline condi-tions, fine tex-tured clays, and low densities of plant roots can increase the persistence of picloram.	moderately long time, depending on soil, soil moisture, and temperature. It may exist at levels that are toxic to plants more than a year after application.	destroys more than 95% of picloram residue.	water.	certain conditions. Picloram leaches more easily in soils that have low organic content or are very sandy. Picloram movement is greatest for soils with low organic matter, alkaline soils, and soils that are highly permeable. Where the water table is very low, picloram may leach into ground water. Picloram should not be applied to any surface that would allow for direct pollution of ground water.	run-off water. To prevent water pol-lution, picloram spray drift or runoff should not be allowed to fall onto banks or bottoms of irrigation ditches, or water intended for drinking or house-hold use. Picloram should not be directly applied to wetlands.	parts per million (ppm). **Plants** - Picloram is highly toxic to many non-target plants. Most grasses are resistant to picloram. **Aquatic animals** - Picloram is moderately to slightly toxic to freshwater fish, and slightly toxic to aquatic invertebrate animals. It does not bio-accumulate in fish. The formulated product is generally less toxic than picloram. **Terrestrial anima**ls - Picloram is almost non-toxic to birds. It is relatively non-toxic to bees. Picloram is low in toxicity to mammals, and animals excrete picloram in urine unchanged. **Human Health**- EPA Toxicity level III. Exposure is primarily through inhalation and dermal sensitization. The exposure levels a person could receive from routine operations are below the levels shown to cause harmful effects in laboratory studies.
Triclopyr (Garlon products)	Microorganisms degrade triclopyr rapidly. The average half-life in soil is 46 days.	Triclopyr is active in soil and is absorbed by plant roots.	Very low potential for volatilization. No information is currently avail-able on potential for byproducts from burning of treated vegetation.	Moderate to low.	The potential for leaching depends on soil type, acidity, and rainfall conditions. Triclopyr should not be a leaching problem under normal conditions since it binds to clay and organic matter in soil. Triclopyr may leach from light soils if rainfall is very heavy.	Sunlight rapidly breaks down triclopyr in water. The half-life in water is less than 24 hours. Irrigation ditches or waters used for irrigation or domestic use should not be polluted by triclopyr.	**Soil microorganisms** - slightly to practically non-toxic to soil microorganisms. **Plants** - Triclopyr is toxic to many plants. Even very small amounts may injure some plants. **Aquatic animals** - Triclopyr is low in toxicity to fish. The ester form of triclopyr, found in Garlon 4, is more toxic, but in normal conditions, it rapidly breaks down to a less toxic form. Does not bio-accumulate in fish. Triclopyr is slightly toxic to practically non-toxic to aquatic invertebrates. **Terrestrial animals** - Triclopyr is slightly toxic to mammals. In mammals, most triclopyr is excreted, unchanged, in urine. Triclopyr and its formulations have very low toxicity to birds. Triclopyr is non-toxic to bees. **Human Health**- EPA Toxicity level III. Triclopyr does not cause birth defects or cancer, and has little or no effect on fertility or reproduction. The exposure levels a person could receive from routine operations are below the levels shown to cause harmful effects in laboratory studies.

Prescribed Fire Treatments
As stated previously in Section 2.1.9, SEUG does not include prescribed fire by itself as a management tool to control exotic plants according to the Fire Management Plan. The plan provides guidance to allow individual burns to be used for disposal of vegetative debris that is infeasible to dispose of by other means. Under this alternative, brush piles that accumulate from cutting of exotic plants such as tamarisk (*Tamarix chinensis*) and Russian thistle (*Salsola tragus*) would continue to be burned. Heat treatments of individual or small populations of emerging plants, particularly puncturevine (*Tribulus terrestris*) and Russian thistle (*Salsola tragus*) would also continue under this alternative.

2.2.6 Monitoring and Record Keeping

Detailed and accurate record keeping and monitoring is a fundamental component of the preferred alternative. Record keeping would be used to provide a historical record of activities and also to provide information that can be used to justify future exotic plant management activities. Monitoring would be used to determine whether exotic plant management activities are effective in meeting management objectives.

The effects of the biological control agent the Tamarisk Leaf Beetle are not well known. They have been released outside the parks but are quickly spreading throughout ARCH and CANY. In fiscal year 2009, funding has been provided to assist with monitoring the beetle's effects on tamarisk and the effects of the dead tamarisk on the environment in general. In some areas monitoring may be more site-specific, like monitoring the large dense tamarisk populations along the river ways. Once these large populations are thinned due to the help of the beetle, what is the potential for other exotics to proliferate in these newly opened riverside areas? It will also be imperative for resource managers to keep in contact with other local agencies that are using biocontrol agents and learn of their results as well.

When biocontrol agents are released in the parks, annual reports would be prepared that summarize the type and number of biological control agents released using the Biological Control Agent Release Form. Biological control reports would be submitted to the Regional IPM Coordinator by March 15 of each year. Biological control reports may also be submitted using an Intranet-Based System once it is developed.

When recording herbicide use, SEUG will use the web-based Pesticide Use Proposal System (PUPS). PUPS is a historical database of the SEUG's control actions and include the amounts of products applied and actual areas treated in the SEUG. Herbicide use in the field would be recorded using the Herbicide Data Form. Information recorded on herbicide use forms would include the following:

- Date and time of application
- Name, location, and estimated area of treatment site

- Brand name of the material or materials used, including formulation
- US EPA registration number of materials used
- The mix rate of material used
- The amount of material used
- Name and license number of herbicide applicator
- General weather conditions, including wind speed

Annual herbicide use reports would be submitted electronically using PUPS. Herbicide use reports must be entered into this system by March 15 of each year.

2.3 BEST MANAGEMENT PRACTICES

To minimize the potential impacts from personnel and equipment, the following general BMPs (mitigation measures) would be implemented under both alternatives.

General

- Equipment would use existing roads and trails to the maximum extent practical.
- Herbicides will be applied primarily by backpack sprayers and hand sprayers, and of specific criteria warrant, boom sprayers on ATV's and aircraft may be used.
- Herbicides would be applied according to application rates specified on the product label.
- Hand tools will be primarily used and only where hand tools are not feasible, chainsaws may be used.
- Equipment used for exotic plant management would be washed prior to entering a park to reduce the potential for accidentally introducing exotic plants from another area.
- Use of equipment in high visibility areas would be avoided to the extent feasible.
- The number of vehicle and equipment passes off-road (only on a case by case basis) would be minimized to the extent possible.
- NPS policy requires that only herbicides that are expected to be used in a 1-year period can be purchased at one time. Therefore, herbicides would not be stored for periods greater than one year. Herbicide efficacy is lost over time.

Air Quality

- Reduced application rates of herbicides would be used wherever possible. Reduced application rates are often more effective than higher application rates because translocation is enhanced prior to loss of physiologic function. Higher rates may burn off leaves and reduce translocation.
- Herbicide application would account for meteorological factors such as wind speed, wind direction, inversions, humidity, and precipitation in relation to the presence of sensitive resources near the treatment area and direction provided on labels. Herbicides would only be applied when meteorological conditions

at the treatment site allow for complete and even coverage and would prevent drifting of spray onto non-target sensitive resources or areas used by humans.
- Herbicides would be applied only during periods of suitable meteorological conditions. Loss of spray from a treated area increases during high winds or low humidity. Herbicides should also not be applied during periods of dead calm (this could indicate an inversion) or when wind velocity and direction pose a risk of spray drift.
- Herbicides would be applied using coarse sprays to minimize the potential for drift. Avoid combinations of pressure and nozzle type that would result in fine particles (mist). Add thickeners if the product label permits.

Soils

- Vehicles used for control will avoid wetland areas with standing water or saturated soils, to the extent practical and will be operated to minimize disturbance to soils.
- Personnel and equipment would avoid areas having sensitive biological soil crusts, especially those including colored lichen, or areas that are prone to erosion.
- Off-road vehicles will not be operated where there are well-developed soil crusts, especially where there are mature soil crusts including colored (yellow, white, red, green, brown or blue) soil lichens.
- Damage to soils will be minimized by using existing access routes, when possible, avoiding sensitive biological soil crusts, especially those including colored lichens.
- Type of mowing equipment will be selected based on the patch size, density of the target species, and terrain and condition of biological soil crusts. Large, dense patches are suitable for vehicle-drawn mowing equipment, while small, dispersed patches are more suitable for control with hand-held equipment, such as a weed-whip.
- Hand raking will be used in smaller-scale sites if there are potential impacts to desirable vegetation or soil crusts.
- Where soil destabilization is not desired, the full removal of root systems will not be employed.
- Herbicides with longer persistence would be applied at lower concentrations and with less frequency to limit the potential for accumulation of herbicides in soils.

Native Vegetation

- Exotic plant management activities would only be used where necessary to promote the reestablishment of native plant communities.
- All mowing activities will be timed so that they are performed before there is a danger of contributing to the spread of viable seed.
- Cut plant material will be removed from the site if it may prevent establishment/growth of desirable vegetation and appropriately transported and disposed of in a way so that no propagules are spread. If plant material

can or must be left, it will be piled or scattered in a way that it does not re-root or interfere with desirable vegetation.

- Re-vegetation will be implemented as quickly as possible to large areas of bare soil to reduce the danger of erosion caused by any loss of vegetative cover. Small areas that are adjacent to healthy native vegetation will be allowed to recover naturally, whenever possible.
- Selection of restoration species will be limited to native species that exist naturally in the region to prevent the accidental introduction of new exotic species. To minimize genetic contamination, propagules will be collected or propagated from the closest sites possible, as long as the collection site remains healthy and resilient to future disturbance. The benefits of local propagule collection must be weighed against the need for prompt re-vegetation. In many cases it may be more important to prevent establishment of non-desirable species and stabilize soils than to wait for sufficient seed to be collected locally.
- To limit the potential for equipment to spread exotic plant seeds, treatments should be completed before seed becomes viable.
- Planning will be utilized to assure that appropriate seed is available at the necessary time, and local collections will be prioritized based on available information concerning each species' genetic site-specificity.
- Parks would identify traditional use plants based on consultation with tribes. Traditional use plants are plants used or held sacred by Native American Tribes for medicinal, ceremonial, religious, or other cultural purposes.
- NPS staff would receive training on identification of traditional use plants and would avoid treating non-target plants to the extent feasible.
- Mechanical methods such as tilling would not be used in areas where traditional use plants are known to occur or have the potential to occur.
- Herbicides would be selected and BMPs would be implemented to maximize the effectiveness of the treatment on the target exotic plant and to minimize the potential effects on non-target plants.
- Herbicides would be applied as near to the target plant as possible.
- Herbicides would be applied at the appropriate time based on the herbicide's mode of action. Poor timing of application can reduce the effectiveness of herbicides and can increase the impact on non-target plants.

Water Resources (including wetlands and floodplains)

- If drought conditions are forecasted, resource managers should delay the purchase and planting of shrubs to avoid the need for irrigation. Resource managers should also confirm that there is water available for irrigation should the need arise.
- Vehicles are only permitted on established roads and will not be driven up or down stream channels. The number of vehicles will also be minimized to the extent possible.
- Applications of herbicides would be avoided during periods and in areas where seasonal precipitation or excess irrigation water is likely to wash residual herbicides into waterways.

- Only herbicides that are registered for use in or near water will be used in those areas. Only those herbicides that have a low potential toxicity, such as glyphosate (Roundup Pro and Rodeo) would be used within areas near surface waters or in areas with a high leaching potential. Glyphosate is strongly adsorbed into soil, with little potential for leaching to ground water. Microbes in the soil readily and completely degrade it even in low temperatures. It tends to adhere to sediments when released to water and does not accumulate in aquatic life (Forest Service 2004).
- Herbicides with high soil retention would be used in areas where there is potential to affect surface water or ground water resources.
- As needed to protect the efficacy of the herbicide, water would be buffered, depending on hardness, pH, and other factors.
- Highly water-soluble herbicides would not be used in areas where there is potential to affect surface water or ground water resources.
- Herbicides with high volatility would not be used to treat areas located adjacent to sensitive areas because of the potential for unwanted movement of herbicides to these areas.
- In areas where there is the potential to affect surface water or ground water resources, herbicide pH and soil pH would be considered to select the herbicide with the lowest leaching potential.

Wilderness

- The Minimum Requirement Decision Guide (Appendix H) will be used to determine whether the action is first necessary, then determines the alternatives (equipment, device, force, or practice) for how to accomplish the action that will achieve both Wilderness and resource objectives.
- Unavoidable impacts, such as vehicle tracks from ATVs, will be mitigated immediately after IPM activities are completed.
- SEUG will disseminate information to the public and staff on various control projects as to how and why particularly loud techniques, such as ATVs and aircraft, are necessary to accomplish project goals.

Cultural Resources

- Surface disturbing activities, such as tilling or use of heavy equipment, would be avoided with the boundary of known or potential cultural resource or historic sites.
- Areas that may contain cultural resources and that have not been previously studies but may contain these resources would be surveyed or avoided. All surface disturbing activities such as digging, pulling, and tilling, would avoided in areas where cultural resources are identified or known to occur. In the event that cultural resources are encountered during manual or mechanical treatments, work would stop immediately and would not continue until the site can be evaluated and cleared by the staff archeologist.
- Use of herbicides within the boundaries of the cultural resource sites would be prohibited. Because of unknown effects, herbicides would not be directly applied to prehistoric or historic structures with sandstone grout, hearth

features, or artifacts comprised of organic material, bone, pollen, seeds and materials made from plant fiber. Physical disturbance to prehistoric and historic structures would be avoided.

- Herbicides may be used in lands outside the established boundaries of a cultural resource sites in accordance with BMPs.
- Consultation with resource managers during planning phase of exotic plant management projects is required to determine sensitive areas and acceptable levels of disturbance.
- Equipment used for re-vegetation and restoration projects will be evaluated and chosen that is determined to be the most effective to accomplish restoration goals while causing the least disturbance to cultural resources.
- Weed management personnel will be briefed about working in an protecting cultural resource sites.
- Vehicle traffic will be limited to roads to protect vulnerable cultural resources.
- To reduce impacts of park personnel on cultural resources, crews will follow field SOP's, such as stay on trails, use slickrock and dry washes and work in small teams.
- Burn piles will not be constructed within 100 feet of known cultural resources.

Visitor Use and Experience

- Exotic plant management activities will be timed to coincide with low visitor use periods.
- Visitor access will be restricted from some areas during the burning of brush piles and chemical applications.
- SEUG will disseminate information to the public and staff on various control projects as to how and why particularly loud techniques, such as ATV's and aircraft are necessary to accomplish project goals.

Human Health and Safety

- Safety protocols for storing, mixing, transporting, handling spills, and disposing of unused herbicides and containers are included in Appendix E and would be followed at all times. Plans for emergency spills are also included in Appendix E.
- All SEUG employees, volunteers and contractors will be advised and required to follow the safety plan in Appendix E.
- Use of appropriate personal protective equipment PPE will be used when implementing control techniques.
- All SOP's will be reviewed and followed prior to implementation.
- All herbicide labels will be followed to ensure that proper application is used in a safe manner.
- A Job Hazard Analysis for herbicide application will be reviewed prior to implementation.
- Signs will be posted to inform visitors of chemically treated areas. Chemically treated areas will be temporarily closed off to visitors. All federal, state, and local regulations regarding herbicide use would be followed at all times.

- All product labels would be read and followed by herbicide applicators. It is a violation of federal law to use an herbicide in a manner that is inconsistent with its label.
- Herbicide applicators would obtain any certifications or licenses required by the state and/or county.
- All concessionaires would comply with the EPMP/EA/AEF and NPS policy when applying herbicides. Concessionaires would comply with guidance document, *"Understanding the National Park Service's Integrated Pest Management Program"* (NPS 2003).

2.3.1 Committed Conservation Measures for Threatened, Endangered, and Species of Concern

A number of conservation measures have been developed to mitigate potential impacts to threatened and endangered species. Although candidate species are not afforded any protection under the ESA, efforts would be made to avoid or minimize potential impacts to these species as well.

- Field personnel would be trained to recognize and avoid threatened, endangered, and candidate species in their travel routes.
- Prior to implementation of mechanical controls, areas that are potential habitat for listed wildlife species will be surveyed. If listed species are found in the vicinity of the treatment area, treatments will be limited to ones that are unobtrusive or to times of year when the listed species are not present or less affected by disturbance.
- Selection of restoration species will be limited to native species that exist naturally in the region, or non-native species that are known to not spread, to prevent the accidental introduction of new exotic plants that would endanger listed plant or wildlife values.
- Larger equipment associated with restoration, such as seed drills, seedbed preparation equipment or harrowing equipment will not be used in the vicinity of listed plant species unless there is a direct benefit to the listed species.
- Restoration activities will be timed so that negligible disturbance to listed wildlife occurs.
- Herbicide use will be avoided in the vicinity of listed plant species.
- All restrictions outlined on herbicide labels will be followed.
- Chemical controls will be used in the vicinity of listed wildlife or their habitat when other weed management techniques might cause undue disturbance to listed wildlife or their habitat or are deemed infeasible.
- Herbicides that are of low toxicity to wildlife and/or that will degrade before wildlife are likely to encounter them will be used and will be applied in a manner that uses the least amount, but still remains effective and that best protects habitat for listed species.
- Ground-based equipment, including backpack sprayers and spray units on trucks will be used in low-wind conditions.

- If portable spraying is used to apply herbicides, establish a 5 foot no- spray zone around T & E species for treatments involving application of herbicides. Portable spraying allows for treatment of individual plants and the spray can be directed within an inch of the target plant.
- In the event that an area infested by one of the target species provides habitat for a listed species, weed management activities will be implemented in such a way that any potential adverse impacts to that species are negligible. If certain times of the year are less likely to cause disturbance than others, then for all treatments this will be implemented. If a critical feature (such as a snag or den) is within the treatment area, then for all treatments it will be maintained. Also, if a target species provides critical habitat for a listed species, such as nesting sites or a food source, then for all treatments it will be controlled in phases, so that native vegetation can be reestablished that will provide equivalent requirements and habitat is maintained.
- Burning of brush piles would not be conducted in T&E species' habitat during active periods. Project specific brush piles would be designed to prioritize the protection of habitat for T&E species.
- Treatments will be chosen as selectively as possible to minimize impacts to native species. "Broad brush" treatments (such as indiscriminately using ATVs or aerial sprayers for chemical treatments, or mechanical treatments such as mowing) will mostly be used for large, dense infestations of exotic plants. In contrast, individual exotic plants or smaller infestations interspersed with native plants will be treated using precise methods. These methods will allow for treatments of smaller areas or individual plants, while limiting the potential impact on non-target native species.
- ATVs would be used on a limited basis in areas where T&E species are known to occur or have the potential to occur and only along established roads.
- If boom treatments are used (on ATVs or aircraft) to apply herbicides, a 50-foot no-spray zone would be established around listed plants. GPS units within aircraft can guarantee this precision when additional BMP's are followed regarding herbicide treatments.
- Only bio-controls that are deemed host-specific by APHIS and other associated federal agencies using the best available science and monitoring techniques will approved for release in the parks, should they match the park's need for management of a particular species.
- When possible, all tamarisk treatments will occur outside the breeding bird period to protect migratory bird species.

Species-specific measures are described below. Some exotic plant management activities may be necessary within buffer zones established for each species. Any activities that could result in take, as defined by the ESA, would be coordinated with the appropriate USFWS Field Office before any actions are taken.

Mexican spotted owl (*Strix occidentalis mexicana*)

- Treatment areas would be evaluated for Mexican spotted owl nesting and roosting habitats prior to conducting exotic plant management activities. Suitable nesting or roosting habitat is any forested mountain, shady or steep canyon with mature trees that create high closed canopies.
- A disturbance-free buffer area would be maintained around any active Mexican spotted owl nests. If a disturbance-free buffer zone is not feasible, then activity should be conducted outside of the period from April through October to protect nesting and fledgling birds.
- Clearing of live or dead trees greater than 12 inches in diameter at breast height (DBH) along canyons would be avoided to the extent possible to help preserve potential Mexican spotted owl roosting or nesting habitat.

Southwestern willow flycatcher (*Empidonaz traillii extimus*)

- Treatment areas would be evaluated for southern willow flycatcher nesting and roosting habitats prior to conducting exotic plant management activities. Suitable nesting/roosting habitat is any dense stand of cottonwood, willows, tamarisk or Russian olive in association with rivers, streams, or any significant body of water.
- A disturbance-free buffer area would be maintained around any active southern willow flycatcher nests. If a disturbance-free buffer zone is not feasible, then activity should be conducted outside of the period from early May through mid September to protect nesting and fledgling birds.

California condor (*Gymnogypus californianus*)

- Treatment areas would be evaluated for California condor nesting and roosting habitats prior to conducting exotic plant management activities. Suitable nesting/roosting habitat is rocky and brushy areas with cliffs or standing snags available for nest sites near important foraging grounds. A disturbance-free buffer area would be maintained around any active California condor nests. If a disturbance-free buffer zone is not feasible, then activity should be conducted outside of the period from early February through early May to protect nesting and fledgling birds.

Yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

- Treatment areas could be evaluated for yellow billed cuckoo nesting and roosting habitats prior to conducting exotic plant management activities. Suitable nesting/roosting habitat is any dense stand of cottonwood, willows, tamarisk or Russian olive in association with rivers, streams, or any significant body of water.
- A disturbance-free buffer area of a minimum 100 foot buffer area would be maintained around any active yellow billed cuckoo nests. If a disturbance-free buffer zone is not feasible, then activity will be conducted outside of the period from early May through mid September to protect nesting and fledgling birds.
- When possible, all tamarisk treatments will occur outside the breeding period to protect this migratory species.

- Removal of tamarisk on a broad scale (10 to 200 acres) will only be conducted after a wildfire. Wildfires are usually infrequent. Typically, treatment (cut stump and apply chemical to stump or basal treatment to new sprouts) of tamarisk is on a smaller scale (less than 2 acres) and site-specific.
- There will be no clear cutting of large areas (i.e. greater than 2 acres) of exotic species.
- Release of the tamarisk leaf beetle, will not be permitted in the parks until it is approved by APHIS in Utah. If and when the leaf beetle will be approved, formal Section 7 consultation will have to be reinitiated.
- Only willows, cottonwoods and other native vegetation species will be used to reseed and/or replant treated areas.

Black-footed ferret (*Mustela nigripes*)

- Black-footed ferrets are not known to occur within any of the four park units of the SEUG. In the unlikely event that black-footed ferrets are located, the USFWS would be consulted and no disturbance would be allowed within prairie dog colonies inhabited by black-footed ferrets.
- Because some white-tailed prairie dog colonies may provide habitat for future black-footed ferret reintroduction, a number of management practices would be implemented to minimize potential impacts to white-tailed prairie dogs. These practices include:
    - *Physical disturbance to prairie dog towns or complexes would be avoided wherever possible.
    - *The use of mechanical treatments such as tilling would not be used in prairie dog colonies.
    - *The use of herbicides in prairie dog colonies would only be considered if no other alternatives are feasible.
    - *Only those herbicides that have a low potential toxicity, such as glyphosate would be used within prairie dog colonies. Glyphosate is strongly adsorbed into soil, with little potential for leaching to ground water. Microbes in the soil readily and completely degrade it even in low temperatures. It tends to adhere to sediments when released to water and does not accumulate in aquatic life (USFS 2004).
    - *Herbicides that do not readily break down in soil would not be used in prairie dog colonies.
    - * To avoid physically disturbing prairie dog towns, no mechanical vehicles or maintenance equipment would be used.

Endangered Fish: Bonytail chub *(Gila elegans)*, Humpback chub *(Gila cypha)*, Colorado pikeminnow *(Ptychocheilus lucius)* and Razorback sucker *(Xyrauchen texanus)*

- Treatment areas would be evaluated for these endangered fish prior to conducting exotic plant management activities along the rivers.
- A fifty foot disturbance-free buffer area from the water would be maintained.

- The Rodeo herbicide (glyphosate) would be applied to exotic vegetation as it is not known to be toxic to fish.

Jones cycladenia *(Cycladenia humillis)*

- Prior to implementation of mechanical controls, areas that are potential habitat for *Cycladenia humillis* will be surveyed. If they are found in the vicinity of the treatment area, treatments will be limited to ones that are unobtrusive or to times of year when the listed species are not present or less affected by disturbance.
- NPS staff responsible for exotic plant management at Arches National Park will receive training on how to identify the Jones cyclandenia plant and its potential habitat. If populations of the Jones cyclandenia plant are identified, conservation measures developed for threatened and endangered plants will be implemented (see below).

Threatened, Endangered, and Sensitive Plants

- If portable spraying is used to apply herbicides, establish a 5- foot no- spray zone around threatened or endangered plants for treatments involving application of herbicides. Portable spraying allows for treatment of individual plants and the spray can be directed within an inch of the target plant.
- If boom treatments are used (ATVs or aircraft) to apply herbicides, establish a 50- foot no- spray zone around threatened and endangered plants.
- Tilling will not be used in areas where threatened, endangered, and sensitive plants are known to occur or have the potential to occur.
- ATVs and off- road vehicle traffic will not be used in areas where threatened, endangered, and sensitive plants are known to occur.
- Herbicides will be applied in accordance with herbicide labels.
- Herbicide applicators will receive training on identification of threatened, endangered, and sensitive plants. If these plants are identified in the field, treatments will be halted until the aforementioned buffer areas are established.

Species of Concern

- Parks would identify state species of concern based on lists developed by each state and federal agency. State species of concern include state endangered, state threatened, state candidate, or state species of concern, or species of special concern and are not part of a federal designation of threatened or endangered species made by the USFWS.
- NPS staff would receive training on identification of state species of concern and would avoid treating these species to the extent feasible.
- Mechanical methods such as tilling would not be used in areas where state species of concern are known to occur or have the potential to occur.
- Herbicides would be applied in accordance with herbicide labels.

2.4 OTHER ALTERNATIVES CONSIDERED, BUT

DISMISSED FROM FURTHER ANALYSIS

A number of alternatives were developed based on the results of internal and external scoping. Alternatives are different ways to meet the purpose and objectives, while resolving needs or issues. The following section discusses those alternatives considered, but eliminated from further study. This discussion also includes an explanation of why these alternatives did not warrant additional analysis. These alternatives and issues were eliminated from detailed study because they did not meet the criteria below.

(a) technical or economic infeasibility.
(b) inability to meet project objectives or resolve need.
(c) duplication with other, less environmentally damaging or less expensive alternatives.
(d) conflict with an up-to-date and valid park plan, statement of purpose and significance, or other policy, such that a major change in the plan or policy would be needed to implement.
(e) too great an environmental impact.

Three alternatives were considered, but all three were eliminated from detailed study. These alternatives include:

Alternative 3 - Stop all exotic plant management and control activities within each park.
Alternative 4 - Develop an IPM Plan that considers all treatments except chemical treatments.
Alternative 5 - Develop an IPM Plan that considers all treatments except biological control treatments.

Each alternative, and the rationale for why it was eliminated from further study, is described below.

Alternative 3 - Stop all exotic plant management and control activities within each park.

This alternative was eliminated from detailed study because stopping all exotic plant management and control activities within the parks are inconsistent with federal noxious weed management policies, NPS resource management guidelines, and state noxious weed laws. Specifically, this alternative is inconsistent with E.O. 13112 on Exotic Species, the Federal Noxious Weed Control Act, NPS management policies, and Utah and Colorado noxious weed laws. This alternative would also defy the purpose and objectives of the resource management objectives at each park.

Alternative 4 - Develop an IPM Plan that considers all treatments except chemical treatments.

Developing an IPM Plan that considers all treatments except chemical treatments was considered, but was eliminated from further analysis because of the efficiency and

efficacy of chemicals for treating some exotic plants. Also, the use of chemical treatments may be restricted or avoided, as necessary, to protect resources under Alternatives 1 and 2. NPS Management Policies (2006:47) states, "Exotic species will not be allowed to displace native species if displacement can be prevented." In some instances, chemical treatment may be the only feasible method available for reducing the threat of exotic plants to environmental and cultural resources. According to NPS Management Policies, the use of herbicides is to be considered only when "all other available options are either not acceptable or not feasible." Because IPM applies a holistic approach to exotic plant management decision-making, it takes advantage of all appropriate exotic plant management tools, which may include, but is not limited to, herbicides (McCrea and DiSalvo 2001:394).

Alternative 5 - Develop an IPM Plan that considers all treatments except biological control treatments.

Developing an IPM Plan that considers all treatments except biological control was considered, but was eliminated because of the efficiency and efficacy of some biological control agents for treating some exotic plants. NPS Management Policies (2006:47) states, "Exotic species will not be allowed to displace native species if displacement can be prevented." In some instances, biological control may be the only feasible method available for reducing the threat of exotic plants to environmental and cultural resources.

2.5 ALTERNATIVE SUMMARIES

Table 2-6 summarizes the major components of Alternatives 1 and 2, and compares the ability of these alternatives to meet the project objectives (the objectives for this project are identified in Chapter 1). As shown in the table, Alternative 2 meets each of the objectives identified for this project, while the Current Management Program Alternative does not address all of the objectives.

Table 2-6. ALTERNATIVE SUMMARIES MEETING PROJECT OBJECTIVIES

	Alternative 1 – No Action, Continuation of Current Management Practices	**Alternative 2 –Preferred Alternative, Integrated Pest Management**
	Continuation of current management practices using mechanical/manual, cultural, and herbicides.	An Integrated Pest Management approach by using mechanical/manual, chemical, cultural, and biological control.
Project Objectives	**Meets Project Objectives?**	**Meets Project Objectives?**
Restore native plant communities to reduce the need for ongoing exotic plant management.	No. Although the current management practices will restore plant communities somewhat it will not reduce the need for ongoing exotic plant management. Introduction/expansions of new and existing exotic species will not be	Yes. With the full use of IPM strategies, managers can use a full range of techniques that will best determine control treatment options. Introduction/expansions of new and existing exotic species will be adequately addressed under IPM because it does provide an integrated

	adequately addressed under the current management practices because it does not provide an integrated approach to treatments. Current treatments are limited in controlling large infestations.	approach to treatments. IPM is done on a case-by-case basis, so that treatment strategies are tailored to local conditions. IPM employs multiple integrated management practices rather than a single solution, wherever technically and economically feasible.
Prevent unacceptable levels of exotic plant damage, using environmentally sound, cost effective management strategies that pose the least possible risk to people, park resources, and the environment.	No. Current practices do not use environmentally sound, cost effective strategies that will cause the least risk to people, park resources and the environment.	Yes. An integrated approach is often more cost effective and safer than a single type of treatment. IPM process helps the resource manager determine whether the treatment is necessary and appropriate, where treatment should be administered, when treatment should be applied, and what strategies should be used for immediate and long-term results.
Develop an EPMP/EA/AEF that provides the necessary environmental compliance for exotic plant management treatments at the four SEUG park units.	No. Current practices would not provide the necessary environmental compliance. Park resource managers would be limited to those treatment options that either qualifies as a categorical exclusion (CE) or those treatments whose impacts have been previously addressed in other NEPA documents.	Yes. SEUG would use the decision making tree "Confirm Compliance of Treatment Method with and Existing NEPA Document" in Appendix A to document NEPA compliance through this EPMP/EA/AEF. This EPMP/EA/AEF would give the parks a guideline to ensure the parks are in environmental compliance with the proposed treatments.
Standardize exotic plant management at parks so their action can be more effectively implemented by park managers and explained to the public.	No. Efforts to prevent establishment of new exotic plants or the spread of existing exotic plants would generally be limited to existing control techniques or previously planned visitor awareness or public education activities.	Yes. Development of the EPMP/EA/AEF is an initial step in the education process because it provides a standardized approach for exotic plant management planning and decision-making. This alternative also identifies educational programs that would be implemented by SEUG. These programs would be used to educate the public on: exotic plant management planning, exotic plant management priorities within the park, the potential threat of these plants to park resources, methods for preventing the introduction of exotics plants into SEUG, treatment methods used within the parks to control exotic plants, and why these treatments were selected.

Table 2-7 provides a comparison of the actions that are proposed in the plan to accomplish the project objectives with regard to the two reasonable alternatives considered.

Table 2-7. SUMMARY OF ACTIONS PROPOSED IN EACH ALTERNATIVE

Actions	Alternative1-No Action, Continue with Current Management Programs	Alternative 2-Integrated Pest Management Plan
Regulatory Measures	All parks would continue to comply with applicable federal, state, and NPS regulatory measures.	All parks would continue to comply with applicable federal, state, and NPS regulatory measures. Cost efficiency and consistency in control and monitoring would be achieved under the EPMP/EA/AEF.

Actions	Alternative1-No Action, Continue with Current Management Programs	Alternative 2-Integrated Pest Management Plan
NEPA Compliance and Planning	Parks would continue to implement treatments that are covered under a CE or are covered under another current NEPA document. Treatments that are not covered under a CE or under another existing NEPA document would require preparation of additional NEPA documents, such as an EA or EIS.	Under the preferred alternative, an EPMP EA/AEF would be prepared. This document would evaluate the potential effects of cultural, manual/ mechanical, biological, chemical and prescribed fire treatments on environmental resources the 4 parks. Parks would use the decision tree, "Confirm Compliance of Treatment Method with an Existing NEPA document" in Appendix A. Because the EPMP/EA/AEF would provide clearance for a number of treatment options, resource managers would be able to select and implement the most appropriate management approach in the future.
Education	Parks would continue with current education and information programs. Efforts to prevent establishment of new exotic plants or the spread of existing exotic plants would generally be limited to existing or previously planned visitor awareness or public education activities.	Parks would expand their current education and outreach programs to incorporate the concept of IPM. Internal training and awareness programs would be developed at each park. Visitor awareness and public education programs might also be developed under the preferred alternative. These programs would be used to educate the public on: exotic plant management planning, exotic plant management priorities within the park, the potential threat of these plants to park resources, methods for preventing the introduction of exotic plants into the park, treatment methods used within the park to control exotic plants, and why these treatments were selected.
Collaboration	Parks would continue to collaborate exotic plant management efforts with the EPMT, experts, and other managers on a limited basis.	Parks would expand their collaboration efforts with neighboring landowners, other parks, park visitors, exotic plant management experts, other resource managers, and local, state, and federal officials.
Planning	Resource managers would continue to develop and refine exotic plant management plans for each park unit. Park units that currently do not have exotic plant management plans would likely need to develop plans in the future.	Resource managers would use a decision-making tool and parks would follow a standard decision-making process to identify exotic plants, determine exotic plant management priorities, identify and evaluate the efficacy and environmental effects of the proposed treatment, consider alternative treatments having less impacts, justify why a treatment was selected, and confirm compliance with applicable policies and regulations. Parks would have a standardized process in place to assist resource managers with exotic plant management planning. Resource managers would establish exotic plant management priorities using a standardized process that could be explained to the public. Parks would submit annual exotic plant mapping and management requests to the EPMT.
IPM	Parks would continue with their current exotic plant management programs. Parks that currently have IPM plans would continue to implement all approved activities.	All parks included in the EPMP/EA/AEF would have an IPM plan. The IPM plan would assist resource managers to coordinate knowledge of exotic plant biology, the environment, and available technology to prevent unacceptable

Actions	Alternative1-No Action, Continue with Current Management Programs	Alternative 2-Integrated Pest Management Plan
	Parks that do not have IPM plans would continue exotic plant management using only a portion of all treatments available.	levels of exotic plant damage, using environmentally sound, cost-effective management strategies that pose the least possible risk to people, park resources, and the environment. Each resource manager would have access to a variety of treatments, including cultural, manual/mechanical, biological, chemical, and prescribed fire.
Cultural Treatments	Cultural treatments, such as preventing the introduction of exotic plants and restoration would be continued.	Cultural treatments would be used as part of IPM planning. Parks might place additional emphasis on restoration activities in developing integrated approaches to exotic plant management.
Manual/Mechanical Treatments	The use of manual/mechanical treatments would continue.	Manual/mechanical treatments would be used as part of IPM planning. These treatments would be implemented in accordance with BMPs developed under the preferred alternative.
Biological Treatments	The parks are currently not using biological treatments.	Only APHIS approved agents would be released. Parks would obtain approval for release of biological control agents from the National IPM Coordinator. Parks that currently are not using biological control agents would have this available as a management tool. Biological treatments would be used in accordance with BMPs developed under the preferred alternative. Parks would use a standardized form to report annual releases of biological control agents to the Regional IPM Coordinator.
Chemical Treatments	Only USEPA registered herbicides would be used. A Regional or National IPM Coordinator would approve use of all herbicides.	Only USEPA registered herbicides would be used. A Regional or National IPM Coordinator would approve use of all herbicides. Parks would have the option to use ATVs and would implement BMPs when using ATVs. All chemical treatments would be implemented in accordance with BMPs developed under the preferred alternative.
Prescribed Fire Treatments	Currently all 4 parks only burn brush piles as a prescribed fire treatment.	All 4 park units would have access to prescribed fire as an exotic plant management treatment. Burning brush piles would continue as a prescribed fire tool. Prescribed fire might be used on a limited basis and would be used in accordance with BMPs and would have burn plans developed.
Monitoring and Record Keeping	Monitoring would continue on a limited basis at each park. Record keeping and reporting would be in compliance with NPS guidelines. Parks would continue to report annual herbicide use. These reports would be submitted to the National IPM Coordinator via the Regional IPM Coordinator.	Monitoring programs would be designed to determine whether management objectives are being met. Overall treatment success would be evaluated, and adaptive management would be used to modify treatments as appropriate. Record keeping and reporting would be in compliance with NPS guidelines. Parks would also prepare annual reports summarizing the herbicide use and release of biological control agents. These reports would be submitted to the National IPM Coordinator via the Regional IPM Coordinator.

Table 2-8 summarizes the anticipated environmental impacts for alternatives 1 and 2. Only those impact topics that have been carried forward for further analysis are included in this table. The *Environmental Consequences* chapter provides a more detailed explanation of these impacts.

Table 2-8. ENVIRONMENTAL IMPACT SUMMARY BY ALTERNATIVE

Impact	Alternative 1 – *No Action, Continuation of Current Management Practices*	Alternative 2 –*Preferred Alternative, Integrated Pest Management*
Geology	Geological features such as paleontological resources may be impacted by mechanical/manual treatments. Ground disturbance may have direct adverse, site-specific, minor impacts to geological resources. Deposition of carbonaceous residue and blackening of the surface may have directly adverse, site-specific, and minor impacts.	Use of IPM would allow more management tools to be used in sensitive areas such as biocontrol treatments which would have negligible impacts to geological resources.
Soils	Treatment methods may have both beneficial and adverse impacts on soil resources. Ground disturbance may have direct adverse, site-specific, minor to major impacts. Biological soil crusts would have major long-term impacts from treatments. Removing exotic vegetation may cause soil erosion and have potentially moderate to major impacts especially if flooding were an issue. However rehabilitating native plant communities may reduce soil erosion.	Full use of IPM with the available techniques would have the most long-term and widespread success at treating large infestations and new species introductions. IPM would also provide the most environmentally sound treatments for sensitive resources such as biological soil crusts. Overall effect would be beneficial, park-wide, long-term and moderate.
Air Quality	Temporary reduction of air quality from dust from vehicles and equipment used for treatments. Chemical treatments may cause herbicide drift and cause minor impacts to air quality in site-specific areas. Burning piles will have a minor to moderate impact to air quality in site-specific areas.	Temporary reduction of air quality from dust from vehicles and equipment (ATV's) used for treatments. Chemical treatments may cause herbicide drift and cause minor impacts to air quality in site-specific areas. Burning piles will have a minor to moderate impact to air quality in site-specific areas.
Visual Resources	Some minor, adverse, short-term visual impacts may occur from use of manual/mechanical treatments, herbicides and pile burning. However, beneficial impacts of treatments would be to open up distant views and enhance local views with native vegetation.	Biological control treatments would have some adverse and beneficial minor to moderate visual impacts. Some areas will contain brown dead tamarisk or be devoid of vegetation until native vegetation becomes reestablished. The end result would be beneficial and long-term by removing tamarisk and improving river corridor viewsheds.
Water Resources	Ground disturbing activities and chemical application may have indirect adverse impacts to water resources and changes to water quality. However removal of exotics	Use of IPM and the RAVE model would assist with determining herbicide application rates for areas with high leaching potential and impacts could be minor to negligible.

Impact	Alternative 1 – *No Action, Continuation of Current Management Practices*	Alternative 2 –*Preferred Alternative, Integrated Pest Management*
	along riparian areas will have beneficial impacts by returning some surface waters to natural flows and help reduce erosion and sedimentation in surface waters.	
Wild and Scenic Rivers	Removal or treatment of exotic plants along rivers would have an adverse impact. The visual effect of dead or cut exotic vegetation would be site-specific, short-term and moderate. Current practices would only have a small scale impact.	Use of IPM would restore large areas along the rivers to natural conditions, reduce visual obstructions along riverbanks, and create additional habitat. These impacts would be beneficial, long-term and moderate to major.
Floodplains and Wetlands	Ground disturbing activities and chemical applications may impact native vegetation and temporarily reduce floodplain and wetland functions. However removing exotics, native vegetation would improve and restore natural functions.	IPM may enhance the existing wetland area or floodplain function and have a long-term impact. Overall beneficial effects would be park-wide and long-term under this alternative with the additional treatment of bio-control agents.
Native Vegetation	There would be adverse and beneficial effects to native vegetation. Manual/mechanical and chemical treatments may have direct adverse minor to moderate impacts to native vegetation. However, there would be a slightly beneficial effect for maintaining/restoring vegetation communities in the long term.	Full use of the available techniques would have the most long-term and widespread success at treating large infestations and new species introductions. Overall effect would be beneficial, park-wide, long-term and moderate.
Terrestrial Wildlife	Manual and mechanical treatments could have site-specific adverse impacts on ground nesting birds or burrowing animals. Chemical treatments could also have a minor to moderate impact on the vegetative food source of animals.	Using the full range of IPM, the treatment of exotics and promoting healthy native plant communities would rehabilitate terrestrial wildlife habitat in a natural state. These beneficial effects would be detectable in most areas over the long-term.
Aquatic Wildlife and Fisheries	Manual and mechanical treatments may result in direct or indirect effects such as increased sedimentation, including suspended solids which reduces dissolved oxygen levels and leads to a degraded habitat.	Using the full range of IPM, the treatment of exotics and promoting healthy native plant communities would rehabilitate aquatic wildlife and fisheries habitat in a natural state. These beneficial effects would be detectable in most areas over the long-term.
Threatened, endangered and species of concern	Manual and mechanical treatments could have site-specific adverse impacts on ground nesting birds or burrowing animals. Chemical treatments could also have a minor to moderate impact on the vegetative food source of animals.	Controlling exotic plants and promoting healthy native plant communities would restore and improve critical habitat for T &E. IPM management would have a greater range for long-term and park-wide management of exotic plants. Any minor or short-term adverse impacts would be outweighed by the benefits of park-wide critical habitat restoration.
Wilderness	Use of noise generating equipment which be only selected be using the minimum wilderness requirement analysis, would have an adverse effect on Wilderness experience. Visual intrusion of treated	The full use of IPM, especially biocontrol methods, would be overall long-term and beneficial in the reduction or elimination of exotic plants over a large scale. This rehabilitation of Wilderness areas would

Impact	Alternative 1 – *No Action, Continuation of Current Management Practices*	Alternative 2 –*Preferred Alternative, Integrated Pest Management*
	areas (cut stumps, burn piles, dead vegetation) would have a minor to moderate impact to Wilderness experience.	enhance the naturalness sought by visitors.
Cultural Resources *Archeological Resources* *Ethnographic Resources* *Historic Structures*	Ground disturbing techniques would have direct, adverse, site-specific, minor to major impacts to cultural resources. Also this alternative is not expected to be the most effective at adequately managing large areas of exotic plants nor is it expected to adequately prevent new species introductions which could result in long-term minor impacts through destabilization and degradation of cultural resources.	Use of IPM would allow more management tools to be used in sensitive areas such as biocontrol treatments. Control of exotics would improve or restore conditions and context for cultural resources and have long-term minor to moderate beneficial impacts.
Visitor Use and Experience	Some aspects of control may intrude on the visitor experience such as noise generating equipment and would compromise the preservation of natural conditions. Treatments of exotics could also adversely impact visitors with area closures.	Use of ATV's, aircraft and heavy equipment would be detectable to visitors but would be short-term and site-specific. IPM activities will be timed to avoid peak visitor use periods and the overall benefit of using IPM in restoring the native plant communities would outweigh the short-term use of equipment.
Human Health and Safety	Use of manual/mechanical tools and chemicals may have direct adverse impacts to park employees and visitors by exposing themselves to chemicals and tool hazards. Conducting burn piles will also have a direct adverse impact to park employees.	IPM would allow for additional treatment practices and management techniques such as biocontrol treatments that would be less hazardous to park employees and visitors. Dissemination of information to the public of closures and why certain techniques are being used would improve with IPM and have a direct beneficial moderate impact.
Soundscape	Some degradation due to noise would result from some mechanical/manual, cultural and chemical management techniques and would have adverse minor impacts.	IPM would allow for additional treatment practices and management techniques such as biocontrol treatments that would not impact the soundscape. Dissemination of information to the public on various control techniques that are being used (ATV's, helicopters, chainsaws) that are necessary to accomplish project goals would improve with IPM.
Socioeconomics	The impacts to the social and economic conditions would be indirectly beneficial since the parks are reducing and controlling exotics which will have a positive impact to adjacent landowners and neighboring communities. This beneficial impact will be local, ongoing, long-term and moderate.	The impacts to the social and economic conditions would be indirectly beneficial since the parks are reducing and controlling exotics which will have a positive impact to adjacent landowners and neighboring communities. This beneficial impact will be local, ongoing, long-term and moderate.

2.6 ENVIRONMENTALLY PREFERRED ALTERNATIVE

NPS policy (NPS 2006) requires that an EA identify the environmentally preferred alternative. Simply put, "this means the alternative that causes the least damage to the

biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural and natural resources" (NPS 2006a:22-23). The environmentally preferred alternative is the alternative that would promote the national environmental policy expressed in NEPA (Sec. 101 (b)). This includes alternatives that:

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

2. Ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.

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

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

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

6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources. (DO-12 Handbook, 2.7D) (NPS 2006).

Based on the impact analysis, Alternative 2 - Integrated Pest Management Plan is the preferred alternative. Alternative 1 has more potential adverse impacts on resources due to the lack of resource-specific BMPs. Alternative 1 would also have fewer overall beneficial effects because the overall effectiveness of current exotic plant management programs is limited. Parks do not have a standardized approach to assist in decision-making have difficulty selecting the most appropriate treatment option and currently do not have the necessary compliance in place to implement some treatment options.

Regarding long-term impacts, Alternative 1 realizes a lower number of positive impacts because it provides less effective control of exotic plants and requires an indefinite treatment period. Alternative 2 realizes greater positive impacts over the long-term because it provides for more rapid control of exotic plants. Alternative 2 is the environmentally preferred alternative because it provides the most long-term benefits to the environment. Consequently, Alternative 2 is the preferred alternative.

CHAPTER 3- AFFECTED ENVIRONMENT

This chapter provides an overview of the current conditions of the resources present within the project area. In most cases, a more detailed description may be found in the individual park GMPs and RMPs.

Chapter 3 is organized by resource areas that are key components of the affected environment or that must be analyzed in accordance with law, regulation, or policy. Detailed discussions are provided for those resources that are associated with issues identified in Chapter 2. This chapter is organized into the following sections:

3.1 Geographical Scope, Topography, and Climate
3.2 Physical Resources (including geology, soil, air quality, visual resources, water resources, and floodplains and wetlands)
3.3 Biological Resources (including vegetation, terrestrial wildlife, aquatic wildlife and fisheries, and threatened, endangered, and state species of concern)
3.4 Wilderness
3.5 Cultural Resources (including archeological resources, ethnographic resources and historic structures).
3.6 Human Environment (including visitor use and experience, human health and safety, soundscape and socioeconomics)

The following sections describe the resource topics that are considered in this chapter and the relevant regulations and policies pertaining to these resources. Each section also describes the desired condition. The "desired condition" is the condition(s) that current laws and policies require parks to achieve for each resource. In cases where laws and policies apply to more than one resource category (e.g., geology and soils), these resources have been combined into a single section. In addition to the desired conditions identified in this section, the four park units have identified desired conditions, goals, and objectives for their park in their GMPs and RMPs, which are tiered off of NPS Management Policies. Individual parks will also continue to meet their park goals, objectives, and desired conditions as identified in their GMPs and RMPs.

3.1 PHYSICAL RESOURCES

Air, water, soils, and rocks combine to create the physical environment, which is the foundation of all ecosystems. The physical environment is addressed in the following six sections: 1) geology; 2) soils; 3) air; 4) visual resources; 5) water resources; and 6) floodplains and wetlands.

3.1.1 Geology

The area surrounding the four SEUG park units is world renowned for its exposed geology and researches travel from around the world to study the many features and processes of this primarily sedimentary region.

Current laws and policies require that the following condition be achieved in each park for geologic resources:

Desired Condition	Source
A condition where soil resources and geologic processes function in as natural a state as possible	NPS Management Policies

Pages 41 through 43, Section 4.8 of 2006 Management Policies address geologic resource management including geologic features and processes. This policy states that NPS will maintain, preserve, and protect geologic resources as integral components of park natural systems. More specific topics covered in this policy include fluvial features/processes, geothermal resources, glacial features/processes, volcanoes, arid land features/processes, quaternary landforms, and paleontological deposits.

DO 77, Natural Resource Protection, is currently being developed, but previous Natural Resource Management Guidelines still apply to geological resources. These guidelines specify policies, programs, and guidance for geologic resource management.

ARCH

Arches National Park is largely covered by exposed bedrock, weakly developed soils and sand dunes. The park was established because of its unique geologic features, in particular the massive, spectacular natural rock arches formed in the Entrada Sandstone. The geology of Arches National Park is largely determined by the collapsed salt anticline in Salt Valley and to a lesser extent by the collapsed Moab and Cache Valley anticlines. There are ten major sedimentary formations exposed in the park ranging in age from the Pennsylvanian Paradox Formation to the Cretaceous Mancos Shale. In stratigraphic order, formations include Paradox, Honaker Trail, Cutler Group, Moenkopi, Chinle, Wingate Sandstone, Kayenta, Navajo Sandstone, Entrada, Morrison, Cedar Mountain, Dakota Sandstone and Mancos Shale.

The first comprehensive paleontological resource inventory for Arches National Park was published by Santucci (2000). A formal paleontological resource scoping session was conducted at Arches National Park in May 2000. An inventory of paleontological resources associated with National Park Service caves, including Arches National Park, was published by Santucci et al (2001). Cooperative paleontology projects include the Morrison Extinct Ecosystem Project (early-mid 1990s), a joint National Park Service and United States Geological Survey project (Turner and Peterson, 1999). There are a few proposed treatment sites that have known fossils in the area.

CANY
The incredible features of the park are the remote mesas, buttes, and deep canyons cut by the Green and Colorado Rivers and their tributaries. The park's name, Canyonlands, is derived from the geology term "Canyon Lands", which is defined as the province south of the Uinta Basin and between the High Plateaus on the west and the Rocky Mountains to the east. As explained by Stokes (1988), the park lies at the rugged and remote heart of the Canyon Lands section of the Colorado Plateau physiographic province in southeast Utah. The park is characterized by sedimentary rock, which has been deformed by anticlines, synclines and monoclines. Uplift of the Colorado Plateau and concurrent water erosion have produced the extensive, deep canyon systems which are the defining features of the park and of the physiographic section (Lammers 1991).

There are five major sedimentary formations exposed in the park ranging in age from the Pennsylvanian Paradox Formation to the Jurassic Navajo Sandstone. In stratigraphic order, formations include Paradox, Honaker Trail, Cutler Group, Moenkopi, Chinle, Wingate Sandstone, Kayenta, and Navajo Sandstone. The Paradox Formation of salt and gypsum evaporites is a highly plastic formation which has formed the salt anticlinal structures and grabens in the park, which collapsed when ground water eroded the salt.

The first comprehensive paleontological resource inventory for Canyonlands National Park was published by Santucci (2000). David Gillette of the Museum of Northern Arizona is presently surveying the park and will write a report in 2008. There are a few proposed treatment sites that have known fossils in the area.

HOVE
The natural environment at Hovenweep is characterized by rugged topography, with small canyons divided by narrow mesa tops. The primary geologic formation is Cretaceous age Dakota sandstone.

The first comprehensive paleontological resource inventory for Hovenweep National Monument was published by Santucci (2000) and followed by Scott et al (2001).

Sedimentary rocks exposed in the monument include the Upper Jurassic Morrison Formation, the Lower Cretaceous Burro Canyon Formation, and the Upper Cretaceous Dakota Sandstone. The only report of paleontological resources from the monument is an unidentified bone found by a Utah Geological Survey geologist, Martha Hayden. Although there are not many reports of fossils from within the monument, judging from their known presence nearby, invertebrate fossils most likely are present in Hovenweep National Monument.

NABR
Nowhere else are three such extraordinary natural bridges found in such close proximity to one another. These three bridges show three different stages of development from youth (Kachina), to maturity (Sipapu), to old age (Owachomo).

Together with the canyons in which they formed, these three bridges are excellent examples of the result of an entrenched meander stream system.

The monument contains two major canyons, White and Armstrong, which are deeply incised into the Cedar Mesa Sandstone, which is the geologic formation that covers the entire park.

The first comprehensive paleontological resource inventory for Natural Bridges National Monument was published by Santucci (2000). An inventory of paleontological resources associated with National Park Service caves, including Natural Bridges National Monument, was published by Santucci et al (2001). A few isolated fossils have been reported.

3.1.2 Soils

The SEUG parks are located within the Colorado Plateau and have arid and semiarid climates. These areas typically include biological soil crusts that form on top of the soil. These crusts, also known as cryptogamic, cryptobiotic, or microbiotic crusts, are formed by living organisms and their by-products that create a crust of soil particles bound together by organic materials. They cover 70 to 80 percent of the living ground cover in the cold deserts of the Colorado Plateau regions. Biological soil crusts on the Colorado Plateau are predominantly composed of cyanobacteria, lichens, and mosses (NRCS 1989). Soil crusts contribute to a number of functions in the environment occurring at the land surface or soil-air interface. These include soil stability and erosion control, atmospheric nitrogen fixation, nutrient contributions to plants, soil-plant-water relations, infiltration, seedling germination, and plant growth. Damage to the crusts from livestock grazing or human activities (e.g., hiking, biking, off-highway vehicle use, road and facility development, oil and gas development and mining) causes decreases in organism diversity, soil nutrients, and organic matter. Native vegetation can be adversely affected when crusts are disrupted or destroyed. Full recovery of disrupted biological soil crusts is a slow process, though visual recovery can be completed in as little as one to five years, depending on climatic conditions (NRCS 1989). However, nitrogen-fixing organisms critical to soil productivity take considerably longer to recover.

NPS Management Policies 2006 page 56; Section 4.8.2.4 addresses soil resource management. This policy states that NPS "…will actively seek to understand and preserve the soil resources of parks, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources." This policy also provides guidance for soil conservation and amendment practices, use of off-site soil, and for minimizing impacts to soils.

The National Resources Conservation Survey (NRCS), funded by the NPS Inventory and Monitoring program, is currently surveying soils in the SEUG parks and will have reports and maps within the next one to two years. The data used for the parks below came mostly from previous NRCS work (available online at

www.nrcs.usda.gov) and previous park documents. The available NRCS data is based on earlier less detailed mapping efforts than the current survey.

ARCH

A large percentage of Arches National Park's land surface is exposed bedrock or shallow soil over bedrock with sparse land cover. The arid climate of the area, with only eight inches of annual precipitation, results in sparse vegetation and poorly developed soils. Large areas of slickrock cover approximately 11 percent of the park and are largely devoid of soil and plant life (NRCS 1989). Soils in the park are derived from local sandstones and were classified by NRCS as well- drained, fine-grained sandy loams of eolian, residual, and alluvial origin with little organic material. The soils are a yellow red color and soil depth varies greatly. Approximately 90 percent of the soils in the park were assigned to the Rizno- Begay Complex (NPS 1996). These soils are fine sandy loams characterized by 2 to 10 percent slopes and are closely intermingled. Rizno soils are found on ridges and close to rock outcrops. Begay soils are found in open areas and are deeper. Rizno soils are 4 to 20 inches in depth, while Begay soils are as deep as 60 inches. Both soils are well drained and contain less than one percent organic matter (NPS 1996). These soils in the park are generally very susceptible to damage by trampling.

Biological soil crusts cover much of Arches National Park. Soil crusts are common on sandy soils in the pinyon/juniper areas and in shrublands. The soil crusts consist of a variety of organisms, including cyanobacteria, lichens, algae, mosses and fungi, which form an intricate web of filaments that increase soil stability, increase rainfall infiltration, fix nitrogen in the soil, and protect the soil surface from wind and water erosion. These functions contribute to the park's ecosystems by increasing nitrogen and other nutrients for plant growth and enhancing germination and establishment of some vascular plants.

CANY

The entire Canyon Lands physiographic section is characterized by bare rock surfaces with sparse soil and vegetation. This makes soil, where it occurs, which is a major natural resource. Organic content is low and the potential for erosion from water and wind is moderate to severe. Surface soil tends to be loose and poorly consolidated, unless they are stabilized by the growth of crytobotic soil. The NCRS in 1991 mapped seven soil units in Canyonlands. Their soil units vary widely from strongly sloping to extremely steep soils that formed in colluvium and residuum derived from sedimentary rock and rock outcrop found on escarpments and canyon walls. The soils in the canyon bottoms consist of mixed alluvial and colluvial deposits of widely varying depth and have a higher organic content than mesa-top soils. Additional NCRS soil units are rock outcrop, and shallow and very deep gently sloping to steep soils that formed in residium; eolian deposits derived from sandstone and shale found on escarpments and mesas; and soils that are shallow and very deep, well drained and excessively drained, gently sloping to moderately steep soils found on mesas, benches and valleys (Lammers1991). Most of these soil types support Juniper/pinyon shrublands with Indian ricegrass, sagebrush and blackbrush.

HOVE

HOVE soils are derived from local sandstones and shales and may be residual, alluvial, or eolian in origin. In general, shallow to deep eolian soils are found on the mesa tops, with shallow colluvium on canyon slopes and deep alluvium in the canyon bottoms. Thirteen soils types have been described for the six units of HOVE and all are typically well drained. Soil textures range from sandy loam to clay loam. The descriptions that follow are derived from NRCS soil surveys (2003b, 1993, and 1980).

The Cajon Unit is capped by Whit Very Fine Sandy Loam, an alkaline soil on gentle slopes that supports shadscale shrublands. Cutthroat Castle Unit soils typically are Romberg-Crosscan-Rock Outcrop Complex soils on very steep slopes supporting pinyon-juniper woodlands. The Hackberry Unit soils include Rizno-Gapmesa Complex on gentle slopes and Romberg-Crosscan-Rock Outcrop Complex soils on very steep slopes. Both types support pinyon-juniper stands. The Holly Unit is characterized by Typic Torriorthents-Rock Outcrop Complex and Claysprings Very Stony Clay Loam soils on moderate to steep slopes. The latter typically supports pinyon-juniper woodlands. The Goodman Point Unit contains the widest range of soils. The Romberg-Crosscan Complex occupies moderately steep canyons, hills and alluvial fans. Wetherhill Loam, Gladel-Pulpit Complex, and Cahona-Pulpit Complex soils formed from eolian deposits occupy gently sloping hills and mesas. These soils support Wyoming big sagebrush shrublands and pinyon-juniper woodlands. Square Tower Unit soils are characterized by Ruinpoint-Cahona Association and Rizno-Ruinpoint-Rock Outcrop Complex on mesa tops that support Wyoming big sagebrush stands. Little Ruin Canyon contains deposits of Littlenan-Moenkopie-Recapture Complex soils on structural benches and alluvial terraces that support basin big sagebrush (*Artemisia tridentate* ssp. *tridentata*), rubber rabbitbrush (*Ericameria nauseosa*), and mixed canyon wall shrublands.

Biological soil crusts are well developed within parts of HOVE, particularly where thin sandy soils overlie slickrock and in the nutrient-poor openings between tree canopies and clumps of vascular plants. Soil crusts were destroyed within most of HOVE by intensive sheep and cattle grazing between 1900 and 1950 (O'Dell et al. 2005).

NABR

NABR soils are derived from sandstone and shale bedrock that has been redistributed as alluvial, colluvial, or eolian deposits (NRCS 2003). Soil textures range from loamy sands (coarse) to sandy clay loams. Five soil types have been described for NABR. Rizno-Barx-Yarts complex covers 85% of the monument. It is associated with relatively gentle slopes on upland mesas and benches. The principal vegetation types are pinyon-juniper woodlands and Wyoming big sagebrush shrublands. The component soil types are susceptible to erosion; dunes and gullies are common. Rizno-Rock Outcrop complex consists of thin soils intermixed with rock outcrops on mesas. Pinyon-juniper woodland with pockets of perennial grasses is the principal

vegetation type found on this complex. Rock Outcrop - Strych - Rizno association occurs on the steep sandstone walls and ledges of White, Armstrong, Deer, and Tuwa Canyons. Plant communities occurring in bedrock cracks include sparse pinyon-juniper woodlands and sparse shrublands of littleleaf mountain mahogany or spiny greasebush (*Glossopetalon spinescens* var. *meionandrum*). The uncommon Strych - Rizno - Strych, Very Steep Association is a unit associated with steep, slopes near the junction of Armstrong and White Canyons. This association supports sparse pinyon-juniper woodlands with roundleaf buffaloberry and Utah serviceberry. Linear strips of Wet Alluvial Land unit occur on drainage bottoms, where they are included in the Rock Outcrop – Strych – Rizno Association. These sandy loams are saturated for at least part of the year and support mesic plant species such as western wheatgrass (*Pascopyrum smithii*), rubber rabbitbrush, coyote willow (*Salix exigua*), and Rio Grande cottonwood.

Biological soil crusts are well developed within NABR, particularly where thin soils overlie slickrock. These crusts are a complex community of cyanobacteria, green algae, lichens, mosses, microfungi, and other true bacteria (Belnap et al. 2001). The cyanobacteria and microfungi have filaments that weave through the top few millimeters of soil, creating a matrix that stabilizes and protects soil surfaces from wind and water erosion. Other services provided by biological soil crusts include fixing atmospheric nitrogen, building soil organic matter (Eldridge and Green 1994), and retaining soil moisture (Belnap et al. 2001).

3.1.3 Air Quality

Current laws and policies require that the following conditions be achieved for air quality:

Desired Condition	Source
A condition where National Ambient Air Quality Standards (NAAQS) for specified pollutants are met;	Clean Air Act (CAA); NPS Management Policies
Current air quality is maintained (and deterioration avoided); and	CAA; NPS Management Policies; NEPA

Federal regulation of air quality was established in the 1990 Clean Air Act (CAA). The purpose of the CAA as amended is to prevent and control air pollution; to initiate and accelerate research and development; and to provide technical and financial assistance to state and local governments in connection with the development and execution of air pollution programs. The CAA establishes requirements for areas failing to attain National Ambient Air Quality Standards (NAAQS) and provides for prevention of significant deterioration of areas where air is cleaner than NAAQS.

NPS Management Policies state that the NPS has a responsibility to protect air quality under both the 1916 Organic Act and the CAA. Accordingly, NPS will seek to perpetuate the best possible air quality in parks to:

1. Preserve natural resources and systems;
2. Preserve cultural resources; and
3. Sustain visitor enjoyment, human health, and scenic vistas.

Vegetation, visibility, water quality, wildlife, historic and pre-historic structures and objects, cultural landscapes, and most other elements of a park environment are sensitive to air pollution and are referred to as "air quality-related values." The NPS will assume an aggressive role in promoting and pursuing measures to protect these values from the adverse impacts of air pollution. Superintendents will take action consistent with their affirmative responsibilities under the CAA to protect air quality related values in Class I areas. Class I areas are national parks over 6,000 acres and national Wilderness areas over 5,000 acres that were in existence on August 7, 1977. The CAA establishes a national goal of preventing any future, and remedying any existing, human-made visibility impairment in Class I areas. The NPS supports that goal and will take advantage of opportunities created by the CAA to help achieve it. The CAA also recognizes the importance of integral vistas, which are those views perceived from within Class I areas of a specific landmark or panorama located outside the boundary of the Class I area. The 2006 Management Policies state that scenic views and visual resources are considered highly valued associated characteristics. More specifically, page 52, Section 4.7 of Management Policies states that the CAA recognizes the importance of integral vistas, which are those views perceived from within Class I areas of a specific landmark or panorama located outside the boundary of the Class I area. Integral vistas have been identified by NPS and are listed in RM-77. There are no regulations requiring special protection of these integral vistas, but the NPS will strive to protect these park-related resources through cooperative means.

Air Quality Standards

The federal government has established NAAQS for criteria air pollutants. The criteria pollutants are carbon monoxide, lead, sulfur dioxide, and particulate matter less than 10 microns in diameter (PM10) and particulate matter less than 2.5 microns in diameter (PM2.5), ozone, and nitrogen dioxide (NO2). The NAAQS are absolute allowable concentration limits for criteria air pollutants that apply to areas where the public has access. Table 3-1 shows the NAAQS.

NAAQS are defined in terms of ambient air concentrations over various averaging times, such as annual or hourly, depending on the type of exposure associated with health and welfare effects. For some pollutants, there are both short-term and long-term standards. Baseline data on criteria pollutants collected by a national monitoring system are used to determine if the NAAQS are met and to track pollutant trends.

TABLE 3-1 NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Ambient Standard Concentration		Averaging Time
	parts per million (ppm)	micrograms per cubic meter (µg/m³)	
Carbon Monoxide	9	10,000	8-Hour
	35	40,000	1-Hour
Nitrogen Dioxide	0.053	100	Annual
Particulate Matter (PM_{10})	-	50	Annual
	-	150	24-Hour
Particulate Matter ($PM_{2.5}$)	-	15	Annual
	-	65	24-Hour
Ozone	0.08	157	8-Hour
	0.12	235	1-Hour
Sulfur Oxides	0.03	78	Annual
	0.14	364	24-Hour
	0.51[1]	1,300	3-Hour
Lead	-	1.5	Quarterly

[1] Secondary standard

Areas are classified as attainment, non-attainment, or unclassifiable for all pollutants. The attainment or unclassifiable designations mean that the area is in compliance with the CAA. Regulations that protect air quality are stricter in non-attainment areas (where monitored air quality has exceeded the NAAQS) than in attainment areas.

ARCH

Arches National Park is designated as a "Class I" area under provisions of the 1977 Clean Air Act Amendments (Binkley et al. 1997). Federal land managers are required to protect air quality related values in Class I areas, including visibility, soils, surface waters, plants, animals, historic and geologic features, night sky, and other resources affected by air quality (Binkley et al. 1997).

Historic air-quality monitoring data are available for Arches, but air quality is not currently monitored in the Park. From 1978 to 1985, panoramic photographs were taken daily from a location at the southwest corner of the Park to document visibility conditions in relation to the Atlas uranium mill south of the Park. The complete dataset consists of approximately 6350 photographic slides (DS-SEUG-054). Monitoring associated with the IMPROVE program (Interagency Monitoring of Protected Visual Environments, http://vista.cira.colostate.edu/improve/) was conducted from 1986 until 1992. As part of this program, visibility was monitored photographically with a 35-mm camera between 1986 and 1991, and concentrations of fine and coarse airborne particles were monitored by air samplers between 1988 and 1992 (DS-SEUG-043). Results of pollutant and meteorological monitoring conducted in 1991 are summarized in an NPS report (NPS 1992). Standard visual range (the greatest distance that a large black object can be seen against the horizon)

was monitored at Arches from summer 1986 until spring 1987. Ozone was monitored in Arches from 1987 until 1992; SO_2 was monitored from 1988 until 1992. Miller et al. (2000) summarized ozone monitoring conducted in National Parks between 1992 and 1997, including Arches. Ozone and meteorological data for Arches are available on-line from the NPS Air Quality Monitoring Database at http://www2.nature.nps.gov/ard/gas/netdata1.htm.

A variety of studies and reports related to air quality are available for Arches. Belnap (1990) studied effects of airborne pollutants on soil and rock lichens of several Colorado Plateau parks, including Arches. This work also was summarized in a subsequent report (Belnap et al. 1991). Gladney et al. (1993) sampled waters of pothole ecosystems in several southwestern parks (including Arches) to assess water quality sensitivity to airborne pollutants. Binkley et al. (1997) provided an excellent summary and synthesis of air-quality conditions in Class I parks and monuments of the Colorado Plateau through 1996. Maniero (2001) summarized extant air quality monitoring for parks of the Northern Colorado Plateau Network and made recommendations regarding priorities for supplemental monitoring. She noted that current monitoring conducted at the Island in the Sky District of Canyonlands National Park (wet deposition, dry deposition, IMPROVE visibility, and ozone) is applicable to Arches National Park. For information on these monitoring efforts, see the air-quality monitoring narrative for Canyonlands National Park.

CANY

Canyonlands National Park is designated as a "Class I" area under provisions of the 1977 Clean Air Act Amendments (Binkley et al. 1997). Federal land managers are required to protect air quality related values in Class I areas, including visibility, soils, surface waters, plants, animals, historic and geologic features, night sky, and other resources affected by air quality (Binkley et al. 1997).

Visibility Monitoring

Visibility monitoring has been conducted at CANY since 1978. Standard visual range estimates were used to monitor visibility at two separate locations at the Island in the Sky District (ISKY) from 1978 until 1987. This technique also was used at the Hans Flat Ranger Station west of the Maze District for two years from spring 1979 until spring 1981. Photographic visibility monitoring with a 35-mm camera was conducted at the Island in the Sky District from 1982 until 1995 as an element of the IMPROVE program (Interagency Monitoring of Protected Visual Environments, http://vista.cira.colostate.edu/improve/). Also in conjunction with the IMPROVE program at ISKY, concentrations of fine and coarse airborne particles have been monitored by air samplers since 1988, and light extinction (a visibility parameter) has been monitored with a transmissometer since 1987 (DS-SEUG-042). Malm (1991) summarized IMPROVE particulate data collected at ISKY from spring 1988 through spring 1990. Particulate data and sampling techniques associated with IMPROVE monitoring at ISKY have been analyzed and discussed by Lewis, Eatough and colleagues (Lewis and Eatough 1990; Lewis et al. 1991a,b; Lewis 1992; Eatough et

al. 1993; Eatough et al. 1996a,b,c). Much of this work was oriented towards the identification of emissions sources responsible for visibility reductions at CANY.

In addition to the IMPROVE program, several other visibility studies have been conducted. Cahill et al. (1979) used particulate and visual-range data from CANY and Zion National Park to assess regional episodes of decreased visibility. Pitchford et al. (1980) sampled aerosols in remote areas of southern Utah, including CANY, to establish baseline conditions prior to the projected development of energy resources in the region. Baseline air-quality studies also were conducted in Davis Canyon adjacent to CANY as part of an environmental assessment for a proposed nuclear waste storage facility (Bechtel National, Inc. 1985). The feasibility of using inert tracers to identify emission sources responsible for visibility reductions at Canyonlands, Glen Canyon National Recreation Area, and Grand Canyon National Park was investigated in the WHITEX study (Winter Haze Intensive Tracer Experiment; Malm et al. 1989). Markowski (1992) critically reviewed the WHITEX study and found it to be flawed.

Ecosystem Effects Monitoring
Investigations concerning effects of air pollutants on ecosystem components and processes have been limited relative to direct monitoring of air-quality conditions and pollutants. Belnap and colleagues (Belnap 1990, Belnap and Harper 1990) studied effects of airborne pollutants on physiological parameters of soil and rock lichens. Sulfur concentrations in soils and foliage of pinyon pine (*Pinus edulis*) were documented by Gladney et al. (1993) to provide baseline data for future assessments of pollutant accumulations.

Synthesis Reports
Two recent air-quality synthesis reports are pertinent to Canyonlands. Binkley et al. (1997) provided an excellent summary and synthesis of air-quality conditions in Class I parks and monuments of the Colorado Plateau through 1996. Maniero (2001) summarized extant air quality monitoring for parks of the Northern Colorado Plateau Network and made recommendations regarding priorities for supplemental monitoring.

HOVE
No air quality monitoring has occurred at Hovenweep National Monument. Maniero (2001) summarized extant air quality monitoring for parks of the Northern Colorado Plateau Network, and she identified the nearest air quality monitoring stations that collect data relevant to Hovenweep. Wet and dry deposition are monitored at Mesa Verde National Park (40 km southeast of Hovenweep) in association with the NADP/NTN program (National Atmospheric Deposition Program/National Trends Network, http://nadp.sws.uiuc.edu/) and the CASTNet program (Clean Air Status and Trends Network, http://www.epa.gov/castnet/), respectively. The nearest IMPROVE visibility monitoring station (Interagency Monitoring of Protected Visual Environments, http://vista.cira.colostate.edu/improve/) also is located in at Mesa Verde. Mesa Verde also continuously monitors ozone. Ozone and associated

meteorological data for Mesa Verde are available on-line from the NPS Air Quality Monitoring Database at http://www2.nature.nps.gov/ard/gas/netdata1.htm.

NABR
Minimal air quality monitoring has occurred at Natural Bridges National Monument. Some air-quality information for Natural Bridges exists in NPS files (National Park Service, Southeast Utah Group 1982), but the content of this information currently is unclear. Belnap (1990) studied effects of airborne pollutants on soil and rock lichens of several Colorado Plateau parks and monuments, including Natural Bridges. Maniero (2001) summarized extant air quality monitoring for parks of the Northern Colorado Plateau Network, and she identified the nearest air quality monitoring stations that collect data relevant to Natural Bridges. Wet and dry deposition are monitored at Canyonlands National Park (90 km north of Natural Bridges) in association with the NADP/NTN program (National Atmospheric Deposition Program/National Trends Network, http://nadp.sws.uiuc.edu/) and the CASTNet program (Clean Air Status and Trends Network, http://www.epa.gov/castnet/), respectively. The nearest IMPROVE visibility monitoring station (Interagency Monitoring of Protected Visual Environments, http://vista.cira.colostate.edu/improve/) also is located in at Canyonlands. Canyonlands also continuously monitors ozone. Ozone and associated meteorological data for Canyonlands are available on-line from the NPS Air Quality Monitoring Database at http://www2.nature.nps.gov/ard/gas/netdata1.htm.

3.1.4 Visual Resources

The visual experience is an important resource at most of the parks. In some of the parks, it is the primary experience. In the evaluation of scenic quality, both the visual character and visual quality of a viewshed should be considered. A viewshed comprises the limits of the visual environment associated with a park. The NPS considers several scenic views important to the visitor experience and worthy of protection. Aesthetics is an important component that contributes to visual or scenic quality and the sense of solitude prized by many park visitors.

Current policy that requires that the following conditions be achieved in the SEUG group:

Desired Condition	Source
Integral vistas are protected through cooperative means.	CAA; NPS Management Policies; RM-77

ARCH
The visibility in Arches National Park is also exceptional. The La Sal Mountains are the most prominent landscape feature visible from the park. They lie approximately 20 miles southeast of the park and rise 13,000 feet in elevation. Their sharp contrast with the red sandstone of the park provides a spectacular view visible from numerous

locations in the park. Other major topographic features visible from the park are the Abajo Mountains and the Book Cliffs. The Abajos lie 60 miles south of the park and approach 12,000 feet in elevation. The Book Cliffs, just to the north, extend over 100 miles east-west from Grand Junction, Colorado to Green River, Utah. Various canyons, valleys, and mesas lying within and beyond the park boundary are visible from several observation points throughout the park. These features, along with the La Sal Mountains and the Book Cliffs, provide the aesthetic panoramic backdrop for the park's many arches, rock fins, and other geologic formations.

CANY

Visibility at CANY is excellent, with distant topography visible in every direction. Certain topographic features 100 to 150 miles eastward are clearly visible throughout much of the year, including the Henry Mountains, Abajo Mountains, La Sal Mountains, and on particularly clear days the San Juan Mountains in Colorado. A distinctive part of the CANY landscape is the mosaic pattern of deep canyons and mesas. The NPS has identified several scenic views extending beyond the park's boundaries that are part of the visitor experience and worthy of protection. These views include: the Needles, the Green River, the Colorado River, Grandview Point, the Maze, the Henry Mountains, the canyon rims, and the Confluence of the Green and Colorado Rivers. Some or all of these views can be seen from observation points throughout the park. A number of walking/hiking trails provide beautiful views. Vistas and cultural landscapes are critical resources, both within and adjacent to the park.

HOVE

From the various site ruins one can also appreciate the impressive views surrounding Hovenweep National Monument. The untainted air quality produces a viewshed that encompasses several mountain ranges. The San Juan Mountain range 80 miles to the east, which at its highest peak rises 14,246 feet above the earth. The Chuska Mountains in Arizona lie 120 miles south of the monument and reach an elevation of approximately 7,000 feet. The Ute Mountains lie 35 miles to the east and the Abajo Mountains lie 50 miles west and rise to an elevation of 11,000 feet. One unique geological feature 65 miles to the southwest in New Mexico can also be seen. Shiprock is a 2,000 foot tall volcanic neck that was a remnant of a volcanic eruption 30 million years ago.

NABR

Pristine air quality ensures extensive vistas and combined with the absence of artificial light provides outstanding opportunities to view the night sky at Natural Bridges National Monument. The viewshed include views of the Henry Mountains that lie approximately 80 miles to the northwest and rise to an elevation of 11,500 feet, Monument Valley, 66 miles south in the state of Arizona, Woodenshoe Butte 10 miles to the north, and Bear's Ears 9,000 foot peak 10 miles to the east in the Elk Ridge Mountains. The vistas have been deteriorating over the past few decades, due to construction of fossil fuel power generating stations, industrialization of the area, urban pollution sources, wood burning and prescribed fire activities.

3.1.5 Water Resources

Water resources in the SEUG region include major rivers, surface water, ground water, potholes, and seeps and springs. The major water sources include the Colorado and Green Rivers, their tributaries, and the local aquifers. Water for domestic needs is provided by surface waters and aquifers.

Current laws and policies require that the following conditions be achieved for water resources:

Desired Condition	Source
A condition where surface waters and ground waters perpetuate as integral components of park aquatic and terrestrial ecosystems;	Clean Water Act; Executive Order 11514; NPS Management Policies
The pollution of park waters by human activities occurring within and outside of parks is avoided whenever possible.	Clean Water Act; E.O. 12088; NPS Management Policies

The primary legislation governing water is the 1972 Federal Water Pollution Control Act, commonly referred to as the Clean Water Act. This act furthers the objectives of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters and of eliminating the discharge of pollutants into navigable waters. It establishes effluent limitation for new and existing industrial discharge into U.S. waters, and authorizes states to substitute their own water quality management plans developed under Section 208 of the act for federal controls. This act also provides an enforcement procedure for water pollution abatement and requires conformance to a permit required under Section 404 for actions that may result in discharge of dredged or fill material into a tributary to, wetland, or associated water source for a navigable river.

The Rivers and Harbors Act of 1899 establishes the USACE regulatory authority over U.S. navigable waters. This act also establishes permit requirements for construction of bridges, causeways, dams, or dikes within or over navigable waters of the U.S. Bridge and causeway construction is regulated by the Transportation Secretary, while dam and dike permits are reviewed by the USACE. Section 10 of the Act requires a USACE permit for construction of any "obstruction of navigable waters" of the U.S. and for any excavation, fill, or other modification to various types of navigable waters. Section 13 requires a USACE permit for discharge of refuse of any kind (except liquid from sewers or urban runoff) from land or vessel, into the navigable waters of the U.S. or into their tributaries. Similarly, discharge of refuse is prohibited upon the banks of navigable waters or their tributaries where the refuse could be washed into the water.

NPS has developed policies and guidance on water resource management. Pages 50 through 52, Section 4.6 of 2006 Management Policies address water resource management including the protection of surface waters and ground water, water rights, water quality, and watershed and stream processes. Director's Order 77, Natural Resource Protection, is currently being developed, but previous Natural Resource Management Guidelines still apply. These guidelines specify policies, programs, and guidance for water resource management including water quality, water quantity, shoreline management, and aquatic organism and habitat protection.

Water Quality

The SEUG has been gathering water quality data at sites in each of the SEUG park units since the mid-1980's (except for HOVE, which was added to the water quality program in 1999, shortly after the monument was added to the Southeast Utah Group). Sites and water quality monitoring protocols evolved rapidly in the first few years, and more slowly since the 1990's. In the last few years, the NPS Inventory & Monitoring (I & M) Program has aided in protocol refinement, data management, and the identification of water quality stressors and indicators of vital signs.

Currently, SEUG collects data from 21 spring, seep and small stream sites spread out throughout the SEUG, including eight in Canyonlands National Park, six in Arches National Park, three in Natural Bridges National Monument, and three in Hovenweep National Monument. Collection of water samples is on a 3-year rotational cycle for most of these sites, so that each site is tested 10 to 12 times a year every three years. One site each in Canyonlands and in Arches is tested monthly every year. Four core water quality field parameters (dissolved oxygen, temperature, pH, and specific conductance) are monitored and flow is measured during each site visit. Additionally, a water sample is collected and tested, in-house at SEUG headquarters, for total coliform bacteria and E. coli. A semi-quantitative, but mostly qualitative aquatic invertebrate monitoring protocol is completed three times per year at the sites being monitored that year.

SEUG also collects data from five sites on the Colorado and Green rivers in and near Canyonlands National Park. A more limited sampling protocol is carried out at these sites, in which river rangers collect samples four to eight times each year during the river travel season, from March through November. They record water and air temperatures, and flow data is obtained from USGS gages. River water is rarely tested for bacteria, because of required short holding times incompatible with multi-day river trips.

Samples obtained at all of the above SEUG sites are sent to Utah state laboratories for testing of 30 to 40 water quality parameters, but none of these parameters are herbicides. There is no legal requirement to monitor herbicides; however the Safe Drinking Water Act of 1974 (SDWA) requires monitoring of drinking water. All new drinking water systems and/or new drinking water sources must be tested for a suite of chemicals. The suite of chemicals includes 2, 4-D, glyphosate, and picloram. Director's Order-83 mandates that if contamination from herbicides is probable,

drinking water will be monitored annually. However, if there is no cause for concern, monitoring of drinking water sources for herbicides is only conducted every nine years.

Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act was passed in October of 1968 (Public Law 90-542, as amended, 16 U.S.C. 1271-1287):

> "It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly 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. Congress declares that the established national policy of dams and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing condition to protect the water quality of such rivers and to fulfill other vital national conservation purposes." (Public Law 90-542, as amended, 16 U.S.C. 1271-1287).

Under this act, uses compatible with management goals are allowed and change is expected to occur. Development not damaging to outstanding resources of a designated river, or curtailing its free flow, may occur only after a Section 7(a) determination is rendered. Section 10 of the act requires administering agencies to enhance said rivers. The Nationwide Rivers Inventory (NRI) is a listing of more than 3,400 free-flowing river segments in the U.S. that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. Under a 1979 presidential directive, and related Council on Environmental Quality (CEQ) procedures, all federal agencies must seek to avoid or mitigate actions that would adversely affect one or more NRI segments. CANY and ARCH have rivers within or adjacent to their boundaries.

Page 25, Section 2.3.1.9 of 2006 Management Policies states that, "GMPs and other plans potentially affecting river resources will propose no actions that could adversely affect the values that qualify a river for the national wild and scenic rivers system." Page 41, Section 4.3.4 also discusses management of Wild and Scenic Rivers and instructs parks to comply with the Wild and Scenic Rivers Act, including assessing whether rivers are suitable for inclusion in the system. Such assessments, and any resulting management requirements, may be incorporated into a park's GMP or other management plan. No management actions may be taken that could adversely affect the values that qualify a river for inclusion in the National Wild and Scenic Rivers System.

Current laws and policies require that the following conditions be achieved for wild and scenic rivers:

Desired Condition	Source
A condition where selected rivers of the Nation, which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values are preserved in free-flowing condition. These rivers and their surrounding environments are protected for the benefit and enjoyment of present and future generations;	Wild and Scenic Rivers Act
Adverse affects on the values that qualify a river for the national wild and scenic rivers system is avoided.	NPS Management Policies

Director's Order-46A, Wild and Scenic Rivers, is currently under development. This section identifies water resources and includes information on water quality and Wild and Scenic Rivers in the SEUG park units.

ARCH

The high-level of the Colorado River forms 10.7 miles of the southeast boundary of the park. Salt Wash is the only perennially flowing stream in the park. Courthouse Wash flows intermittently and seasonally and has perennial pools. Both Salt and Courthouse have headwaters outside the park. Arches and SEUG personnel have identified these streams, along with Freshwater Spring, Sleepy Hollow Spring, Sevenmile Canyon, Salt Valley Wash, Salt Spring, Willow Spring, and Lost Spring as significant and natural water bodies within the park. Several other springs and many seeps on canyon walls provide valuable wildlife habitat and water sources for wildlife and human use.

Seven water sources are monitored in the long-term water quality program for ARCH: Lower Courthouse Wash, Freshwater Spring, Sleepy Hollow, Willow Spring, Salt Wash near Wolfe Ranch, Lost Spring, and Upper Courthouse Wash.

In Arches National Park, a total of 18.4 miles of streams have been determined as eligible for the wild and scenic river system. Almost 9 miles of Courthouse Wash and 9.5 miles of Salt Wash are eligible as wild rivers. Both these washes are currently being managed as if they were designated as wild rivers.

CANY

The most significant water sources in Canyonlands are the Colorado and Green Rivers. The Colorado River flows 420 miles from its headwaters in Rocky Mountain National Park, through western Colorado and southeast Utah to its confluence with the Green River. Mean discharge of the Colorado River at the nearest USGS gage to CANY, calculated from 1914-1995 records, was 7393 cfs. The gage is located near Cisco, UT, 64 miles upstream of the park. But extremes and seasonal fluctuations are

the norms for these rivers. The Green River starts in the Wind River Mountains of Wyoming and flows south 730 miles to its confluence with the Colorado River. Its mean discharge, from a gage 73 miles upstream of the park near Green River, Utah, was 6191 cfs for the period from1906-1995. Though there are no dams within a couple hundred miles upstream of the park on either of the river, the flows of both rivers are strongly affected by dams farther upstream-the Aspinall Unit of dams on the Gunnison River, which flows into the Colorado, and Flaming Gorge Dam on the Green River near the Wyoming-Utah border. The main effect of the dams on flow is to dampen the extremes in flow.

Besides the Green and Colorado rivers, Salt Creek is the wettest drainage in CANY. It is an intermittent stream with numerous perennial pools and a few short semi-perennial stretches. Its headwaters are on Elk Ridge of the Abajo Mountains on U.S. Forest Service land. From Elk Ridge, Salt Creek flows north for a few miles through BLM lands then into CANY, where it continues thirty miles before joining the Colorado River. Long and Smith's (1996) summary of monitoring data reports flows in Salt Creek ranging from 0.448 to 0 .896 cfs. but their report did not include flood flows. In the extreme drought year of 2002, lower pool levels were observed in Salt Creek, and a normally perennial stretch reduced to one or two pools, but the perennial pools did not dry up.

Most of the canyons in CANY, and on the Colorado Plateau in general, are ephemeral drainages. Some of these have seasonal spring flow, or a perennial pool or two, and all of them carry large amounts of water, sediment, and debris during storm events. CANY has numerous springs and even more numerous ephemeral water sources that are of importance to wildlife, as well to visitors. Some of CANY's significant ephemeral drainage canyons are Big Spring, Davis, Lost, Little Spring, Horseshoe, Horse, Lavender, Jasper, Squaw and Water canyons. Park personnel note that these water sources are critically significant to the park as representative of natural riparian and floodplain habitat, and provide recreational and scenic opportunities.

Fourteen sites have been monitored for long-term water quality in or near CANY: in the Needles District-Little Spring, 2.4 Mile Loop in Big Spring Canyon, Cave Spring, Salt Creek near Peekabo Spring, Salt Creek near Crescent Arch, Salt Creek near Old Bates Wilson Camp; in the Maze District- Maze Overlook Spring, Chocolate Drops Spring, Horseshoe Canyon Spring; in or near the River District-Colorado River at Potash Boat Ramp, Green River at Mineral Bottom, Green River above Confluence with Colorado River, Colorado River above Confluence with Green River, and Colorado River below Big Drop 3 Rapid.

CANY has 127 miles of rivers proposed to Congress that qualify for an inclusion to the wild and scenic river system. The Green River has 49 miles and the Colorado has 45 miles of eligible status. Salt Creek is 28 miles long and the upper 10 miles are eligible. The section of Horseshoe Canyon River is 5 miles long with the upper 4 miles being eligible. These rivers are currently being managed as wild in accordance with NPS policy.

HOVE
Permanent seeps and springs are common in canyonheads that are cut into Cajon Mesa, especially at the point of contact between the porous Dakota Sandstone which caps the mesa and the underlying, more impervious Burro Canyon Formation and Morrison Formation Shales. The springs in the canyonheads provide moisture for localized lush vegetation communities as well as water sources for wildlife.

SEUG monitors many of the perennial water sites in Hovenweep. Three sites are monitored for water quality: Cajon Spring, Square Tower Spring, and Horseshoe Spring 1. Six sites are monitored for water quality, including the three water quality sites plus Hackberry Spring 2, Horseshoe Spring, and Goodman Point Spring.

Hovenweep does not have any rivers eligible as wild or scenic.

NABR
The monument contains limited water resources in the form of intermittent streams, plunge pools, intermittently filled bedrock potholes (tinajas), seeps, and springs. Intermittent streams in Armstrong and White Canyons support stands of riparian and wetland vegetation, especially below bedrock pour-offs where plunge pools exist. Tinajas develop in solution pits formed in level exposures Cedar Mesa Sandstone. Seeps and springs with flow rates of only a few gallons per minute provide sufficient water for localized surface flows in canyon heads and moist to saturated soils where they emerge from bedding planes and joints in sandstone cliffs (Berghoff and Vana-Miller 1997). Seeps emerge from cliff faces deposit dissolved salts, as the water evaporates, staining the surface white. Flow and standing water from hydrologic sources is typically ephemeral, but constitutes a significant source of water for wildlife and aquatic biota. NABR is a plateau dissected by a canyon system consisting of White, Armstrong, Deer, and Tuwa canyons. Surface water exits NABR via White Canyon and flows toward Lake Powell in Arizona. Surface flows are intermittent, occurring most commonly during and following precipitation events, when runoff from exposed bedrock and upland soil surfaces drains to the canyon floors. Debris lines and channel scour indicate that flash flooding periodically removes vegetation, moves boulders, incises channels and builds new terraces.

Only one river in Natural Bridges is proposed as a wild river. Seven miles of White Canyon River is eligible as a wild river and is being managed as such.

3.1.6 Floodplains and Wetlands
Current laws and policies require that the following conditions be achieved for floodplains and wetlands:

Desired Condition	Source
Natural floodplain values are preserved or restored;	E.O. 11988; Rivers and Harbors Act; Clean Water Act;

	NPS Management Policies; NEPA
Natural and beneficial values of wetlands are preserved and enhanced.	E.O. 11990; Rivers and Harbors Act; Clean Water Act; NPS Management Policies

The 2006 Management Policies also provide guidance for protection of floodplains and wetlands. Pages 51, Section 4.6.4 requires the NPS to protect, preserve, and restore the natural resources and functions of floodplains; avoid the long-term and short-term environmental effects associated with the occupancy and modification of floodplains; and, avoid the direct and indirect support of floodplain development and actions that could adversely affect the natural resources and functions of floodplains or increase flood risks. Page 51, Section 4.6.5 requires the NPS to manage wetlands in accordance with NPS mandates and the requirements of E.O. 11990 (Wetland Protection), the Clean Water Act, the River and Harbors Appropriation Act of 1899, and procedures described in DO 77-1: Wetlands Protection. For proposed new development or other new activities, plans, or other programs that are either located in, or otherwise have the potential for direct or indirect adverse impacts on wetlands, the NPS will employ the following sequence: avoid adverse wetland impacts to the extent practicable; minimize impacts that cannot be avoided; and compensate for remaining unavoidable adverse wetlands impacts by restoring wetlands that have been previously destroyed or degraded.

ARCH

The Colorado River reaches its highest stage of flooding in late May or early June, although this level varies considerably from year to year. The park boundary is the normal high-water line and the only park facilities in the Colorado River floodplain are the county-maintained boat launching ramp and parking area near the highway bridge. This area is flooded periodically by high runoff of the Colorado River.

Several of the park's developed areas are in the floodplains of other streams. At the headquarters site, the entrance road, the apartment building, residence 3 and some of the underground utilities are in the 100 year floodplain of Bloody Mary Wash; the well house, the maintenance yard, and other underground utilities are in the 500-year floodplain; and all the above plus the visitor center/administration building and the Canyonlands Natural History Association (CNHA) offices, located within the VC building, are in the probable maximum flood zone. Residences 5, 6, and 10 are above the probable maximum floodplain of Bloody Mary Wash (NPS 1989). Much of the visitor center/headquarters area is also vulnerable to sheet flooding down the rocky slopes north of the buildings during thunderstorms.

The Wolfe Ranch area is within the floodplain of Salt Wash. Although no floodplain determination has been completed, the ranch has been flooded several times during the past 50 years (NPS 1989). The stream crossings along the access road near the

ranch are low water crossings and periodically wash out. In recent years this road has been closed for several times for brief times during the peak travel season.

Wetland vegetation is found in areas adjacent to seeps and springs and along streams with perennial water or shallow groundwater. The vegetation covers a relatively small area of the park but provides diverse habitat. Wetland vegetation includes willows, cottonwood, horsetails, cattails, phragmites, rushes, sedges, grasses, and non-native tamarisk and Russian olive.

CANY

With the Colorado and Green Rivers flowing through Canyonlands, not to mention the numerous streams, creeks and dry washes, flooding can be a frequent occurrence. Flooding of park land is generally from flash flooding during thunderstorms in the mid to late summer and early fall. The Colorado and Green Rivers reach the highest stage of flooding in late May or early June, although these levels vary considerably from year to year. Floodplains in the backcountry were identified by professional hydrologists who identified 100 year, 500 year and maximum possible floods based on standard hydrologic definitions. Along Salt Creek a few campsites were determined to be within these floodplains and were closed to visitor use.

Wetlands are limited but are located along the rivers, streams and creeks and are host to a variety of vegetation such as cottonwood, willow, non-native tamarisk and Russian olive, grasses and sedges. Most wetland areas have unique features and plant species of special concern and are associated with riparian areas, relict areas, seeps/springs, and hanging gardens.

HOVE

Because of the limited amount of rainfall this area receives, floodplain mapping information is likely incomplete for the monument. Ephemeral drainages and minor tributaries to canyons have historically carried floodwaters during monsoonal flows that visit this part of southwest Colorado during the late summer and early fall season. Due to the minimal amounts of precipitation in the area and other hydrologic factors such as limited basin sizes and soil conditions wetlands are also a limited resource.

NABR

Floodplains in Natural Bridges are limited to the major canyon bottoms and along the dry washes on the mesa tops. Late summer and early fall thunderstorms lead to flash flooding along the canyon bottoms. Some of these floods can be spectacular; water levels rose up to 25 or 30 feet above the canyon bottoms of Armstrong and White canyons on September 9, 2003; flood debris indicated water levels 50 feet above the canyon bottom below the confluence of these two streams.

Wetlands are limited in the monument. Most of the canyon bottoms are occupied by riparian vegetation. While this acreage is not extensive, these are important wetlands, which include vegetation such as willow. Vegetation along the streams in White and Armstrong canyons provides important habitat for deer and other mammals, as well

as migratory birds. The water is home to invertebrates not found outside this limited habitat. Hanging garden wetlands are found in seep areas along canyon walls.

3.2 BIOLOGICAL RESOURCES

Vegetation, terrestrial wildlife, and aquatic wildlife and fisheries combine to create the biological environment. The biological environment is addressed in the following five sections: 1) background information on biological resources in the SEUG area; 2) native vegetation; 3) terrestrial wildlife; 4) aquatic wildlife and fisheries; and 5) threatened, endangered, and state species of concern.

Current policies require that the following conditions be achieved for plants and wildlife:

Desired Condition	Source
A condition where, as parts of the natural ecosystems of parks, all native plants and animals are maintained.	NPS Management Policies

There are no federal laws governing vegetation in general; however, NPS has developed policies and guidance on vegetation management. Page 42, Section 4.4 of 2006 Management Policies addresses biological resource management, including general vegetation management. This policy states that NPS will maintain as parts of the natural ecosystems of parks all native plants and animals. The term “plants and animals” refers to all five of the commonly recognized kingdoms of living things; which are plants, animals, fungi, protista, and monera. More specific topics covered in this policy include native species, species harvesting, exotic species, and pest management.

DO-77, Natural Resource Protection, is currently being developed, but previous Natural Resource Management Guidelines still apply. These guidelines specify policies, programs, and guidance for vegetation management and non-sensitive wildlife management.

3.2.1 Native Vegetation

Until recently, vegetation management at the park units of the Southeast Utah Group was a series of sporadic events heavily dependent on funding and interested personnel. Arches National Park and Natural Bridges National Monument were blessed with rangers that took it upon themselves to do everything possible to control specific noxious weeds, especially tamarisk. The Southeast Utah Group has employed at least three vegetation managers in the past ten years and they have primarily focused on just a couple of species, tamarisk, Russian olive, and Russian knapweed. These folks have had plenty of work and spent much of their time in the field trying to get an upper hand on a few infested areas. They have focused their work on canyons and side canyons where control was effective and attainable. Some

areas are so entangled in tamarisk, along the rivers and in some canyons that control has yet to be attempted due to the sheer magnitude of the job. Other areas, such as Salt Valley in Arches, Horseshoe Canyon in Canyonlands, and the canyons of Natural Bridges and Hovenweep National Monuments, contained manageable populations and the elimination of tamarisk has been a very successful endeavor. All of these areas, however, require constant annual attention as new sprouts appear from seeds that have been washed or blown in from adjacent areas outside the parks.

The NPS Inventory and Monitoring Program undertook inventories over the last few years designed to improve park species lists of vascular plants and vertebrate animals to at least a 90 percent completion level for all Northern Colorado Plateau Network parks, including those of SEUG. These inventories provide park managers in the network with scientifically sound information on the nature and status of selected biological resources in a readily accessible form to assist field resource managers. Current species lists, resulting from older list reviews and recent inventories, on the SEUG parks plants and vertebrates is available on-line on the NPS Inventory and Monitoring (I & M) Program website at:

http://science.nature.nps.gov/im/units/ncpn/SpeciesSelect.cfm

The majority of vegetative resources, including exotic plants, for each park unit are described below. The Utah Flora 3rd edition was used to confirm current scientific names. For a more complete and up to date species list please refer to the I & M website listed above.

ARCH

There has been a lot of work done on the vegetation of ARCH. Approximately 645 species have been collected and there are a relatively large number of endemics. Allen, in 1977, defined the vegetation with a quantitative description of the composition of the major plant communities, including a vegetation map. These communities include (1) shrublands dominated by blackbrush (*Coleogyne ramosissima*) on shallow (<50 cm depth), weakly developed calcareous soils formed from sandstone or sandy shales, (2) shrublands dominated by shadscale (*Atriplex confertifolia*) on shallow soils formed from shales with high clay content, (3) grasslands dominated by needle and thread grass (*Stipa comata*), indian ricegrass (*Stipa hymenoides*), galleta grass (*Hilaria jamesii*), various species of dropseed (*Sporobolus spp*.), and cheatgrass (*Bromus tectorum*) on deep (>50 cm depth) soils where plant roots cannot reach the water table or capillary zone, (4) shrublands dominated by 4-wing saltbush (*Atriplex canescens*) and sagebrush (*Artemisia tridentata*) on deep sandy soils where roots seasonally access the capillary zone, (5) communities dominated by cottonwood (*Populus fremontii*), willow (*Salix* spp.), tamarisk (*Tamarix chinensis*) and other shrubs in riparian zones where there is immediate root access to the water table, and (6) sparse woodlands dominated by pinion (*Pinus edulis*) and juniper (*Juniperus osteosperma*) on lithic soils where water availability is controlled by hydrological effects of bedrock joints and outcrops.

Other plant communities include: Garrett Saltbush/Mat Saltbush (*Atriplex garrettii/Atriplex corrugata*), Fringed Sagebrush/ Purple Sage/ Indian ricegrass (*Artemisia frigida/ Poliomintha incana/ Stipa hymenoides*), Snakeweed/Shadscale/Mormon Tea (*Gutierrezia sarothrae/ Atriplex confertifolia/ Ephedra viridis),* Purple Sage/Shinnery Oak/Utah Juniper (*Poliomintha incana/ Quercus harvardii/Juniperus osteosperma*), and Greasewood/Four-wing Saltbush (*Sarcobatus vermiculatus/Atriplex canescens*). Springs and seeps are also scattered throughout the park and are generally composed of Maidenhair Fern/Jones Reedgrass (*Adiantum capillus-veneris/ Calamagrostis scopulorum*).

Exotic Plant Management at ARCH

ARCH has about 53 exotic plants. Controlling tamarisk (*Tamarix chinensis*) was the first exotic plant concern in Arches National Park. Evans and others (1981) evaluated control methods in the early 1980's. Thomas and others (1987) provided a brief description of tamarisk control work and plans for the future. Gary Salamacha, a ranger at Arches National Park, had actively pursued tamarisk control throughout the 1990's to 2007. He set up a permanent plant transect in one of his control sites in Salt Wash and collected data annually. Budelier and Torrence, past vegetation management specialists of the Southeast Utah Group, along with seasonal weed control staff including Joe Castello, have been actively controlling tamarisk and other exotic species such as cheatgrass (*Bromus tectorum*), Russian olive (*Elaeagnus angustifolia*), and Russian knapweed (*Centaurea repens*) since the late 1990's. They have mapped a number of populations using GPS technology, and use that as a method of monitoring exotic plant expansion.

In 2000, Schelz and Budelier compiled a list of exotic plants in the Southeast Utah Group, including Arches National Park. In the summers of 2003, 2004 and 2004, Utah State University conducted a three-year project to inventory and map invasive non-native plants for the National Park Service, Northern Colorado Plateau Network (NCPN). This report and an annual updated exotic plant species list are maintained on the NCPN website: http://science.nature.nps.gov.

Various authors have compiled plant lists for ARCH. I & M has the most up to date plant list on their website and is currently in the process of producing a more detailed vegetative map of ARCH.

CANY

Previous research conducted in Canyonlands National Park documented strong relationships between edaphic characteristics and the distribution and composition of plant communities. Loope (1977) mapped the distribution of six relatively distinct vegetation types in relation to substrate. These types include (1) shrublands dominated by blackbrush (*Coleogyne ramosissima*) on shallow (<50 cm depth), weakly developed calcareous soils formed from sandstone or sandy shales, (2) shrublands dominated by shadscale (*Atriplex confertifolia*) on shallow soils formed from shales with high clay content, (3) grasslands dominated by needle and thread grass (*Stipa comata*), indian ricegrass (*Stipa hymenoides*), galleta grass (*Hilaria*

jamesii), various species of dropseed (*Sporobolus* spp.), and cheatgrass (*Bromus tectorum*) on deep (>50 cm depth) soils where plant roots cannot reach the water table or capillary zone, (4) shrublands dominated by 4-wing saltbush (*Atriplex canescens*) and sagebrush (*Artemisia tridentata*) on deep sandy soils where roots seasonally access the capillary zone, (5) communities dominated by cottonwood (*Populus fremontii*), willow (Salix spp.), tamarisk (*Tamarix chinensis*) and other shrubs in riparian zones where there is immediate root access to the water table, and (6) sparse woodlands dominated by pinion (*Pinus edulis*) and juniper (*Juniperus osteosperma*) on lithic soils where water availability is controlled by hydrological effects of bedrock joints and outcrops.

Other plant communities include: Snakeweed/Shadscale/Mormon Tea (*Gutierrezia sarothrae/Atriplex confertifolia/Ephedra viridis*), Purple Sage/Shinnery Oak/Utah Juniper (*Poliomintha incana/Quercus welshii/Juniperus osteosperma*), and Greasewood/Four-wing Saltbush (*Sarcobatus vermiculatus/Atriplex canescens*). Springs and seeps are also scattered throughout the park and are generally dominated by Maidenhair Fern/Jones Reedgrass (*Adiantum capillus-veneris /Calamagrostis scopulorum*).

There are a number of small communities scattered throughout the park in unique micro sites. These include relictual Douglas fir (*Pseudotsuga menziesii*) and aspen (*Populus tremuloides*) sites.

Plants: Canyonlands NP has a number of sensitive plant species but none are federally classified as Threatened or Endangered. Sensitive endemics include the southwestern cloakfern (*Argyrochosma limitanea* ssp. *Limitanea*), large-seeded milkweed (*Asclepias macrosperma*), Rusby milkweed (*Asclepias rusbyi*), bird's nest milkvetch (*Astragalus nidularius*), Fisher milkvetch (*Astragalus piscator*), sandstone milkvetch (*Astragalus sesquiflorus*), Franklin's ceanothus (*Ceanothus greggii* var. *franklinii*), Cateract gilia (*Gilia latifolia* var. *imperialis*), Hutchin's gilia (*Gilia hutchinsifolia*), rimrock phlox (*Phlox austromontana* var. *lutescens*), Alcove Bog Orchid (*Habanaria zothecina),* Jane's globemallow (*Sphaeralcea janeae*), resinbush (*Vanclevea stylosa*), Alcove Rock Daisy (*Perityle specuicola),* Entrada Rushpink (*Lygodesmia entrada),* Helleborine *(Epipactus gigantea),* Howell Scorpionweed (*Phacelia howelliana),* Trotter Oreoxis (*Oreoxis trotteri),* Alcove Death Camus (*Zigadenus vaginatus),* Osterhout's cryptanth (*Cryptantha osterhoutii*), Utah Bladder fern (*Cystopteris utahensis*), wing-seed stickleaf (*Mentzelia pterosperma*), roseate gilia (*Gilia roseata*), Eastwood monkeyflower (*Mimulus eastwoodiae*), and Moab *woodyaster (Xylorhiza glabriscula* var. *linearifolia*), San Rafael prickly pear (*Argemone corymbosa* ssp. a*renicola*), Toft's yucca (*Yucca angustissima* var. *toftiae*).

Exotic Plant Management at CANY

Canyonlands NP has about 60 exotic plants. Tamarisk (*Tamarix chinensis*), an exotic plant from Eurasia, has been the focus of much of the exotic plant control and monitoring work in Canyonlands National Park. Graf (1978) considered fluvial

adjustments in the Green and Colorado Rivers and the spread of tamarisk. In his report he analyzed historic photos along the rivers and estimated that it spread at a rate of about 20 km/yr. He also estimated an average reduction in channel width of 27 percent, from sediments stabilized by tamarisk. Collins and Belnap (1987) discuss control and mapping efforts of tamarisk in Horseshoe Canyon. Schelz (1988) wrote a report on tamarisk control in Horseshoe Canyon. He set up five permanent transects and took a number of photos to monitor vegetation change. The technique was a line-intersect method that ran perpendicular to the stream channel.

Steve Budelier, a vegetation specialist for the NPS Southeast Utah Group from 1997 to 2000, and Ian Torrence, his replacement since 2001, have been involved with exotic plant mapping and control. Their mapping work is primarily GPS-based (Geographic Positioning System) and products can be found in the Geographic Information Systems (GIS) office at Southeast Utah Group Headquarters in Moab, Utah. In 2000, Schelz and Budelier compiled a list of exotic plants in the Southeast Utah Group, including Canyonlands National Park. In the summers of 2003 and 2004, Utah State University conducted a two-year project to inventory and map invasive non-native plants for the National Park Service, Northern Colorado Plateau Network (NCPN). This report and an annual updated exotic plant species list are maintained on the NCPN website: http://science.nature.nps.gov.

A number of studies have looked at various control methods and soil-plant interactions of exotics in Canyonlands (Graham 1985, Thomas et al. 1987, Kunzmann et al. 1989, Rawlings 1996, Sperry et al. 1998, 1999, 2000, Gelbard 1999, Miller and Belnap 1999, 2000, and Belnap et al. 2001). None of these studies have developed long-term monitoring plots.

Tamarisk *(Tamarix chinensis*) is the largest problem along the river and smaller riparian areas, accompanied by Russian olive (*Eleagnus angustifolia*), Russian knapweed (*Centaurea repens*), and Perennial pepperweed (Lepidium latifolium). Cheatgrass (*Bromus tectorum*) is problematic throughout the park.

Various authors have compiled plant lists for CANY. I & M has the most up to date plant list on their website and is currently in the process of completing a much more detailed vegetation map of CANY than that which is now available.

HOVE

Hovenweep National Monument contains about 356 vascular plant taxa and 6 mosses according to a 2003 Floristic Survey of the monument. Vegetation zones range from shrubland to mixed sage and juniper woodland to pinyon-juniper forest. Riparian communities are also found.

From the early 1900's through the 1940's all of Hovenweep NM was subjected to heavy sheep grazing, eliminating much of the ground cover. Depletion of the vegetation was followed by soil loss through erosion. Thus, soils are thin and species composition is poor.

Most of Hovenweep's units are in the juniper-sage and sage areas in the mid-portion of Cajon Mesa. In addition to the above plants, rabbitbrush (*Chrysothamnus* spp.), cliff-rose (*Purshia mexicana*), mormon tea (*Ephedra viridis*), yucca (*Yucca* spp.), and serviceberry (*Amelanchier* spp.) are commonly found and were important plants to the prehistoric Ancestral Puebloans. It is the part of the mesa that was most heavily occupied by the ancient people when they built the settlements preserved at Hovenweep NM.

South of the Square Tower Unit sagebrush blends into the mix-shrubland plant zone composed of shadscale (*Atriplex confertifolia*), greasewood (*Sarcobatus vermiculatus*), snakeweed (*Gutierrezia sp.*), and grasses. This zone covers the southern end of Cajon Mesa and the San Juan River Valley. In some places snakeweed has become the dominant plant, especially in overgrazed areas. The Cajon Unit is the only part of the monument in this plant zone.

The Goodman Point unit lies a few miles northwest of Cortez, Colorado, and has a higher elevation, receives more moisture, and has slightly cooler temperatures than the other Hovenweep units. The immediate environment is a pinyon-juniper forest, surrounded by modern dry farmland producing pinto beans and winter wheat. Parts of the Goodman Point unit are almost completely overgrown with a vigorous sage cover.

Hovenweep may contain a couple of plant species of concern. Cronquist's milkvetch (*Astragalus cronquistii*), Naturita milkvetch (*Astragalus naturitensis*), and cut-leaf gumweed (*Grindelia laciniata*) are reported in the general area but have not been found within the monument yet.

Exotic Plant Management at HOVE

There are 27 exotic plant species known to occur within Hovenweep National Monument (NPS 2000d). Agricultural lands surround the monument and the exotic plant source is high and constant. Tamarisk has been found in some canyon bottoms in all the units except Cajon. It has been controlled through mechanical cutting and herbicide but the program must remain vigilant because of the constant seed source from surrounding lands. In the summers of 2003 through 2005, Utah State University conducted a three-year project to inventory and map invasive non-native plants for the National Park Service, Northern Colorado Plateau Network (NCPN). This report and an annual updated exotic plant species list are maintained on the NCPN website: http://science.nature.nps.gov.

NABR

Long-term vegetation monitoring began in 1987 with the establishment of permanent monitoring plots to document long-term trends and natural vegetation variability (Schelz and Moran 2004). The Northern Colorado Plateau Network I&M review of all documented plant specimens and literature resulted in a species list currently showing 303 vascular plant species confirmed as present in NABR and another 115

species probably present. Additional species are listed as unconfirmed or false reports.

From 2003 to 2005, The Northern Colorado Plateau Inventory and Monitoring Network (NCPN) worked with the U.S. Geological Survey (USGS) and National Park Service (NPS) Vegetation Characterization Program to describe and map vegetation at Natural Bridges National Monument. The team collected vegetation and environmental data from 80 vegetation classification plots and 17 observation points. Analysis of the plot data revealed 35 National Vegetation Classification plant associations or park special vegetation types within the monument and environs. Four of these associations were added to the classification following an analysis of the accuracy assessment data in the latter stages of the project (Coles et al. 2008).

NABR supports vegetation broadly classified as temperate or semi-desert (West 1988). Although woodlands dominate the vegetation, a variety of shrublands and a few small grasslands are also present. The distribution of vegetation is controlled by substrate (geology and soils) and to a lesser extent, aspect. The remainder of this section is a summary of the general distribution of vegetation in relation to geology across the mapping area, organized from oldest to youngest rocks.

Cedar Mesa Sandstone (Permian). This formation is the most widely exposed within the monument; it supports the plateau and forms the rims and walls of the canyons, as well as the natural bridges. It is a massive, light gray sandstone. Where the sandstone is covered by deep eolian or residual soils, the vegetation consists of woodlands with a canopy of pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*). Openings within the woodlands contain shrublands of Wyoming sagebrush (*Artemisia tridentata* ssp. *wyomingensis*). Thinner soils near canyon rims support a diverse wooded shrubland community. Lenses of fine-grained shale (evidence of interdunal wetlands) exposed in the canyon walls force groundwater to the surface and are the locations of hanging gardens.

Five of the six plant species of special concern found within NABR are restricted to hanging gardens or perennial seeps emerging from Cedar Mesa Sandstone (Schelz and Moran 2004). These species are Rydberg thistle (*Cirsium rydbergii*), kachina daisy (*Erigeron kachinensis*), helleborine (*Epipactus gigantea*), alcove death camas (*Zigadenus vaginatus*), and alcove bog orchid (*Habenaria zothecina*). The sixth species, Monument milkvetch (*Astragalus monumentalis*), is an endemic upland plant.

Organ Rock and Triassic Moenkopi Formations (Permian). These formations are combined because they are continuous and difficult to distinguish. They form the slopes of Mossback Butte and Deer Mesa on the west side of the project area. Fallen blocks of Shinarump conglomerate modify the shale surface and provide microsites that support a diverse woodland or wooded shrubland, especially on cooler, north-facing slopes. Characteristic shrubs include roundleaf buffaloberry (*Shepherdia rotundifolia*) and Utah serviceberry (*Amelanchier utahensis*). Other common species include littleleaf mountain mahogany (*Cercocarpus intricatus*), true mountain

mahogany (*Cercocarpus montanus*), Mormon-tea (*Ephedra viridis*) and desert snowberry (*Symphoricarpos longiflorus)*. Scattered pinyon pine and Utah juniper are usually present except on drier slopes. Salina lyme grass (*Leymus salinus*) occurs in most stands. Steep, south-facing shale slopes support an open woodland with a sparse understory of the same species on thin soils.

Shinarump Conglomerate (Triassic). The erosion-resistant Shinarump Conglomerate (part of the Chinle) forms the caprock of buttes and benches on the margins of the mapping project area. Exposures are limited to the environs of the vegetation mapping area. These sites support pinyon-juniper woodlands with an understory of Wyoming sagebrush or black sagebrush (*Artemisia nova*) and various grasses. On Deer Mesa and Mossback Butte, the woodland was chained and planted to pasture grasses, but remnants of the original woodland vegetation persist.

Quaternary Alluvial Deposits. Unconsolidated stream sands and gravels are confined to narrow terraces and point bars in the bottoms of White and Armstrong Canyons and their tributaries. These deposits cover less than 1% of the mapping area and support primarily riparian vegetation. Lower terraces support Rio Grande cottonwood (*Populus deltoides* ssp. *wislizeni*) woodlands and willow (*Salix* spp.) shrublands. Higher terraces support woodlands of pinyon pine, Utah juniper, or Gambel oak (*Quercus gambelii*), or shrublands of sagebrush (*Artemisia tridentata* ssp. *tridentata*) and rubber rabbitbrush (*Ericameria nauseosa*). Point bars (sometimes support small grasslands dominated by needle-and-thread (*Hesperostipa comata*) and Indian ricegrass (*Achnatherum hymenoides*).

Exotic Plant Management at NABR

There are 42 known species of non-native plants within NABR (NPS 2008d). Tamarisk has been the focus of most of the monument's weed control efforts, with the result that the species was mostly eliminated from the monument (Gilbert and Hendrickx 1977, Thomas et al. 1987, Kunzmann 1989). In the 1990's, park ranger Jim Dougan actively pursued tamarisk and eliminated it from the park through the use of mechanical cutting and herbicide. He did not map locations.

Even with these earlier efforts, tamarisk has resprouted and is again the main exotic plant species in terms of area occupied (Dewey and Andersen 2005). In the summers of 2003 through 2005, Utah State University conducted a three-year project to inventory and map invasive non-native plants for the National Park Service, Northern Colorado Plateau Network (NCPN). This report and an annual updated exotic plant species list are maintained on the NCPN website: http://science.nature.nps.gov. In 2008 SEUG Resource Management staff began efforts to treat tamarisk resprouts in the canyons.

3.2.2 Terrestrial Wildlife

Terrestrial wildlife resources for each park unit are described below. For a more current and up to date listings please refer to the I & M Program website previously listed.

ARCH

Mammals **-** Major mammals common to the park are the Western Pipistrel (*Pipistrellus hesperus*), Gray Fox (*Urocyon cinereoargenteus*), Bobcat (*Lynx rufus*), Mountain Lion (*Puma concolor*), Whitetailed Antelope Ground Squirrel (*Ammospermophilus leucurus*), Rock Squirrel (*Spermophilus variegatus*), Colorado Chipmunk (*Eutamias quadrivittatus*), Apache Pocket Mouse (*Perognathus flavescens*), Ord Kangaroo Rat (*Dipodomys ordi*), Canyon Mouse (*Peromyscus crinitus*), Deer Mouse (*P. maniculatus*), Piñon mouse (*P. truei*), Northern Grasshopper Mouse (*Onychomys leucogaster*), Desert Woodrat (*Neotoma lepida*), Porcupine (*Erethizon dorsatum*), Blacktailed jackrabbit (*Lepus californicus*), Desert Cottontail (*Sylvilagus auduboni*), Mule Deer (*Odocoilus hemionus*), Desert Bighorn Sheep (*Ovis canadensis nelsoni*), Striped Skunk (*Mephitis mephitis*), Ringtail (*Bassariscus astatus*) and Badger (*Taxidea taxus*).

Birds **-** Common bird species likely to be found in the park are the Mourning Dove (*Zenaidura macroura*), Common Nighthawk (*Chordeiles minor*), White-throated Swift (*Aeronautes saxatalis*), Violet-green Swallow (*Tachycineta thalassina*), Ash-throated Flycatcher (*Myiarchus cinerascens*), Say's Phoebe (*Sayornis saya*), Scrub Jay (*Aphelocoma coerulescens*), Common Raven (*Corvus corax*), Piñon Jay (*Gymnorhinus cyanocephalos*), Plain Titmouse (*Parus inornatus*), Cañon Wren (*Catherpes mexicanus*), Rock Wren (*Salpinctes obsoletus*), Loggerhead Shrike (*Lanius ludovicianus*), Gray Vireo (*Vireo vicinior*), Black-throated Gray Warbler (*Dendroica nigrescens*), Black-throated Sparrow (*Amphispiza bilineata*), Dark-eyed Junco (*Junco hymenalis*), Cooper's Hawk (*Accipiter cooperi*), Golden Eagle (*Aquila chrysaetos*), Red-tailed Hawk (*Buteo jamaicensis*) and Northern Harrier (*Circus cyaneus*).

Amphibians and Reptiles **-** Common herptofauna of the park are the Red Spotted Toad (*Bufo punctatus*), Woodhouse Toad *(B. woodhousei*), Collared Lizard (*Crotaphytus collaris*), Short-horned Lizard (*Phrynosoma douglassi*), Sagebrush Lizard (*Sceloporus graciousus*), Eastern Fence Lizard (*S. undulatus*), American Bullfrog (*Rana catesbeiana*), Side-blotched Lizard *(Uta stansburiana*), Western Whiptail (*Cnemidophorus tigris*), Gopher Snake (*Pituophis catenifer*), Common Garter Snake (*Thamnophis cyrtopsis*) and the Midget Faded Rattlesnake (*Crotalus viridis concolor).*

CANY

Mammals **-** Canyonlands NP is extremely important habitat for desert bighorn sheep (*Ovis canadensis nelsonii*). Additional mammals include the Western Pipistrel (*Pipistrellus hesperus*), Gray Fox (*Urocyon cinereoargenteus*), Bobcat (*Lynx rufus*), Mountain Lion (*Puma concolor*), Whitetailed Antelope Ground Squirrel (*Ammospermophilus leucurus*), Rock Squirrel (*Spermophilus variegatus*), Colorado Chipmunk (*Eutamias quadrivittatus*), Apache Pocket Mouse (*Perognathus flavescens*), Ord Kangaroo Rat (*Dipodomys ordi*), Canyon Mouse (*Peromyscus crinitus*), Deer Mouse (*P. maniculatus*), Piñon mouse (*P. truei*), Northern Grasshopper Mouse (*Onychomys leucogaster*), Desert Woodrat (*Neotoma lepida*), Porcupine (*Erethizon dorsatum*), Blacktailed jackrabbit (*Lepus californicus*), Desert Cottontail (*Sylvilagus*

auduboni), Mule Deer (*Odocoilus hemionus*), Striped Skunk (*Mephitis mephitis*), Ringtail (*Bassariscus astatus*) and Badger (*Taxidea taxus*), Elk (*Cervus canadensis*), and Black Bear (*Ursus americanus*).

Birds - Common bird species likely to be found in the park are the Mourning Dove (*Zenaidura macroura*), Common Nighthawk (*Chordeiles minor*), White-throated Swift (*Aeronautes saxatalis*), Violet-green Swallow (*Tachycineta thalassina*), Ash-throated Flycatcher (*Myiarchus cinerascens*), Say's Phoebe (*Sayornis saya*), Scrub Jay (*Aphelocoma coerulescens*), Common Raven (*Corvus corax*), Piñon Jay (*Gymnorhinus cyanocephalos*), Plain Titmouse (*Parus inornatus*), Cañon Wren (*Catherpes mexicanus*), Rock Wren (*Salpinctes obsoletus*), Loggerhead Shrike (*Lanius ludovicianus*), Gray Vireo (*Vireo vicinior*), Black-throated Gray Warbler (*Dendroica nigrescens*), Black-throated Sparrow (*Amphispiza bilineata*), Dark-eyed Junco (*Junco hymenalis*), Cooper's Hawk (*Accipiter cooperi*), Golden Eagle (*Aquila chrysaetos*), Red-tailed Hawk (*Buteo jamaicensis*) and Northern Harrier (*Circus cyaneus*).

Amphibians and Reptiles - Common herptofauna of the park are the Red Spotted Toad (*Bufo punctatus*), Woodhouse Toad *(B. woodhousei*), Collared Lizard (*Crotaphytus collaris*), Short-horned Lizard (*Phrynosoma douglassi*), Sagebrush Lizard (*Sceloporus graciousus*), Eastern Fence Lizard (*S. undulatus*), Tree Lizard (*Urosaurus ornatus*), Leopard Lizard (*Gambelia wislenzenii*), Side-blotched Lizard *(Uta stansburiana*), Western Whiptail (*Cnemidophorus tigris*), Gopher Snake (*Pituophis catenifer*), Common Garter Snake (*Thamnophis cyrtopsis*) and the Midget Faded Rattlesnake (*Crotalus viridis concolor).*

HOVE

There are over 150 species of mammals, birds, reptiles, amphibians found in Hovenweep National Monument. Common mammals include mule deer (*Odocoilus hemionus*), bobcat *(Lynx rufus*), mountain lion (*Puma concolor),* and coyote *(Canus latrans*). Birds are most numerous in cottonwood and willow vegetation found along canyon bottoms and perennial water sources. Reptiles are found throughout the monument. The most common lizards are the side-blotched and sagebrush lizards (*Uta stansburiana and Sceloporus graciousus)*, and the most common snakes are gopher snake (*Pituophis catenifer*), western rattlesnake *(Crotalus oreganos),* and striped whipsnake *(Masticophis taeniatus).* Amphibians are not common in Hovenweep, being found only near streams, springs, and rock pools. Tiger salamanders *(Ambystoma tigrinum)* have been found at some of the springs. There are no fish.

NABR

In Natural Bridges NM there are approximately 127 species of birds, 68 species of mammals, 17 species of reptiles, and 7 species of amphibians. There are no fish.

Birds - Common bird species in the monument are the Turkey Vulture (*Cathartes aura*), Northern Harrier (*Circus cyaneus*), Red-tailed Hawk (*Buteo jamaicensis*) American *Kestrel (Falco sparverius),* Mourning Dove (*Zenaidura macroura*), Great

Horned Owl (*Bubo virginianus*), Common Nighthawk (*Chordeiles minor*), White-throated Swift (*Aeronautes saxatalis),* Ash-throated Flycatcher (*Myiarchus cinerascens),* Violet-green Swallow (*Tachycineta thalassina*), Cliff *Swallow (Hirunda pyrrhonta*), Scrub Jay (*Aphelocoma coerulescens*), Pinyon Jay (*Gymnorhinus cyanocephalos*), Common Raven (*Corvus corax*), Plain Titmouse (*Parus inornatus*), Canyon Wren (*Catherpes mexicanus*), and Black-throated Sparrow (*Amphispiza bilineata*).

Annual riparian bird surveys have been conducted since 1986. Two transects were monitored three times over the breeding season through 2005. New I & M monitoring protocol took over the surveys in 2006 and currently monitor once or twice yearly. Please refer to the I & M website http://science.nature.nps.gov/im/units/ncpn for updated survey information. Among species of concern are the peregrine falcon (one breeding pair has been successfully nesting within the monument since the 1993 breeding season), the bald eagle (occasionally seen, but not a resident), and the Mexican spotted owl (found in remote canyons nearby, but not within the monument). Brown-headed cowbirds (*Molothrus ater*) have been recorded in Natural Bridges NM, and are of concern because of their negative impacts on some songbird species.

Mammals **-** Mammals were systematically surveyed within the monument from 1987-1994. The most common mammals inhabiting the monument are the Western Pipistrel Bat (*Pipistrellus hesperus*), Coyote (*Canus latrans*), Gray Fox (*Urocyon cinereoargenteus*), Whitetailed Antelope Squirrel (*Ammospermophilus leucurus*), Colorado Chipmunk (*Eutamias quadrivittatus*), Canyon Mouse (*Peromyscus crinitus*), Deer Mouse (*P. maniculatus*), Pinyon Mouse (*P. truei*), Desert Woodrat (*Neotoma lepida*), Porcupine (*Erethizon dorsatum*), Blacktailed Jackrabbit (*Lepus californicus*), Desert Cottontail (*Sylvilagus auduboni*), and Mule Deer (*Odocoilus hemionus*). According to Mike Bogan of the USGS/BRD Albuquerque, Natural Bridges is a "hot spot" for bats on the Colorado Plateau. Of the 19 species thought to live in Utah, 15 have been captured in the monument (including the spotted bat, a candidate species for federal listing). Mountain lion tracks are commonly seen within the monument; actual sightings are rare. Black bear occasion the canyons and rim, but they, too, are rarely seen. Desert bighorn sheep were observed within the monument prior to 1966 when the loop road was constructed. They probably still roam sections of lower White Canyon and surrounding environs.

Amphibians and Reptiles **-** Common herptofauna of the monument are the Red Spotted Toad (*Bufo punctatus*), Woodhouse Toad (*B. woodhousei*), Tiger Salamander (*Ambystoma tigrinum*), Plateau Striped Whiptail (*Cnemidophoras velox*), Collared Lizard (*Crotaphytus collaris*), Short-horned Lizard (*Phrynosoma douglassi*), Sagebrush Lizard (*Sceloporus graciousus*), Eastern Fence Lizard (*S. undulatus*), Tree Lizard (*Urosaurus ornatus*), Desert Night Lizard (*Xantusia vigilis*), Side-blotched Lizard (*Uta stansburiana*), Western Whiptail (*Cnemidophorus tigris*), Gopher Snake (*Pituophis melanoleucus deserticola*), Western Terrestrial Garter Snake (*Thamnophis elegans vagrans*), and the Midget Prairie Rattlesnake (*Crotalus viridis viridis*).

3.2.3 Aquatic Wildlife and Fisheries

Habitat for aquatic invertebrates in the Southeast Utah Group parks falls into three broad categories: 1) large rivers (Colorado and Green in CANY and Colorado bordering ARCH), 2) springs, seeps and intermittent streams (all four parks), and 3) potholes (ARCH, CANY and NABR). Contributions to the knowledge of aquatic invertebrates in the parks comes from research on aspects of pothole ecology, several short-term studies of both river organisms and intermittent stream organisms, and a longer-term aquatic invertebrate monitoring program related to the SEUG water quality monitoring program for springs, seeps and intermittent streams. The NCPN I&M program has been developing aquatic invertebrate monitoring protocols over the last few years and carried out a one-time sampling of aquatic invertebrates at several intermittent stream and spring sites throughout the SEUG in 2008.

The following sections describe the aquatic wildlife and fisheries resources at each park.

ARCH

ARCH has 31 fish species, 8 of which are native, if you include Colorado River species. Arches National Park, though bounded by the Colorado River high-water zone, legally does not include its waters; therefore, primary fish habitat is found in Courthouse Wash and Salt Wash. Very little fish survey work has been done in Arches NP. The only significant study was by Selby and Holden (1979). Holden did a little work in 1969-71 and provided a list in 1978. Conner and Kepner (1983) provided some information on fish in Arches NP, and Webb (1988) surveyed for fish for a couple of days.

The US Fish and Wildlife Service's Upper Colorado River Endangered Fish Recovery Program has been coordinating numerous fish studies on the Colorado River and its tributaries since 1988, cooperating in the Arches region especially with the Utah Division of Wildlife Resources, as well as USGS and various universities.

Exotics / Exotic Fish **-** There are a number of exotic fish species in Courthouse Wash and even more in Salt Wash north of Wolfe Cabin. These areas should be re-inventoried because it has been 21 years since the last inventory. Schelz cited probable bluegill (*Lepomis macrochirus),* but the identification needs verification. Schelz (2002) compiled a fish species list for Arches NP based on personal observations and previous work. I&M did not inventory fish species during their recent inventory effort.

CANY

Fish **-** The US Fish and Wildlife Service's Upper Colorado River Endangered Fish Recovery Program has been coordinating numerous fish studies on the Colorado River, Green River and their larger tributaries since 1988. In the Canyonlands region they cooperate extensively with the Utah Division of Wildlife Resources, as well as USGS and various universities. Fish data in Canyonlands National Park was

first collected and recorded by Holden (1973); he wrote a dissertation on the distribution, abundance and life history of the fishes of the upper Colorado River Basin which included Canyonlands National Park. He also put together a species list for the park (Holden 1978).

Surveys of the Colorado River through Cataract Canyon were first conducted from 1979 to 1981 by the U.S. Fish and Wildlife Service (Valdez et al. 1982). Eighteen species of fish were reported from the Colorado and Green rivers by Valdez and Williams (1993) in a survey conducted from 1985 to 1990. These surveys revealed that the Canyonlands National Park region of the Colorado River Basin included the federally endangered Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), razorback sucker (*Xyrauchen texanus)*, and bonytail chub (*Gila elegans*).

The State of Utah Division of Wildlife Resources has done yearly work since the 1980's on monitoring for various endangered fish species in and around Canyonlands National Park (Chart et al. 1998). They have also been involved with exotic fish control. Bio-West, Inc, in studies headed by Paul Holden and Richard Valdez, completed a number of studies on spawning locations of all the endangered fish (Bio-West 1987-1990). They also concentrated on the Humpback chub in Cataract Canyon (Bio-West 1990), and Colorado pikeminnow survival over winter (Bio-West 1990). The Recovery Implementation Program for endangered fish of the upper Colorado River (1990, 1996, and 1997) summarizes research and monitoring findings of the endangered fish. Keleher et al. (2000) also provide abstracts for the latest research and monitoring efforts.

Bates et al (1991) summarized results of 1986-1990 data on Colorado pikeminnow monitoring on the Colorado and Green Rivers. Foster and Mueller (1999) released razorback suckers into the Green River and tracked them with radio transmitters.

Canyonlands National Park does not have a fish monitoring program and relies solely on outside agencies monitoring fish in the upper Colorado River Basin (United States Fish and Wildlife Service, Utah Division of Wildlife Resources, the Colorado River Fishes Recovery Team, etc.)

In recent years the I & M Program has compiled a fish species list for Canyonlands National Park based on all previous work. This list, which was last updated in November of 2007, includes 32 species, with only 9 that are native.

Aquatic Invertebrates - In a survey of the ichthyofaunal communities of the Colorado and Green rivers in Canyonlands National Park, Valdez (1993) associated invertebrate production to the dominant fish habitat types. Haden et al (1997) conducted a cooperative study between the U.S. DOI and Northern Arizona University on the benthic ecology of the Colorado River system. The focus of the study was to determine the effects of the potential release of warm water on the benthic community in the Colorado River below Glen Canyon dam. The study also

covered mass and structure of the benthic community above and below the dam, reaction of certain invertebrate species to elevated water temperatures, and the potential establishment of other macro-invertebrates below the dam in warmer waters.

Jordan et al (1997, 1999) conducted a study in the Green and Colorado rivers in Canyonlands to establish baseline densities of benthic invertebrates in preparation for a long-term bio-monitoring program. Four remote sites were sampled on each river and density estimates of meiofauna and macroinvertebrates were estimated. Dominant taxa are listed, together with their analysis of the interactions between habitat, river discharge levels and time. As part of this study, Bray and Shiozawa (1997) tested a semi-quantitative method to quickly evaluate the benthic community on-site. Their results indicated that the new procedure was not as effective when compared to other collection methods.

Conner and Kepner (1983) lend some invertebrate information in their single-month, late summer study on fish, invertebrates and water quality and quantity in smaller Canyonlands streams. A peripheral study was performed by Magnum (1988) which described the benthic invertebrate community in four streams in the vicinity of Canyonlands National Park. Wolz et al (1995) sampled small pools in the Needles district of Canyonlands National Park in a study with BYU. They identified 37 taxa, provided taxonomic keys for the specimens they collected, and introduced a semi-quantitative sampling protocol for aquatic invertebrates in desert pool habitats.

Schelz initiated long-term monitoring of aquatic macroinvertebrates in the four park units of the SEUG in 1997, in conjunction with the previously established water quality monitoring program. From 1997 through 2001, all spring, seep and small stream water quality sites were sampled quarterly for aquatic macroinvertebrates. Field IDs to the lowest possible taxonomic level were performed, and rough counts were recorded. Since 2001, most sites are monitored for macroinvertebrates three times each year, in March, June, and September, in one out of every three consecutive years. Two sites, Salt Wash in Arches and Salt Creek in Canyonlands, are sampled three times every year. There are currently eight sites in Canyonlands, three in Natural Bridges, three in Hovenweep, and six in Arches. An additional ten sites were sampled for aquatic macroinvertebrates in the Salt Creek drainage in the Needles District of Canyonlands from fall 1998 though spring 2001. Schelz (2001) reported on the Salt Creek results in preparation for a 2002 Environmental Assessment concerning Salt Creek.

In 2006-2007, Anne Brasher of the USGS-WRD sampled at White Canyon in NABR, Salt Creek in CANY and Courthouse Wash in ARCH while developing aquatic invertebrate monitoring protocols for the I&M Program. In 2008, a one-time sampling of several spring and small stream sites in the SEUG was completed by I&M in coordination with the Utah State University Bug Lab.

Numerous studies of pothole ecology and pothole organisms have been completed in and near Canyonlands and Arches National Parks. Romney (1971) completed his Ph.D. dissertation on the bionomics of a rock pool mosquito (*Diptera: Culicidae)*, which included the first comprehensive biosurvey of all flora and fauna occurring within desert rock pools in and around Canyonlands National Park. Twenty years following Romneys' original work, Graham (1991) began his baseline studies on the community structure and ecosystem processes of pothole ecosystems, using invertebrates as ecological models. Much of this work was done in or near Arches National Park. This led to specialized studies on branchiopod ecology (Graham 2001 and Galvin et al 2001), and to the discovery of an undescribed ameronothroid (*Acari: Ameronothridae*) mite (Graham et al 1998).

Invertebrate studies from the Green and Colorado rivers in Canyonlands National Park have been conducted in association with D.K. Shiozawa, a biology professor at Brigham Young University, his colleagues and graduate students. Shiozawa et al (1994) proposed a study to quantify the aquatic invertebrates in selected habitats on these two rivers.

3.2.4 Threatened, Endangered, and Species of Concern

This section summarizes federal threatened and endangered species and species of concern (includes national park and state species of concern) present within the project area. The biological assessment analysis pursuant to Section 7 of the Endangered Species Act will be included in this section as well.

The Endangered Species Act (ESA) of 1973, as amended, requires federal agencies to ensure that any action authorized, funded, or carried out does not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modifications of critical habitat. Section 7 of the ESA requires that a federal agency consult with the United States Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service on any action that may affect threatened or endangered species or proposed species, or that may result in adverse modification of critical habitat to "...insure that any action authorized, funded or carried out by such agenc[ies]...is not likely to jeopardize the continued existence or destruction or adverse modification of habitat of such species which is...critical."

Current laws and policies require that the following conditions be achieved for threatened, endangered, and species of concern in parks:

Desired Condition	Source
A condition where federal- and state-listed threatened and endangered species and their habitats are sustained;	ESA; NPS Management Policies; NEPA
Populations of native plant and animal species function in as natural condition as possible;	NPS Management Policies

Extirpated native plant and animal species are restored to parks.	NPS Management Policies

According to page 45, Section 4.4.2.3 in *2006 Management Policies*, the NPS will survey for, protect, and strive to recover all species native to national park system units that are listed under the ESA. Director's Order-77: Natural Resource Management is currently being developed, until which time the former NPS-77 still applies. NPS-77 addresses the management of federally listed threatened, endangered, and candidate species, as well as state species of concern. It also addresses the management of species of concern identified by other groups, such as locally designated species or those established by organizations such as TNC. All of these species need to be considered in the NEPA process; however, only federally listed species need to be considered in the Section 7 consultation process.

Federally Threatened, Endangered and Candidate Species
This section and subsequent Impact Analysis section for Alternative 2 (Preferred Alternative) of this EPMP EA/AEF contain information and analysis pertaining to the relevant federally listed and candidate species consistent with the NPS obligations under the ESA. Collectively, these serve as Biological Assessment for these species. Table 3-2 summarizes federally listed threatened, endangered and candidate species that may be present or have habitat in each park as identified through correspondence with the Utah and Colorado USFWS Field Offices. Committed conservation measures for each specific species are included in section 2.3.1. The information and determination of effect for federally listed and candidate species under the preferred alternative is also included.

Mexican Spotted Owl-The federally threatened *Strix occidentalis lucida* nests in steep canyons with dense stands of large ponderosa pine or pinyon-juniper with Douglas-fir, and in mature to old-growth mixed-conifer forest with high canopy closure. Favored stands generally are multi-storied, with snags and downed logs. The owls nest in tree cavities or on cliff ledges. Extensive inventories have been conducted and a number of breeding Mexican spotted owls (MSO) were found in Canyonlands National Park. Most of the existing twenty-two Protected Activity Centers (PAC) in CANY were surveyed sometime during 2002 and 2003. A total of 47 Mexican spotted owls were confirmed within CANY in 2002-2003. This total includes 10 pairs and 27 individuals (Schelz et al. 2004). Two pairs and 5 individuals were confirmed in the Maze District, 3 pairs and 7 individuals were in the Island-in-the-Sky District, and 5 pairs plus the remaining 15 individuals were in the Needles District (Schelz et al. 2004).

Arches National Park has potential habitat for MSO as determined by several polygons from the 1997 and 2000 Spotskey and Willey models for MSO habitat. The majority of potential habitat is along the Colorado River, mainly beyond park boundaries. Although no formal MSO survey has been documented, park resource

management staff has surveyed much of the park for many years and none of this staff has detected the presence of MSO (Sloan 2008).

MSO is known to occur in similar habitats near NABR, but surveys have not revealed their presence in the monument. There is also a possibility that the Mexican spotted owl could be found in HOVE once surveys are initiated.

Southwestern Willow Flycatcher- This endangered migratory bird, *Empidonax traillii extimus,* requires dense riparian, cottonwood-willow habitat (although it has adapted to tamarisk) that is associated with rivers, streams and wetlands for nesting and breeding. The SEUG area, especially in Canyonlands and Arches National Park has this potential habitat. In 1999, a survey of the Southwestern willow flycatcher (SWFL) by the USGS was conducted along the Colorado and Green Rivers in CANY. The survey from CANY's boundary to the Colorado/Green River confluence determined that although many flycatchers were detected they appeared to use these portions of rivers as a migratory stopover rather than as a breeding area (Johnson et. al.1999).

The USGS conducted a study on the southwestern willow flycatcher from1999 to 2001. They surveyed the segment of river adjacent to ARCH from the CANY boundary to Dewey Bridge (30 miles upstream from the park). The same results were found as in CANY. Although some SWFL were detected, the flycatcher appears to use this portion of the river as a migratory stopover as well (Johnson et al. 1999). There is no potential habitat for southwestern willow flycatcher in NABR or HOVE, nor is it known there.

California Condor- Historically the federally endangered, *Gymnogypus californianus,* habitat is along the Pacific Coast line from Baja to British Columbia but there is potential habitat within the SEUG. There have been two sightings; 1) one sighting in ARCH in 1997 of one condor was reported by Damon Fagan, a park ranger and avid birder and 2) visitors in NABR reported seeing a tagged condor in the summer of 2007 (Sloan 2008). It was considered that both condors were experimental non-essential and probably came from the Grand Canyon National Park in Arizona reintroduction population and the Hurricane Cliff population near Zion National Park in southwest Utah (Sloan 2008).

Yellow-billed Cuckoo- *Coccyzus americanus occidentalis* habitat consists of old-growth riparian cottonwood-willow galleries with dense understories. The riparian zone along the Colorado and particularly the Green River include many areas that appear, based on vegetation characteristics, to be potential Yellow-billed cuckoo (YECU) breeding habitat (e.g., overstory of cottonwood spp. and/or old growth tamarisk with dense understory (Halterman 1991). During 1999, 2000 and 2001 surveys in CANY by the USGS, only 3 Yellow-billed cuckoo were documented. It was determined that all three cuckoos were migrant or unpaired non-breeding birds since all of which were not detected on subsequent surveys (Johnson 2002).

In ARCH, Sonya Daw, avian biologist for SEUG, observed a Yellow-billed cuckoo on 3 June 2006, during the annual riparian bird survey. This was the first sighting of this species in Arches National Park.

There is no potential habitat for Yellow-billed cuckoo in NABR or HOVE. Nor is it known there.

Black-Footed Ferret- The *Mustela nigripes* natural habitat coincides with most species of prairie dogs (Brown et al. 2003). Prairie dog towns provide the primary source of food and needed cover. Prairie dogs prefer areas of short vegetation and bare ground. Sagebrush shrubs are the largest plants found near preferred habitat. Suitable habitat for prairie dogs and black-footed ferrets in Utah is found in the eastern portion of the state which includes the SEUG. Gunnison prairie dogs are found southeast of the Colorado River. However within the four SEUG park units, there was only a historic report of one in CANY and an unconfirmed report in HOVE (Haymond et.al 2003). White-tailed prairie dogs have been found in ARCH and were monitored for several years by Gary Salamacha, a park ranger, as part of a burrowing owl monitoring program. There are no reports of black-footed ferrets in SEUG parks.

Colorado Pikeminnow, Razorback Sucker, Humpback Chub and Bonytail Chub- These four federally endangered fish species historically occur in the Upper Colorado River Basin, including the Green and Colorado Rivers. These fish require a diversity of habitats within the Colorado River, particularly during certain life stages. Low velocity side channels, backwaters, oxbows, sloughs, and flooded bottom lands are all important habitats for both young and adult fish.

The Green and Colorado Rivers flow through CANY. The entire segments of both rivers that flow through CANY have been designated as critical habitats by the USFWS for the Colorado pikeminnow and razorback sucker (USFWS 2008). The humpback chub and bonytail chub prefer eddies, pools, and backwaters near swift current in larger rivers and are found near the confluence of the Green and Colorado Rivers in Cataract Canyon (USFWS 2008).

The USWFS has designated the Colorado River and its floodplain, for the segment adjacent to ARCH as critical habitat for Colorado pikeminnow and razorback sucker (USFWS 2008). This includes the Colorado River and its confluence with Courthouse Wash to the point where the spring floods of the Colorado back up into these tributaries. The humpback chub and bonytail prefer shallow, backwater sections of river. The sections of river adjacent to ARCH do not have this type of habitat and there is no critical habitat within 60 miles upstream or downstream of the park (UFWS 2008).

There is no fish habitat in NABR or HOVE.

Jones Cycladenia- *Cycladenia humillis var.jonesii* is a federally threatened plant and has been found in Eriogonum-ephedra, mixed desert shrub, and scattered pinyon-

juniper communities, at elevations ranging from 4,000 to 6,800 feet. However, the only report of the plant within the SEUG area is an unconfirmed report in ARCH (Albee et al. 1988). The unconfirmed category indicates this species is included in the park species list based on weak (unconfirmed record) or no evidence, giving minimal indication of the species' occurrence in the park. This category is used as a means of maintaining a "watch list," that is, species that could possibly occur in the park and that should not, at this point, be totally removed or absent from the park's species list. A designation of Unconfirmed implies that there is no evidence that a species was ever in the park. There have been no current reports of the Jones Cycladenia within SEUG.

Although the following threatened, endangered and candidate species of plants on the county lists of San Juan County, Utah and Montezuma County, Colorado they do not occur within the Southeast Utah Parks: Navajo Sedge (*Carex speculicola),* Mancos milk-vetch (*Astragalus humillimus*), Mesa Verde cactus (*Sclerocactus mesae-verde*) and Sleeping Ute milk-vetch (*Astragalus toripes*). Recent extensive plant surveys (NPS 2008d) and personal observations from field resource managers (Moran 2008b) give us confidence that these plants do not extend into the SEUG parks.

Species of Concern

NPS management policy requires the maintenance of all native plant and animal species and their habitats inside parks (NPS 2006:34). State listed "species of concern" may also occur within the four parks of the project area. Lists of the species were obtained from several sources including NatureServe Explorer (NatureServe 2008), State of Utah Division of Wildlife Resources (UDWR 2008), State of Colorado Division of Wildlife Resources (CDWR 2008), Colorado Natural Heritage Program (CNHP 2008), and species list for parks in the project area (NPS 2008d).

ARCH has Peregrine Falcon *(Falco peregrinus*) active nest sites. There are a dozen peregrine falcon sites within the SEUG that are monitored annually for territory occupancy and productivity. Another bird of concern is the Western burrowing owl (*Athene cunicularia hypugia*). The brown-headed catbird (*Molothrus ater*) is of concern because of its negative impact on other songbird species.

Arches NP has a number of sensitive bat species including: Long-Eared Myotis (*Myotis evotis*), Fringed Myotis (*Myotis thysandodes),* and Pale Townsends Big-eared Bat (*Plecotus townsendii palleseons*)

The Northern River Otter (*Lutra canadensis*) is another species of concern, sited occasionally on the Colorado River along the boundary of ARCH.

The bald eagle (*Haliaeetus leucocephalus*) and the peregrine falcon (*Falco peregrinus*) have recently been delisted. The bald eagle uses the park primarily for winter forage; very limited monitoring of them has been done. There are a dozen peregrine falcon sites within the SEUG that are monitored annually for territory occupancy and productivity. Another bird of concern is the Western burrowing owl

(*Athene cunicularia hypugia*). The brown-headed catbird (*Molothrus ater*) is of concern because of its negative impact on other songbird species.

Canyonlands NP has a number of sensitive bat species including: Long-Eared Myotis (*Myotis evotis*), Fringed Myotis (*Myotis thysandodes)*, and Pale Townsends Big-eared Bat (*Plecotus townsendii pallesoens*). The Northern river otter (*Lutra canadensis*) is another species of concern; it is rarely sited in the river corridors.

The Gunnison sage grouse (*Centrocercus urophasianus* var *gunnisonii*), was sighted 20 years ago within 5 or 10 miles of Hovenweep National Monument, but has not been documented in recent years.

Currently the peregrine falcon (*Falco peregrinus*) has been delisted but is still of concern at Natural Bridges National Monument. A breeding pair of peregrine falcons has nested successfully within the monument since the 1993 breeding season. The location of the aerie has changed with each breeding season, but has remained within a discrete area. A Northern Goshawk (*Accipter gentilis*) nested in the monument in 1998.

Table 3-2 contains "species of concern" that may occur within the project area. These species may be a state species of concern or are species within the SEUG that are determined by resource managers as a "special concern species". Within the four parks, 12 mammals, 11 birds, 2 reptiles, and 23 plants are listed as species of concern. The table also lists park units where each species may occur.

Table 3-2. SPECIES OF CONCERN

Common Name	Scientific Name	Parks with Known Occurrences	Global Rank
BIRDS			
American White Pelican	*Pelecanus erythrorhynchos*	CANY	G3
Bald Eagle	*Haliaeetus leucocephalus*	CANY, ARCH, NABR, HOVE	G5
Gunnison Sage-grouse	*Centrocercus minimus*	HOVE	G4
Western Burrowing Owl	*Athene cunicularia hypugia*	ARCH, CANY	G4
Ferruginous Hawk	*Buteo regalis*	ARCH, CANY, HOVE	G4
Northern Goshawk	*Accipiter gentilis*	ARCH, CANY, HOVE	G5
Lewis' Woodpecker	*Melanerpes lewis*	ARCH, CANY	G4
Long-billed Curlew	*Numenius americanus*	ARCH	G5
Peregrine Falcon	*Falco peregrinus*	ARCH, CANY, NABR, HOVE	G4
Short-eared Owl	*Asio flammeus*	ARCH, HOVE	G5
MAMMALS			
Allen's Big-eared Bat	*Idionycteris phyllotis*	CANY, NABR	G3/G4
Big Free-tailed Bat	*Nyctinomops macrotis*	ARCH, CANY, NABR	G5
Bighorn Sheep	*Ovis canadensis nelsonii*	ARCH, CANY	G4
Botta's Pocket Gopher	*Thomomy bottae*	ARCH, CANY, HOVE, NABR	G5
Fringed Myotis	*Myotis thysanodes*	CANY	G4
Gunnison's Prairie-dog	*Cynomys gunnisoni*	CANY	G5
Long-eared Myotis	*Myotis evotis*	CANY, HOVE, NABR	G5
Silky Pocket Mouse	*Perognathus flavus*	HOVE	G5

Common Name	Scientific Name	Parks with Known Occurrences	Global Rank
Southwestern River Otter	*Lontra canadensis sonorae*	ARCH, CANY	G5
Spotted Bat	*Euderma machlatum*	CANY, NABR	G4
Townsend's Big-eared Bat	*Plecotus townsendi pallescens*	CANY, ARCH. NABR	G4
White-tailed Prairie Dog	*Cynomys leucurus*	ARCH	G4
AMPHIBIANS			
Desert Night Lizard	*Xantusia vigilis*	NABR	G5
Longnose Leopard Lizard	*Gambelia wislizenii*	ARCH, CANY, HOVE	G5
PLANTS			
Abajo Penstemon	*Penstemon lentus var. albilflorus*	NABR	G4
Alcove Bog Orchid	*Platanthera zothecina*	ARCH, NABR, CANY	G2
Alcove Death Camas	*Zigadenus vaginatus*	ARCH, NABR, CANY	G2
Alcove Rock Daisy	*Perityle specuicola*	ARCH	G1
Arthur Smith's buckwheat	*Eriogonum corybosum var. smithii*	ARCH, NABR	G5
Cataract Gilia	*Gilia imperialis*	CANY, NABR	G4
Canyonlands lomatium	*Lomatium latilobum*	ARCH	G1
Cisco milkvetch	*Astragalus sabulosus var. vehiculus*	ARCH	G1
Entrada skeletonplant	*Lygodesmia grandiflora var. entrada*	ARCH	G1
Ferron milkvetch	*Astragalus musiniensis*	CANY	G3
Fisher milkvetch	*Astragalus piscator*	CANY	G2/G3
Franklin's desert lilac	*Ceanothus greggii var. franklinii*	CANY	G5
Giant Helleborine	*Epipactus gigantea*	ARCH, CANY, NABR	G4
Howell Scorpionweed	*Phacelia howelliana*	ARCH, CANY	G2
Isley milkvetch	*Astragalus isleyi*	ARCH	G1
Jane's Globemallow	*Sphaeralcea janeae*	CANY	G1
Kachina Daisy	*Erigeron kachinensis*	NABR	G2
Monument milkvetch	*Astragalus monumentalis*	CANY	G4
Osterhout's cats-eye	*Cryptantha osterhoutii*	CANY, HOVE	G2/G3
Ruin Park winter-fat	*Krascheninnikovia lanata var. ruinina*	ARCH, CANY, HOVE	G5
Rydberg Thistle	*Cirsium rydbergii*	ARCH, NABR, CANY	G3
San Rafael prickly	*Argemone corymbosa*	CANY	G4
Trotter's spring-parsley	*Oreoxis trotteri*	ARCH	G1

GLOBAL RANK

The Global (G) Conservation Status (Rank) of a species or ecological community is based on the rangewide status of that species or community. The rank is regularly reviewed and updated by experts, and takes into account such factors as number and quality/condition of occurrences, population size, range of distribution, population trends, protection status, and fragility. The definitions of these ranks, which are not to be interpreted as legal designations, are as follows:

G1 Critically Imperiled: At high risk of extinction due to extreme rarity (often 5 or fewer occurrences), very steep declines, or other factors.

G2 Imperiled: At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.

G3 Vulnerable: At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.

G4 Apparently Secure: Uncommon but not rare; some cause for long-term concern due

to declines or other factors.
G5 Secure: Common; widespread and abundant.

Some species with a secure global rank are listed here due to local presence and a documented loss of population size in the region.

3.3 WILDERNESS

A description of Wilderness resources is provided in the following sections. Current laws and policies require that the following conditions be achieved for Wilderness:

Desired Condition	Source
A condition where Wilderness areas are managed for the preservation of Wilderness character and resources, in an unimpaired condition as well as for the purposes of recreational, scenic scientific, education, conservation, and historic uses.	The Wilderness Act 1964 The Organic Act of 1916 NPS Management Policies 2006 Director's Order 41: Wilderness Preservation and Management

Pages 78 through 84, Section 6.1 of *2006 Management Policies* address Wilderness resource management. This policy states that National Park Service will manage "Wilderness areas for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as Wilderness. Management will include the protection of these areas, the preservation of their Wilderness character, and the gathering and dissemination of information regarding their use and enjoyment as Wilderness."

A variety of uses, management actions, and even facilities are permitted in Wilderness areas under the Wilderness Act and NPS policies. The Wilderness Act declares that "a wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

The 2006 NPS *Management Policies* state that Wilderness areas will be devoted to the "public purposes of recreational, scenic, scientific, educational, conservation, and historical use" and includes that activity of exotic species management as described specifically by "management actions, including the restoration of extirpated native species, the alteration of natural fire regimes, the control of exotic alien species, the management of endangered species, and the protection of air and water quality" also states that when planning documents to guide in the management, preservation and use of Wilderness areas, resource managers will ensure that Wilderness considerations will be integrated into the documents so that Wilderness will be left unimpaired (NPS 2006).

A method designed to assist wilderness managers in making appropriate decisions in wilderness is the Minimum Requirements Decision Guide (MRDG). Use of the MRDG requires familiarity with the difference between wilderness and other public lands as defined by the Wilderness Act. The MRDG is a process to identify, analyze, and select management actions that are the minimum necessary for wilderness administration (minimum requirement analysis) and is found in Appendix H. It applies this direction from the Wilderness Act and incorporates a two-step process. Step 1 determines whether administrative action is necessary. If action is found to be necessary, then Step 2 provides guidance for determining the minimum activity. Step 2 has been referred to as determining the minimum tool but could include any type of activity, method, or equipment.

ARCH

Six units of Wilderness totaling 73,309 acres are proposed for designation as Wilderness in Arches National Park (NPS 1986). These units, except for roads and the visitor center area comprise of nearly the entire park. Unit 1 is 9,945 acres and located in the southwestern corner of the park and is bounded on the east by the main park road, on the north by the Willow Flats road and on the west, the park boundary. This unit contains Courthouse Towers, Park Avenue, The Great Wall and Rock Pinnacles. Unit 2 is a large 22,193 acres of proposed Wilderness and is bounded on the east by the west bank of the Colorado, and on the south, west and north by park roads. This unit encompasses the geologic features of the Windows section, Petrified Dunes, Garden of Eden and Balanced Rock. Unit 3 is a smaller 3,381 acre unit bounded by primitive jeep roads and the park western boundary. This unit features Herdina Park and the Eye of the Whale Arch. Unit 4 is the most centrally located unit in the park and is bounded by the main park road on the east and primitive jeep roads to the south, west and north. This unit contains Salt Valley. Unit 5 is a smaller unit comprised of 3,142 acres in the northwestern part of the park. This unit contains Klondike Bluffs and Tower Arch and is bounded by the park western boundary, main park road and primitive jeep roads. Unit 6 is the largest unit, 25,039 acres, proposed as Wilderness and encompasses the majority of the parks geologic features; Devils Garden area with its many arches, the Fiery Furnace, and the internationally renowned Delicate Arch. Each of these units is being managed as if they were designated Wilderness areas.

CANY

Wilderness totaling 250,700 acres, which include about 75 percent of the park, is proposed for designation in Canyonlands National Park. Representative portions of all the park's physiographic types are contained within eight units (NPS 1994). The main features of Unit 1 consist of the Needles, Chesler Park, Virginia Park, Horse Canyon, and Salt Creek and total 55,640 acres of proposed Wilderness. Unit 2 is the very heart of Canyonlands and is 100,260 acres of Wilderness which contains Cataract Canyon, the Grabens, and the Maze. Unit 3 is bounded by the east bank of the Green and the west bank of the Colorado and primitive jeep trails. This 36,000 acre unit encloses the White Rim that forms a scenic irregularly shaped flat plateau between the rivers and Island in the Sky district (ISKY), Canyonlands highest feature. Unit 4 is a 5,000 acre in the northeastern portion of the park. It is bounded by the east by the west bank of the Colorado and on the west by primitive jeep trails and also includes White Rim formations. Unit 5 is a 6,600 acre area located in the northwestern corner of the park. It contains some of the White Rim country and Stillwater Canyon. It is bounded on the east by the west bank of the Green River and extends to the park boundary on the west and south. Unit 6 is the northern portion of the park and contains 44,700 acres of proposed Wilderness between the White Rim drive and ISKY. The dominant feature is Upheaval Dome. Unit 7 is a 2,500 acre Wilderness unit located within a detached area of the park slightly over 7 miles to the west. It contains a portion of Horsethief Canyon and some outstanding pictographs. Unit 8 is a small 2,300 acre unit in the northeastern corner of the park and contains much of Shafer Canyon. All these units are being managed as if they were designated Wilderness.

HOVE
There is no designated or proposed Wilderness in Hovenweep National Monument.

NABR
There is no designated or proposed Wilderness in Natural Bridges National Monument. However, a Wilderness suitability study in1995 was conducted and approximately 5,340 acres or 72 percent of the monument has been found to possess Wilderness characteristics and values and is currently being managed as such.

3.4 CULTURAL RESOURCES

The National Park Service, as a steward of many of America's most important cultural resources, is charged to preserve archeological resources, ethnographic resources and historical structures for the enjoyment of present and future generations. Management decisions and activities throughout the National Park System must reflect awareness of the irreplaceable nature of these resources. The National Park Service will protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the 2006 *Management Policies* and the appropriate Director's Orders.

DO-28 recognizes five categories of cultural resources including archeological resources, ethnographic resources, and historic structures. According to the *NPS Management Policies (2006)* The National Park Service cultural resource management program involves:

- research to identify, evaluate, document, register, and establish basic information about cultural resources and traditionally associated peoples;
- planning to ensure that management processes for making decisions and setting priorities integrate information about cultural resources and provide for consultation and collaboration with outside entities; and
- stewardship to ensure that cultural resources are preserved and protected, receive appropriate treatments (including maintenance) to achieve desired conditions, and are made available for public understanding and enjoyment.

Current laws and policies require that the following conditions be achieved in each park for cultural resources:

Desired Condition	Source
Provide authority and responsibility for managing cultural resources in every unit of the national park system so that those resources may be preserved unimpaired for future generations.	NPS Management Policies 2006; Director's Order #28; National Historic Preservation Act

Cultural resource management will be carried out in a manner that is consistent with these legislative and regulatory provisions and with implementing policies and procedures such as the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (48 Federal Register* (FR) *44716-740),* and *Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act (63 FR 20497-508).*

3.4.1 Archeological Resources

In addition to the National Historic Preservation Act and the National Park Service 2006 *Management Policies,* the National Park Service's Director's Order-28B *Archeology* affirms a long-term commitment to the appropriate investigation, documentation, preservation, interpretation, and protection of archeological resources inside units of the National Park System. As one of the principal stewards of America's heritage, the National Park Service is charged with the preservation of the commemorative, educational, scientific, and traditional cultural values of archeological resources for the benefit and enjoyment of present and future generations. Archeological resources are nonrenewable and irreplaceable, so it is important that all management decisions and activities throughout the National Park System reflect a commitment to the conservation of archeological resources as elements of our national heritage.

The current policies require that the following condition be achieved in the parks for archeological resources:

Desired Condition	Source
A condition where archeological sites are protected in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable.	National Historic Preservation Act; E. O. 11593; NPS Organic Act; Archeological and Historic Preservation Act; Archeological Resources Protection Act (ARPA); NPS Management Policies 2006; the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; Native American Graves Protection and Repatriation Act

Below are summaries of the parks archeological resources based on the National Park Service Archeological Site Management Information System (ASMIS) and on specific cultural resource inventories and reports in the four SEUG parks (CANY: Atherton and Donald 1991, Einiger, 2008; ARCH: Kramer 1991; and HOVE: Fritz 2004 and Hovezak, et al. 2004). With the exception of NABR, which has had a nearly complete inventory (McVickar, ed. 2001); the other three SEUG parks have had limited inventories conducted and only a general idea of the settlement patterns and time periods are represented.

ARCH

Arches National Park has archeological remnants from more than 239 documented sites representing the four broad archeological periods. Most sites known in the park are from the archaic period. The first peoples to inhabit-Arches were archaic hunter-gathers. The majority of known cultural resources in the park appear to date from 8,000 B.C to A.D. 1. Archaic people entered Arches primarily to gather the fine cherts found in the Summerville Formation. Summerville Chert was used by archaic and later peoples for stone tools. Consequently, surface scatters of stone tools and debris from the manufacture and sharpening of Summerville stone tools comprise the majority of the archeological sites in Arches, as well as the main components of museum collections from the park. A few Barrier Canyon Style rock art panels, possibly dating from the archaic period, have also been documented in the park.

Archeological resources that are in the proposed treatment areas are primarily lithic scatter and Barrier Canyon Style rock art.

CANY

To date, 10,362 acres, or approximately 3% of the park, has been surveyed for archeological resources, resulting in the documentation of 1539 sites. Four broad archeological periods are represented in the archeological record including the

paleoindian period (12,000-8,000 B.P.), archaic period (9,000 B.P. - A.D. 200), formative period (A.D. 200-1300), and protohistoric period (A.D. 1300-1850). Most sites known in the park are from the archaic period. Evidence of archaic occupation within the park includes Barrier Canyon Style rock art panels that can be seen in Horseshoe Canyon. (Schaafsma 1971). In the Needles District, archaic projectile points provide further evidence for archaic occupation.

Three Clovis points have been collected in CANY, suggesting geographically broad but sparse paleoindian occupation (Tipps 1989). Evidence of archaic occupation within the park includes Barrier Canyon Style rock art panels that can be seen in Horseshoe Canyon (Schaafsma 1971) and Needles District (Noxon and Marcus 1982). In the Needles District, archaic projectile points provide further evidence for archaic occupation.

The majority of sites in CANY date to the late formative period, and in particular, during the Pueblo II-III time period. This period is characterized by large masonry roomblocks including kivas, granaries, and habitation structures. Ceramics, grinding implements and petroglyph panels attest to the complexity of material culture during this period.

HOVE

A total of 430 acres, or approximately 55% of the monument, has been surveyed for archeological resources, resulting in the documentation of 94 sites. The majority of the documented sites date to the Pueblo III period (A.D. 1100-1300), but there is some evidence for earlier occupations of the area.

By A.D. 900, Ancestral Puebloans started to settle at Hovenweep year-round, planting and harvesting crops in the rich soil of the mesa tops. By the late 1200's, the Hovenweep area was home to over 2,500 people. Most of the structures at the monument were built between A.D. 1200 and 1300. Similarities in architecture, masonry, and pottery styles indicate the inhabitants of HOVE were closely associated with groups living at Mesa Verde and other nearby sites (Hovezak, et al. 2004). The structures were built skillfully and in a variety of shapes and sizes including square and circular towers, D-shaped dwellings and many kivas. Many structures are still standing after more than 700 years. At the end of the 13th century, Hovenweep, along with the entire four corners area, was abandoned for reasons that are still being debated.

Portions of Goodman Point and Hackberry Units contain areas proposed for exotic weed treatment. In 2004, a 100 percent Class III survey of the 142-acre Goodman Point Unit was conducted by Crow Canyon Archeological Center. Forty-two sites were documented within 56 temporal components (Hovezak, et al, 2004), and all were determined eligible for inclusion on the National Register of Historic Places on July 21, 2004 by the Colorado SHPO. One great kiva is located at the southern edge of the Unit and there is evidence of a roadway remnant in the northern portion of the Unit. There is also evidence of check dams, ditches, and other remains of irrigation

systems. The Hackberry Unit was determined eligible for inclusion in the National Register of Historic Places on April 12, 2007 by the Colorado SHPO.

NABR
A total of 7107 acres, or approximately 93% of the monument, has been surveyed for archeological resources, resulting in the documentation of 530 sites. These sites represent three broad archeological periods including the archaic period (9,000 B.P. - A.D. 200), the formative period (A.D. 200-1300), and the protohistoric period (A.D. 1300-1850) (McVickar 2001).

Most sites known in the park are from the formative period. Around A.D**.** 700 the Ancestral Puebloan people moved onto the mesa tops to dry farm but the area was later abandoned until about AD 1000, when immigrants moved back from across the San Juan River and built single-family houses throughout the best watered areas (McVickar 2001: 32). In the 1200s, farmers from Mesa Verde migrated here, but by 1300, all the Ancestral Puebloans migrated south. Ceramics and masonry structures from these time periods are the best known cultural resources in Natural Bridges.

3.4.2 Ethnographic Resources

Certain contemporary Native American and other communities are permitted by law, regulation, or policy to pursue customary religious, subsistence, and other cultural uses of park resources with which they are traditionally associated. The NPS plans and executes programs in ways that safeguard cultural and natural resources, while reflecting informed concern for the contemporary peoples and cultures traditionally associated with those resources.

The current policies require that the following condition be achieved in the parks:

Desired Condition	Source
A condition where access to and ceremonial use of Indian sacred sites by Indian religious practitioners is accommodated and adverse affects on the physical integrity of these sacred sites is avoided;	E.O. 13007 on American Indian Sacred Sites; NEPA
Certain research data is withheld from public disclosure to protect sensitive or confidential information about archeological, historic, or other NPS resources when doing so would be consistent with the Freedom of Information Act (FOIA). In many circumstances, allowing the NPS to withhold information about ethnographic resources;	NPS Management Policies
The NPS is consistent with E.O. 13007, and to the extent practicable, accommodates access to and ceremonial use of Indian sacred sites by religious	NPS Management Policies; E.O. 13007 on American Indian Sacred Sites

practitioners from recognized American Indian and Alaskan native tribes, and avoids adversely affecting the physical integrity of such sacred sites;	
Native Americans and other individuals and groups linked by ties of kinship or culture to ethnically identifiable human remains are consulted when remains may be disturbed or are encountered on parklands;	NPS Management Policies; Native American Grave Protection and Repatriation Act
Other federal agencies, state and local governments, potentially affected Native American and other communities, interest groups, State Historic Preservation Officer, and the Advisory Council on Historic Preservation are given opportunities to become informed about and comment on anticipated NPS actions at the earliest practicable time;	NHPA; Programmatic MOA among the NPS, Advisory Council on Historic Preservation, and the National Council of Historic Preservation Officers (1995): E.O. 11593: American Indian Religious Freedom Act; Native American Graves Protection and Reparation Act; E.O. 13007 on American Indian Sacred Sites; Presidential Memorandum of April 29, 1994, on Government to Government Relations with Tribal Governments NPS Policies; NEPA

E.O. 13007 directs federal land managing agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. Specifically, federal agencies are directed to (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites.

ARCH

ARCH has identified Purple sage **(***Salvia leucophylla)*, in consultation with the Uinta and Ouray Ute, as an example of an ethnobotanical resource with traditional cultural significance. Purple sage has edible and medicinal uses.

CANY

Although there has not been a formal ethnographic survey conducted within CANY, no ethnographic resources that have been identified by consulted Native American tribes.

HOVE
Archeologists speculate that Hackberry canyon may have had one of the largest populations of all the Hovenweep units because of the constant seepage of water in the canyon (NPS 2009). As many as 250 to 350 people may have lived here. It is unclear if the residents were related or represented different clans and lineages. The concentrations of structures at Hackberry demonstrate the importance of water to the people who lived here. Large multi-story pueblos and towers, located at canyon heads with seeps and springs, are the defining characteristics of the late Pueblo III time period.

The spring in Hackberry canyon is considered by Hopi Elders, among other consulted Native American tribes to be a sacred site. This site is associated with subsistence, religious, ceremonial, or other traditional activities.

NABR
Although there has not been a formal ethnographic survey conducted within CANY, no ethnographic resources that have been identified by consulted Native American tribes.

3.4.3 Historic Structures

§106 of the National Historic Preservation Act, as amended in 1992 (16 USC 470 *et seq.*); the National Park Service's Director's Order-28 *Cultural Resource Management Guideline*; and National Park Service *2006 Management Policies* require the consideration of impacts on historic structures that are listed on or eligible to be listed on the National Register of Historic Places. The National Register is the nation's inventory of historic places and the national repository of documentation on property types and their significance. The above-mentioned policies and regulations require federal agencies to coordinate consultation with State Historic Preservation Officers regarding the potential effects to properties listed on or eligible for the National Register of Historic Places.

According to the *NPS-28: Cultural Resource Management Guideline,* "a historic structure is "a constructed work . . . consciously created to serve some human activity." Historic structures are usually immovable, although some have been relocated and others are mobile by design. They include buildings and monuments, dams, millraces and canals, nautical vessels, bridges, tunnels and roads, railroad locomotives, rolling stock and track, stockades and fences, defensive works, temple mounds and kivas, ruins of all structural types, and outdoor sculpture".
The current policies require that the following condition be achieved in the parks:

Desired Condition	Source
A condition where historic structures are identified and inventoried and their significance and integrity are evaluated under National Register criteria. The qualities that contribute to the eligibility for listing or listings	National Historic Preservation Act; E. O. 11593; NPS Organic Act; Archeological and Historic Preservation Act; Archeological Resources Protection Act

of historic properties on the NRHP are protected in accordance with the Secretary of the Interior's Standards.	(ARPA); NPS Management Policies 2006; the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; Advisory Council on Historic Preservation, and National Council of Sate Historic Preservation Officers (1995).

Below are summaries of the parks historic structures based on based on specific cultural resource inventories and reports in the four SEUG parks (CANY: Atherton and Donald 1991, Einiger, 2008; ARCH: Kramer 1991; and HOVE: Fritz 2004 and Hovezak, et al. 2004). With the exception of NABR, which has had a nearly complete inventory (McVickar, ed. 2001), the other three SEUG parks have had limited inventories conducted and only a general idea of the settlement patterns and time periods are represented.

ARCH

A total of 3284 acres, or approximately 4% of the park, has been surveyed for archeological resources and/ or historic structures, resulting in the documentation of 239 sites.

One National Register District, the Wolfe Ranch National Historic District, is listed on the National Register. The Rock House is also listed on the National Register of Historic Places (NPS 2008c) and may be impacted by the proposed plan.

CANY

To date, 10,362 acres, or approximately 3% of the park, has been surveyed for archeological resources and/or historic structures, resulting in the documentation of 1539 sites.

Historic euroamerican occupation is characterized by remains from grazing and mining activities, both of which were prevalent during the last 100 years. Cabins, mining adits, watering troughs, tin can dumps, and other remains are present throughout the CANY districts.

The Salt Creek Archeological District is listed on the National Register and contains 541 contributing sites. Seven additional sites are currently listed on the National Register including Cave Springs Cowboy Camp, Lost Canyon Cowboy Camp, Kirk's Cabin Complex, D.C.C. & P. Inscription, Murphy Trail and Bridge, the Harvest Scene Pictograph Panel, and Horseshoe Canyon Pictographs (NPS 2008c). The Lathrop Canyon Mining District and the Downwash Site have nominations pending.

HOVE

A total of 430 acres, or approximately 55% of the monument, has been surveyed for archeological resources and/ or historic structures, resulting in the documentation of 94 sites.

Hovenweep National Monument consists of six non-contiguous units including Cajon, Square Tower, Holly, Hackberry/Horseshoe, Cutthroat and Goodman Point. Each unit contains clusters of pueblos and towers situated near permanent springs at canyon-head locations on Cajon Mesa and to the east in the case of the Goodman Point Unit. These canyon rim towers and villages are the best preserved and protected, most visually striking, and accessible examples of 13th century Ancestral Puebloan architecture and community locations within the San Juan River Basin. These six units are significant because of the large number of structures possessing a high degree of physical and locational integrity. In addition, the towers are noteworthy because of their many stylistic variations.

Goodman Point Pueblo is one of the largest Ancestral Puebloan villages in the four corners region. It was inhabited during the Pueblo II-III time periods, approximately spanning the years A.D. 900 to A.D. 1300. The village site consists of approximately 1,000 rooms, with numerous kivas and towers.

Hackberry Unit consists of architecture built approximately 800 years ago by the ancestors of today's Puebloan people and proposed treatment areas are within this unit. Archeologists speculate that Hackberry canyon may have had one of the largest populations of all the Hovenweep units because of the constant seepage of water in the canyon (NPS 2009). As many as 250 to 350 people may have lived here. It is unclear if the residents were related or represented different clans and lineages. The concentrations of structures at Hackberry demonstrate the importance of water to the people who lived here. Large multi-story pueblos and towers, located at canyon heads with seeps and springs, are the defining characteristics of the late Pueblo III time period. The Hackberry site was determined eligible for inclusion on the National Register of Historic Places on April 14, 2007 by the Colorado State Historic Preservation Office.

NABR

A total of 7107 acres, or approximately 93% of the monument, has been surveyed for archeological resources and/ or historic structures, resulting in the documentation of 530 sites. The Horsecollar Ruin site is among the largest and best preserved Ancestral Puebloan structures in the monument. The results of a 1997-98 survey of the upland areas of Natural Bridges resulted in the nomination and listing of the entire monument to the National Register of Historic Places in 2004.

3.5 HUMAN ENVIRONMENT

According to the CEQ, all impacts to the "human environment" need to be considered in a NEPA document. CEQ defines the human environment as the natural and

physical environment and the relationship of people with that environment. This section will discuss 1) visitor use and experience, 2) human health and safety, 3) soundscape, and 4) socioeconomics.

3.5.1 Visitor Use and Experience

According to the NPS *Management Policies*, the enjoyment of park resources and values by people is part of the fundamental purpose of all park units (NPS 2006).

Current policies require that the following conditions be achieved for visitor use and experience:

Desired Condition	Source
provide appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society.	NPS Management Policies 2006
provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks.	

The *Management Policies* also state that scenic views and visual resources are considered highly valued associated characteristics that the National Park Service should strive to protect.

ARCH

Arches National Park is one of America's natural wonders and visitors from around the world come to see the park's extraordinary sandstone arches, towers, fins and other natural and cultural resources. The park is open all year and recreational opportunities include sightseeing, photography, hiking, biking, climbing, camping, four wheeling and auto touring. According to the National Park Service Public Use statistics and park staff, Arches averages 800,000 visitors annually and in 2007, the park received 860,181visitors. The park's "season" for visitation is from March through September. Recreation visits peak in the months of May, June and September. Some days may have up to 3,000-4,000 visitors visiting the park visitor center according to park visitation records. Arches is typically considered a drive-through park where most visitors stay less than half a day, although some stay longer for extended hiking or camping. For reporting purposes, the park estimates the average visitor stay at 3 hours. A small portion of visitors camp in the 53-unit campground and are assumed to stay an additional 24 hours for each night that they camp (NPS 1989).

Over the past couple of decades, the park's fame has increased as more and more people visit the park. The rapidly increasing level of visitor use is affecting both the park's resources and visitor experiences. In the summer of 1992, the Visitor Experience and Resource Protection (VERP) Program began in Arches as a test pilot program for the national park service system. A central component of the program was to conduct a two phase visitor-oriented social science research program that was designed and implemented as part of a cooperative agreement between the NPS (Arches National Park, Denver Service Center), the Cooperative Park Studies Unit (CPSU) at the University of Minnesota and the School of Natural Resources at the University of Vermont. The phase I portion was designed to learn about a variety of human-use aspects of visitation at Arches and to begin to identify potential indicators of a quality visitor experience. Phase II was conducted during the months of July through October, 1993, to rate the importance of selected indicator variables identified in phase I and assist in establishing standards of desired conditions of each of these indicators. The final results were, generally speaking, that visitors reported that they benefited from (1) enjoying nature and learning; i.e., viewing scenery, learning about nature, experiencing new and different things, and learning more about things in the park, (2) escaping daily routes and (3) to get exercise (Lime et al 1994).

CANY

Canyonlands is the largest national park in Utah and the vast landscape offers hundred-mile vistas of rust-colored pinnacles, high mesas, sculpted buttes, sandstone spires, and sheer cliffs. The Colorado and Green Rivers carve this high desert into a maze of red-rock canyons that provide the visitor with an abundance of recreational opportunities and a must see destination. Most visits to Canyonlands involve hiking, biking, climbing, boating or four-wheel driving in the park's backcountry. Overnight trips are common. For day trips, the Island in the Sky is the most accessible district for the auto touring visitor, offering expansive views from many overlooks along the paved scenic drive, as well as several short hiking trails. According to the National Park Service Public Use statistics and park staff, the park averages 440,000 visitors a year and in 2007 the park received 417,560 visits. The park is busiest during the months of March through October with an increase in visitation in May, June and July. The month of September shows an increase in visitors as well. The park has two developed campgrounds, the Willow Flats Campground in ISKY that has 12 sites and the Squaw Flats campground in NEED that has 26 sites. Both campgrounds are full from late March through June and from early September to mid October. Of the visitors spending less than one day in the park 43 percent spent four to six hours. Of the visitors who spent one day or more, 61 percent visited for two to three days. Most visitors viewed scenery and hiked less than four hours.

HOVE

Hovenweep National Monument protects six prehistoric, Puebloan-era villages spread over a twenty-mile expanse of mesa tops and canyons along the Utah-Colorado border. Multi-storied towers perched on canyon rims and balanced on boulders lead visitors to marvel at the skill and motivation of their builders. Hovenweep is noted for its solitude and undeveloped, natural character.

Hovenweep is open year round and has annual visitation of approximately 26,000 visitors. The busy season is usually from April though October with September being a peak month for visitation. The monument averages 80-100 visitors a day and provides opportunities for camping, hiking and interpretive programs. Backpacking is not permitted at the monument. Visitors primarily tour the villages and archeological sites and take the 2 mile or less lightly maintained trails throughout the monument. There is a small campground near the visitor center which is open year round on a first-come, first-served basis. Visitor's who camp stay one or two nights, use the campground as a base camp while touring the Four Corners area. Hovenweep is usually a first or last stop site for visitors heading for Mesa Verde National Park.

NABR

Natural Bridges preserves some of the finest examples of natural stone architecture in the southwest. On a tree-covered mesa next to deep sandstone canyons, three natural bridges formed when meandering streams slowly cut through the canyon walls.

Natural Bridges is open all year and has an annual average of 120,000 visitors, according to the National Park Service Public Use statistics. In 2007 the monument received 88,319 visitors (NPS 2008b). The monuments busy season is from March through October with recreational use increasing in May and continues high in June, July and August. September is also a busy month and experiences an increase in bus tours that occur after Labor Day. On a peak day, visitation can be in excess of 900 visits according to park staff. Many people visit the monument on their way to other destinations or as part of a circle loop tour of the Southwest/ Four Corners area. The only overnight accommodation available is the 13 unit primitive campground. This is the only developed campground on the 1 million acre Cedar Mesa plateau. The nearest other developed campgrounds are in Blanding, UT (45 miles); Halls Crossing (60 miles) and Hite (50 miles) both developed areas at Glen Canyon National Recreation Area. Most visitors who camp in the monument stay for one or two nights. However, some will stay several days and use the campground as a base while touring other areas. The monument has opportunities for auto touring, sightseeing, camping, hiking, photography, and interpretive programs.

3.5.2 Human Health and Safety

The health and safety of visitors, park staff, and neighbors are the highest priority for NPS. According to NPS Management Policies (2006), it states that "While recognizing that there are limitations on its capability to totally eliminate all hazards, the Service and its concessionaires, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees." The equipment proposed for use such as hand tools, chainsaws, portable sprayers, and ATVs are all standard devices with established safety protocols. Training on the proper use of equipment is included as part of both alternatives. Safety protocols for storing,

mixing, transporting, handling spills, and disposing of unused herbicides and containers are included in Appendix E and would be followed at all times.

The herbicides proposed for use has very low acute toxicity to humans and personal protective equipment (PPE) is used during application to reduce the potential for chronic exposure of employees. Safety protocols for storing, mixing, transporting, handling spills, and disposing of herbicides and containers are an integral part of both alternatives. Treated areas subject to visitation are marked during the no-entry period as described on the herbicide label or until dry to advise visitors against entering treated areas and thus exposing themselves to the chemicals. Training is required prior to use of herbicides. Meteorological conditions are accounted for in planning to decrease the risk of herbicide drift.

3.5.3 Soundscape

"Soundscape" is defined as the totality of sounds-both "natural sounds (the sounds of the animals, the wind in the trees, water, etc.) as well as human-caused sounds. Though intangible, the natural soundscape is considered a natural resource of the National Park Service to be protected under the Organic Act.

Current laws and policies require that the following conditions be achieved in the SEUG group:

Desired Condition	Source
Preserve, to the greatest extent possible, the natural soundscapes of parks.	NPS Management Policies (2006)
Restore degraded soundscapes to the natural condition wherever possible and will take action to prevent or minimize all noise (undesirable human-caused sound), that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values.	Director's Order 47: Sound Preservation and Noise Management

Directors Order 47 refers to the total ambient acoustic environment associated with a given environment (sonic environment) in an area such as a national park. It is also refers to the total ambient sound level for the park. In a national park setting, this soundscape is usually composed of both natural ambient sounds and a variety of human-made sounds. *Existing Ambient Sound Level (L_{50})* is the sound level of all sounds in a given area, including all natural sounds as well as all mechanical, electrical and other human-caused sounds. The sound level exceeded 50 percent of the time, the L_{50} (median).

With the exception of high flying commercial aircrafts that pass over the parks 25% of the time, the Southeast Utah Group as a whole has a very low occurrence of intrusive human-caused noise (Ambrose 2008). The NPS monitored sound at twenty

three sites in Arches, Canyonlands, Natural Bridges and Hovenweep from 2001 to 2007. Annual average L_{90} levels ranged from 23.3 dBA (adjusted L_{50} dBa) at one Canyonlands site to 16.9 dBA at one Hovenweep site. (Ambrose 2008). Sound levels in the backcountry areas of SEUG units were generally very low, often less than 20 dBA. Absent non-natural sounds, sound levels were often near or below the lower limit measurement capability (noise floor) of the sound level meters. At one location (CANY005), a special low-noise microphone capable of measuring down to 6.0 dBA was used. Recorded sound levels at this location were as low as 7.2 dBA. However, given that this low-noise microphone had a noise floor of 6.0 dBA, actual sound levels in this instance were less than 7.2 dBA (Ambrose 2008). For comparison, 20 dBA is the typical sound level in a broadcast studio, 30 dBA is a soft whisper at five feet, and 40 dBA is the typical sound level in a library. When sound level increases by 10 dBA, the higher level is perceived as about "twice as loud" as the lower level. Sound levels varied hourly, daily and seasonally, with winter generally the quietest seasons.

3.5.4 Socioeconomics

NEPA requires an analysis of impacts to the human environment which includes economic and demographic elements in the affected area. The SEUG parks lie mostly in Grand County, UT, San Juan County, UT, and Montezuma County, CO. Canyonlands National Park lies also in Emery and Wayne County, UT but only in a very small section therefore only Grand County, San Juan County and Montezuma County will be discussed. Most of the statistical data of these counties are a result of the 2000 Census as well as the county websites regarding labor and workforce information.

Grand County, UT is 3,689 square miles in land area and has a population density of 2.3 persons per square mile. The 2006 estimate census data reports that of the 8,999 residents, the majority of the county's population is white (92.9%), followed by Hispanic (of any origin) (7.1%). The median household income is $33,332.The top three employers in the county (by percent of residents employed) in 2006 are leisure/hospitality, government, and trade/transportation/ utilities according to Utah's Department of Workforce Services (DWS 2008). Arches National Park is located in Grand County.

San Juan County, UT is 7,820 square miles in land area and has a population density of 1.8 persons per square mile. The 2006 estimate census data reports that the 14,647 residents, the majority of the county's population is American Indian (53.9%), followed by white (43.1%). The median household income is $28,751.The top three employers in the county (by percent of residents employed) in 2007 are government, leisure/hospitality, and education/health/social services according to Utah's Department of Workforce Services (DWS 2008). Canyonlands National Park, Natural Bridges National Monument and two outlying units of Hovenweep National Monument are located in San Juan County.

Montezuma County, CO is 2,036 square miles in land area and has a population density of 11.7 persons per square mile. The 2006 estimate census data reports that the 25,217 residents, the majority of the county's population is white (85.4%). followed by American Indian (11.9%). The median household income is $34,416. The top three employers in the county (by percent of residents employed) in 2007 is the government, construction, and health care according the Montezuma County Office of Economic Development (MOCO 2008). Four units of HOVE sites are located in Montezuma County.

Current policies require that the following conditions to be achieved in the parks:

Desired Condition	**Source**
A condition where an understanding of park visitors, the non-visiting public, gateway communities and regions, and human interactions with park resources is provided.	Director's Order #78-Social Science; NPS Management Policies (2006)

Commercial services are also a part of the socioeconomics of the SEUG parks. According to SEUG Commercial Visitor Use Statistics, in 2007 there were 30 commercial services that operated in CANY and 3 commercial services that operated in ARCH. A total of 11,736 people visited the parks on commercial tours, generating $4.5 million in gross receipts. There are no commercial services available in Natural Bridges and Hovenweep National Monuments.

CHAPTER 4- ENVIRONMENTAL CONSEQUENCES

NEPA requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the preferred alternative be implemented. This chapter identifies the impacts to the physical, biological, and human aspects of the environment that could be affected by the alternatives. The effects of project alternatives on each resource are also described. This chapter is organized into the following sections:

4.1 METHODOLOGY

This section describes the methodology used to predict impacts to resource areas. Resource areas were developed by the interdisciplinary EPMP team based on the results of internal scoping and input received during the public scoping process. The definition of an environmental impact is the change in condition of the resource or environment under examination due to the proposed action. Impacts are analyzed by considering the action to the resource and the effect to the resource. The magnitude or type and degree of impacts were analyzed by considering the following factors:

- Type (beneficial or adverse, direct or indirect)
- Context (site-specific, local, regional)
- Duration and timing (short or long-term) and
- Intensity (negligible, minor, moderate, or major) of effects

For all impact topics, the following definitions were applied:

Beneficial impacts - a positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

Adverse impacts - in the context of most resources, an adverse impact refers to a change that moves the resource away from a desired condition or detracts from its appearance or condition.

Direct impacts - an effect that is caused by an action and occurs in the same time and place.

Indirect impacts - an effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.

Short-term impacts - an effect that within a short period would no longer be detectable as the resource is returned to its pre-disturbance condition or appearance, generally less than 5 years.

Long-term impacts - a change in a resource or its condition that does not return the resource to pre-disturbance condition or appearance and for all practical purposes is considered permanent.

Site-specific impacts - the action would affect areas within a park unit boundary.

Local impacts - the action would affect areas within a park unit boundary and land adjacent (sharing a boundary) to a park unit.

Regional impacts - the action would affect the park, land adjacent to the park, and surrounding communities.

Because definitions of intensity (negligible, minor, moderate, or major) vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this EPMP EA/AEF. Definitions of intensity are provided for each resource area. Unless otherwise noted, impact definitions apply to the intensity of the impact, which could be either adverse or beneficial.

4.2 CUMULATIVE IMPACTS

The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "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" (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Both additive and interactive cumulative impacts are assessed. Additive impacts accumulate by adding more of the same impact on a resource. For example, one impact-causing occurrence, such as a single gas well, may be of little significance. A hundred wells in the same area, however, may cause significant impacts on a resource. Interactive impacts accrue as a result of assorted similar or dissimilar actions being taken that tend to have similar impacts, relevant to the valued resource in question. Examples of interactive impacts could include unmitigated overgrazing by cattle, horses, or elk, plus motorcycle/off road vehicle use, urban development, and roads. The geographic area of influence for cumulative impacts varies according to resource.

Geographic areas for the cumulative impact analysis were defined as follows:

- Geology and soils were defined as land inside the park unit boundaries and lands immediately adjacent to park boundaries.
- Water resources are defined as the regional watershed.
- Air quality was defined as the regional air shed.
- Biological resources, including vegetation, terrestrial wildlife, aquatic wildlife, T&E were limited to cumulative effects within the range of each species.
- Cultural resources and geological resources were defined as land inside the park unit boundaries and land adjacent to park boundaries.
- Human health and safety and visitor use and experience were defined as experience inside the park unit boundaries.
- Socioeconomics were defined as the county or counties in which the park unit is located.

The temporal scope is the same for all resources and was defined as impacts that have taken or would take place within the next 10 years. A period of 10 years was selected because that is also the proposed duration of this plan.

Cumulative effects were determined by combining the effects of the alternative with other past, present, and reasonably foreseeable future actions. Resource specialists at each park unit identified other past, ongoing, or reasonably foreseeable future actions

within each park unit and in the surrounding region of each park unit. A more detailed discussion of potential cumulative impacts for each park is provided in this section.

Past Actions

The following past actions could contribute to cumulative effects.

- Uranium, copper and potash mining and developing seismic lines
- Agricultural activities within park boundaries (grazing, farming, irrigation) have had the biggest impact to introducing exotics into the parks.
- Development of Jeep trails
- CANY-Backcountry Management Plan-1995
- ARCH-Visitor Center and park entry road realignment project-2002
- HOVE, Square Tower Unit- Building of new visitor center and restoration of old visitor center access road- 2002
- ARCH- Building and landscaping of new visitor center-2005
- ARCH-Transportation Implementation Plan-2005
- All parks- Fire and Fuels Management Plan-2005

Current Actions

The following current actions could contribute to cumulative effects.

- Oil and gas Exploration on BLM lands-in progress
- Agricultural practices such as livestock grazing on neighboring lands-in progress
- Tamarisk removal projects along Colorado River in BLM campgrounds-in progress
- Grand County releases *Diorhabda elongata* (Tamarisk Leaf Beetle) along Colorado River-2004 and is ongoing.
- CANY-Building new ISKY Visitor Center-in progress
- All parks-Chip seal all park roads-in progress
- All parks-Cyclic road maintenance-ongoing
- All parks-Cyclic trail maintenance-ongoing
- All parks-Search and rescue activities-ongoing

Future Actions

The following are future actions or plans that could contribute to cumulative effects.

- ARCH-Climbing Management Plan
- ARCH- Eliminate turnouts along park road
- ARCH- Replace riprap on entrance road
- CANY-River Management Plan
- CANY-Commercial Services Plan
- CANY-Removal of Needles District dump site
- HOVE- Replace water system
- NABR- Replace gas lines
- NABR- Replace and improve solar field

4.3 IMPAIRMENT

The *2006 NPS Management Policies* (2006:11) require analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within park, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values.

An impact to any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it has a major or severe adverse effect upon a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessionaires, contractors, and others operating in the park. Impairment determinations are not required for resource topics that are not considered to be park resources or values.

In accordance with DO-12, this impact analysis includes a finding on whether or not the actions contained in the alternatives "impair" park resources. Non-impairment is a project objective. An alternative that leads to impairment would be rejected as an alternative. BMPs and mitigation measures were designed to prevent major adverse impacts.

The context and intensity level for effects have been identified for each impact topic. The criteria from Management Policies were used to determine if any adverse effect constituted impairment. A team of resource experts and park decision-makers made the impairment determination.

Socioeconomics, visitor use and experience, and human health and safety are not addressed in the impairment analysis. Impairment on the human environment does not apply because impairment relates to park values and purpose; human environment

effects rarely relate to park values and purpose. According to the Organic Act, enjoyment cannot be impaired in the same way that park resources and values can be impaired. If enjoyment is allowed to deteriorate then this is a secondary consideration.

4.4 UNACCEPTABLE IMPACTS

The impact threshold at which impairment occurs is not always readily apparent. Therefore, the Park Service applies a standard that offers greater assurance that impairment will not occur by avoiding unacceptable impacts. These are impacts that fall short of impairment, but are still not acceptable within a particular park's environment. Park managers must not allow uses that would cause unacceptable impacts; they must evaluate existing or proposed uses and determine whether the associated impacts on park resources and values are acceptable.

Virtually every form of human activity that takes place within a park has some degree of effect on park resources or values, but that does not mean the impact is unacceptable or that a particular use must be disallowed. Therefore, for the purposes of these policies, unacceptable impacts are impacts that, individually or cumulatively, would

- be inconsistent with a park's purposes or values, or
- impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process, or
- create an unsafe or unhealthful environment for visitors or employees, or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or
- unreasonably interfere with
  - park programs or activities, or
  - an appropriate use, or
  - the atmosphere of peace and tranquility, or the natural soundscape maintained in Wilderness and natural, historic, or commemorative locations within the park.
  - NPS concessionaire or contractor operations or services.

In accordance with *Management Policies*, park managers must not allow uses that would cause unacceptable impacts to park resources. To determine if unacceptable impact could occur to the resources and values of the Southeast Utah Group parks, the impacts of proposed actions in this EPMP EA/AEF were evaluated based on the above criteria. A determination on unacceptable impacts is made in the *Conclusion* section for each of the resource topics carried forward in this chapter.

4.5 IMPACTS TO CULTURAL RESOURCES AND §106 OF THE NATIONAL HISTORIC PRESERVATION ACT

In this EPMP EA/AEF, impacts to cultural resources are described in terms of type, context, duration, and intensity, which is consistent with the regulations of the Council of Environmental Quality (CEQ) that implement the National Environmental Policy Act (NEPA). These impact analyses are intended, however to comply with the requirements of both NEPA and §106 of the National Historic Preservation Act (NHPA). In accordance with the Advisory Council on Historic Preservation's (ACHP) regulations implanting §106 of the NHPA (36 CFR Part 800, Protection of Historic Properties), impacts to cultural resources will be identified and evaluated by (1) determining the area of potential effects, (2) identifying historic properties present in the area of potential effects that were listed in or eligible to be listed on the Natural Register of Historic Places, (3) applying criteria of adverse effect to affected historic properties which are unevaluated, listed in, or eligible to be listed on the National Register, and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under ACHP's regulations, a determination of either *adverse effect* or *no adverse effect* also must be made for affected National Register-eligible historic properties. An *adverse effect* occurs whenever an impact alters, directly, or indirectly, any characteristics or historic properties that qualify it for inclusion on the National Register, e.g. diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects caused by an alternative that would occur later in time, be farther removed in distance or be cumulative (36 CFR Part 800.5, *Assessment of Adverse Effects).* As noted earlier, although adverse effects under §106 may be mitigated, the effect remains adverse. A determination of no adverse effect means there is an effect, but the effect would not diminish in any way the characteristics of the historic property that qualify it for inclusion on the National Register. Table 4-2 *Assessment of Effect on Cultural Resources* has been provided on page 212 to demonstrate what cultural resources may be in the area and identifies the project's effect on those resources. Appendix J has a more specific table on what type of cultural resources are affected. This appendix contains sensitive information and is available for internal use only.

CEQ regulations and the NPS's *Conservation Planning, Environmental Impact Analysis and Decision-making* (Director's Order #12) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, for example, reducing the intensity of an impact from major to moderate or minor. However, any reduction in intensity of an impact resulting from mitigation is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by §106 is similarly reduced. Although adverse effects under §106 may be mitigated, the effect remains adverse.

A §106 summary is included in the impact analysis sections under the preferred alternative. The §106 summary is intended to meet the requirements of §106 and is an assessment of the effect of the undertaking (implementation of the alternative) on historic properties based upon the criterion of effect and criteria of adverse effect found in the ACHP's regulations.

4.6 IMPACT TOPICS CONSIDERED AND ANALYSIS BY RESOURCE

This section describes the impact topics considered and impact analysis by resource. As part of this analysis, existing general BMPs that are currently implemented under Alternative 1 are summarized in Chapter 2. Additional BMPs that are proposed under Alternative 2 to minimize the potential for resource impacts are summarized in this analysis.

4.6.1 Geology

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to geology were derived from available surveys and SEUG staff's past observations of the effects on geology from visitor use, construction activities and exotic plant management removal. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impacts to geological resources would not be measurable or of any perceptible consequence.

Minor: Changes to character of fossil-bearing strata are detectable but small, localized and of little consequence. Any mitigation needed to offset adverse effects would be standard, uncomplicated and effective.

Moderate: Changes may be evident over large portion of the fossil-bearing strata. Mitigation measures to offset adverse effects would probably be necessary and likely successful.

Major: Impacts to geological resources are severe over a wide area. Mitigation to offset adverse effects would be needed, but its success not assured.

Duration: Short-term refers to a transitory effect, one that largely disappears over a period of days or months. The duration of long-term effects is essentially permanent.

Impacts of Alternative 1 (No-Action Alternative)

Measures to protect geology resources vary from park to park. Management practices typically include measures to avoid impacts to sensitive geological resources, such as paleontological resources. These practices include avoiding operation of heavy equipment in areas where sensitive resources are known or potentially present. Heavy equipment will only be allowed on established roads or in dry washes. In general, potential impacts to geological resources would be minor. Some minor impacts to

paleontological resources could also occur from exotic plant management activities. Potential impacts from each treatment are summarized below:

Surface disturbing activities such as tilling may physically impact geological resources and equipment could potentially impact unknown geological resources in un-surveyed areas. However, these activities will be avoided within the boundaries of sensitive sites. Cultural treatments may not have any measurable or perceptible effects on geological resources and impacts to geological resources would therefore be negligible.

Manual and mechanical treatments may have measurable or perceptible effect on geological resources. Mechanical disturbance from tilling or other ground disturbing activity may be negligible since these sites will be avoided. The impacts of manual and mechanical treatments on geological resources would therefore be directly adverse, site-specific, short and long-term, and negligible.

Chemical treatments may not have any measurable or perceptible effect on geological resources. The impacts of chemical treatments on geological resources would therefore be negligible.

Effects of pile burning could include some deposition of carbonaceous residue and carbonaceous blackening of the upper surfaces. Pile burns will not be allowed on known paleo-sites. Therefore, the impacts of pile burning would be directly adverse, site-specific, short-term and negligible.

Cumulative Effects
Past land practices (prior to each park's establishment), such as ranching and farming, may have disturbed, damaged, or destroyed some paleontological sites and associated resources. Road and trail maintenance and construction activities could adversely affect remaining paleontological resources. Consultation with resource management staff, to evaluate and mitigate potential impacts occurs during the planning phase of these types of projects. Visitor use could cause loss or damage to paleontological resources, particularly from the collection of fossils from the backcountry. Fire could uncover some resources that would otherwise be unknown. Implementation or continuation of exotic plant management activities under any of the alternatives would have negligible additive effects on paleontological resources. Under this alternative, ARCH, CANY, HOVE and NABR would avoid surface-disturbing activities in areas of known paleontological resources without first consulting resource staff. Currently unknown or undocumented sites could be affected by treatments, but in the event such sites are discovered, treatments would stop until staff could evaluate these resources. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
Disturbance to geology resources may be slight and site-specific, within a relatively small area. Exotic plant management may not inhibit the achievement of the desired condition to have geologic processes, such as erosion, functioning in as natural condition as possible. BMPs, for example, revegetation with native plants; will be implemented to prevent soil erosion from removing exotic plants. The impacts of exotic plant management on the geological resources would therefore be directly adverse, site specific, short and long-term, and negligible. This alternative would not result in impairment to geological resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts to geology under this alternative are the same as under Alternative 1 with the exception of the following treatment:

Biological control treatments would not have any measurable or perceptible effect on geological resources. The impacts of biological treatments on geologic resources would therefore be negligible.

Cumulative Effects
Cumulative effects are the same as in Alternative 1.

Conclusion
IPM would not inhibit the achievement of the desired condition to have natural and geological processes, such as erosion, functioning in as natural condition as possible. The impacts of IPM on geologic resources would therefore be directly adverse, site-specific, short-term and negligible. This alternative would not result in impairment to geology. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.2 Soils

Methodology and Intensity Thresholds
Analyses of the potential intensity of impacts to soils were derived from available soils information (USDA 2002) and SEUG staff's past observations of the effects on soils from visitor use, oil and gas developments and exotic plant management removal. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Any effects to soils would be below or at the lower levels of detection. Any effects to soil crusts would be slight and short-term. Impacts would be site-specific, and no mitigation measures would be necessary.

Minor: The effects to soils would be detectable. Effects to soil crust would be small, as would the area affected. Impacts would be short-term. If mitigation were needed to offset adverse impacts, it would be simple to implement and likely successful.

Moderate: The effect on soil and intermediate soil crust (moss and *Collema spp*. present) would be readily apparent and detectable, likely long-term, and would result in a change to the soil character over a relatively localized area. Mitigation measures would probably be necessary to offset adverse impacts and would likely succeed.

Major: The effect on soil and more mature soil crust (colored lichen present) would be readily apparent and detectable, long-term, and would substantially change the character of the soils over a large localized or regional area. Mitigation measures to offset adverse impacts would be needed, extensive, and their success could not be guaranteed.

Duration: Short-term refers to a period of less than 5 years. The duration of long-term effects is essentially permanent.

Impacts of Alternative 1 (No-Action Alternative)
Restoration activities, such as reseeding, may cause negligible, temporary disturbance to soil. Effects could include compaction of soil and disturbance to upper soil profiles. The effects to soil may be detectable in some areas. However, these changes may be small, short-term, and the effects would be site-specific. The impacts of restoration activities on soil resources would therefore be site-specific, short-term, and negligible.

Manual and mechanical treatments may cause negligible to moderate, short- to long-term disturbance to soil. Removal of exotic plants can destabilize soils. Flash floods, although infrequent, can cause moderate to major erosion in areas devoid of vegetation. Implementing BPM's, such as revegetation of native plants and building check dams to reduce water velocity, may reduce potential impacts on soils. The impacts of manual and mechanical treatments on soil resources would therefore be directly adverse, site-specific, short-and long term, and negligible to moderate. Intrusion into parks by personnel conducting exotic plant management may cause short-term, direct impacts to soil en route to exotic plant populations. Effects could include compaction of soil and disturbance to upper soil profiles. The effects to soil may be detectable in some areas. To reduce the impacts of park personnel on soils, crews will follow field standard operating procedures, such as stay on trails, use slickrock, and work in small teams. The impacts of foot and vehicle traffic on soil resources would therefore be directly adverse, site-specific, short-term, and minor.

There is a low potential for accidental spills of herbicides that may temporarily contaminate soils. Potential impacts of accidental spills at the four parks with the safety plan (Appendix E) may be minor and short-term. Individuals involved with exotic plant management will be trained and certified to use herbicides and will be aware of procedures for the clean up of herbicides, which will increase response time

and decrease potential impacts. Impacts may be short-term and site-specific. The impacts of accidental chemical spills on soil resources would therefore be directly adverse, site-specific, short-term, and negligible to minor.

Some herbicides have the potential to persist in soils, which may lead to herbicide buildup in soils. Coarse to medium-textured soils are less likely to retain herbicides. Medium and fine-textured soils with higher organic matter content have a greater potential to retain herbicides. The impacts of herbicide treatments on soil resources would therefore be directly adverse, site-specific, long-term, and minor.

Burn piles will increase nutrient availability in soil in very site-specific areas, particularity where the pile is set up. This increased nutrient content could benefit native and non-native vegetation. The impacts of pile burning on soil resources would therefore be directly beneficial (promote native species) and adverse (increase non-native species like cheatgrass), site-specific, short-term, and negligible.

Cumulative Effects
A number of activities affect soils, including visitors traveling off established trails, unauthorized off-road travel and road/trail maintenance, winds and water. Soils in all areas of the park are highly erodible and susceptible to extreme damage to biological soil crusts. Soil microbotia and mycorrhizal fungi can be disturbed by foot traffic in most areas of the parks, causing erosion from loss of vegetative cover. However, most exotic plant management activities take place along waterways, where soil crusts generally do not have the conditions to mature fully because of periodic flooding, so continuation of current exotic plant management activities would have minor additive negative effects on soil crusts.

Oil and gas exploration produce nitrogen oxide emissions which can produce elevated nitrogen levels in soils. Although not fully supported, the additional nitrogen may enhance the proliferation of exotic species and inhibit establishment of native vegetation. Soils in all areas of all four parks are highly erodible and susceptible to extreme damage to biological soil crusts. Soil microbotia and mycorrhizal fungi could be disturbed by foot in sensitive areas causing erosion from loss of vegetative cover or compaction from the use of heavy equipment. Continuation of current exotic plant management activities would have minor additive effects on soils. Surface-disturbing activities such as tilling could have negligible, short-term, additive effects on regional soil loss through erosion until native vegetation reestablishes. Heavy equipment could compact soils. Soils may be lost due to wind scouring and water erosion on trails and roads where fragile soils are exposed but not hardened, resulting in entrenched road and trail sections. Continuation of current exotic plant activities would have minor additive effects on local soils in the cumulative effects area. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
In conclusion, exotic plant management may have both adverse and beneficial impacts on soil resources. Removing exotic vegetation may cause soil erosion and would potentially have moderate to major impacts especially if flooding were an issue. However, BPM's will be implemented to reduce direct adverse impacts to site-specific, short-term, and negligible to moderate.

Overall, exotic plant management may have long-term beneficial effects on soil resources. Rehabilitating native plant communities may reduce the potential for soil erosion and sedimentation in disturbed areas. Removal of exotic plants would also allow more room for soil to fully develop and support a native ecosystem. Fortunately for the sake of the oldest most fragile soils of the region, most treatment areas are in riparian zones, which generally have regular disturbance and do not contain many of these oldest lichen-rich soil crusts. The impacts of exotic plant management on soil resources would therefore be directly beneficial and adverse, site-specific, short and long-term, and negligible to moderate. This alternative will not result in impairment to soil resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Soil impacts under this alternative would be comparable to Alternative 1, except for the following BMPs using an All-terrain vehicle (ATV) or other heavy equipment:

- ATVs may be used for the application of herbicides. Effects could include compaction of soil and disturbance to upper soil profiles. The effects to soil may be detectable in some areas. However, treatments would be chosen as selectively as possible to minimize impacts to soils and avoid biological soil crust areas. ATVs will not be used in areas where there are well developed soil crusts, especially where there are soil crusts present, including colored soil lichens (white, yellow, red, green, brown or blue).
- ATVs would be transported by trailer from one general area of the park to another and not driven off-roads.
- Tractor-drawn equipment will also be limited to use along established roads.
- The use of a seed drill will be limited to species and project sites that require it for successful establishment. Multiple perpendicular passes will be performed to prevent the formation of rows, and drill use will be limited to soils that are not prone to compaction and that lack well-developed soil crusts. De-compaction treatments will only be used if necessary for the establishment of vegetation (i.e. road removal) or if performed as an initial exotic plant management treatment.

Potential impacts to soils under this alternative are as follows:

Heavy machinery (tractor drawn equipment,) impacts would be minor since BMPs would be implemented to ensure this equipment would stay on established roads. Therefore the impacts of heavy equipment would be directly adverse, site-specific, short-term and minor.

Harrowing will be limited to sites where there is no risk to desirable vegetation, no danger of soil compaction and no disruption of well-developed biological soil crusts. Impact would be directly adverse, site-specific, short-term and minor.

"Broad brush" treatments such as using ATVs to chemically treat large areas will mostly be used for large, dense infestations of exotic plants along roadways. Equipment would use existing roads to the maximum extent practical. The impacts of ATV traffic on soil resources would therefore be directly adverse, site-specific, short-term, and minor.

No known direct impacts to soils would occur from biological treatments. The impacts of biological treatments on soil resources would therefore be negligible.

Cumulative Effects
Cumulative impacts would be the same as Alternative 1.

Conclusion
Short-term impacts to the soil resource from the implementation are expected to be minor, adverse and direct; primarily due to the impacts of disturbance of soils during mechanical treatments and the potential for chemical residue in the soils from herbicide applications. BMPs would also be implemented under this alternative to limit the potential for impacts to soils during sensitive periods or in sensitive areas. IPM may have long-term beneficial effects of reducing regional soil erosion rates by rehabilitating native plant communities. IPM has the ability to select the exotic plant control method that is best for each individual infestation and site. Long-term soil impacts are expected to be minor and beneficial as more areas would be treated using chemical and biological methods that result in reduced soil disturbance. The impacts of exotic plant management on soil resources would be directly adverse and beneficial, site specific, short-term, and minor. This alternative will not result in major adverse impairment to soils resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.3 Air Quality

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to air quality were derived from the available scientific data and literature and SEUG staff's past observations of the effects on air quality from visitor use, oil and gas developments, prescribed fires, wildfires, and herbicide use with exotic plant removal. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Any changes in air quality would be below or at the level of detection, and if detected, would have effects that would be considered slight and short-term.

Minor: Changes in air quality would be measurable although small, short-term, and site specific. No air quality mitigation measures would be necessary.

Moderate: Changes in air quality would be measurable and would have consequences, although the effect would be relatively local. Air quality mitigation measures would be necessary and likely successful.

Major: Changes in air quality would be measurable, would have substantial consequences, and would be noticed regionally. Air quality mitigation measures would be necessary and their success could not be guaranteed.

Duration: Short-term refers to a transitory effect, one that largely disappears over a period of hours or days. The duration of long-term effects is months or years.

Impacts of Alternative 1 (No-Action Alternative)
Potential impacts to air quality from exotic plant management may occur from surface disturbing activities (digging, pulling, and reseeding) that generate dust and spraying of herbicides:

Potential impacts include temporary increases in fugitive dust from vehicles and increases in emissions from vehicle exhaust and equipment. These changes in air quality would not likely be measurable. Mitigation measures would be followed to restrict traffic and heavy equipment to existing roads and suppress dust for larger treatment areas. The impacts of mechanical treatments on air quality would therefore be directly adverse, site-specific, short-term, and negligible.

Limited dispersion of chemicals by wind may occur, although resulting changes in air quality may not be detectable. The overall potential for herbicide drift would be negligible since herbicides would be applied in accordance with label specifications. Most herbicides used have a low volatility. Those herbicides with higher volatility are used at low concentrations. Impacts from herbicide volatilization are therefore expected to be negligible. The impacts of chemical treatments on air and visual resources would therefore be directly adverse, site-specific, short-term, and negligible.

Conducting prescribed fires on land that has been previously treated with an herbicide can be problematic. Chemicals released into the air through burning could be carried in air currents for some distance beyond the treated area, which could pose a health risk to employees conducting the burn and/or the public. It is important that chemical application be coordinated with prescribed fires. Areas treated with a chemical should not be burned for a time. An area may be treated with a chemical after a prescribed fire, but not before. The length of time that an herbicide would remain

active and thereby available for re-release if a fire occurred depends on the herbicide used. Most chemicals should not be a concern three to four months after application, but some residue could last for up to one year. Close coordination with the Fire Management Officer and their staff is essential to maintain the safety of SEUG employees, visitors and park neighbors. The impacts of burning vegetation that has been treated with herbicides on air resources would therefore be directly adverse, site-specific, short-term and minor.

Potential impacts include temporary increases in fugitive dust from vehicles, increases in emissions from vehicle exhaust and equipment, and temporary increases in fugitive dust from cultural activities, such as reseeding and irrigation work. These changes may be slight and would not be measurable over large treatment areas. The impacts of cultural treatments on air would therefore be directly adverse, site-specific, short-term, and negligible.

Cumulative Effects

Local air quality impacts in all four parks are similar and are most often caused by visitor and staff vehicle traffic, maintenance projects and any fire activity in the area. Equipment operations would be expected to have negligible additive adverse impacts on regional air quality since emissions would only be generated by a few sources that would emit small quantities of emissions. Energy development on BLM lands (oil and gas) emits air pollutants and dust, and emissions levels may further increase with additional development, though the degree to which they impact air quality is presently unknown. Coal-fired powered plants in the airshed also cause air quality and visual impacts. When added to these existing impacts within or near the parks, most exotic plant management activities are expected to have negligible additive impacts to local or regional air quality. Brush pile burning for exotic plant management may have additive cumulative short-term minor adverse impacts to air quality if fires are conducted during periods of poor regional air quality or during periods of increased fire activity in areas outside the park; however state burn permits are required to minimize local smoke concerns. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion

Exotic plant management activities would not inhibit the maintenance of the desired condition to have air quality standards met or maintained. Any impacts of mechanical, cultural, or chemical techniques are expected to therefore be directly adverse, site-specific, short-term, and negligible to minor decrease in air quality conditions and is not likely to impact visibility for, at most, greater than a couple of hours. There would be no major adverse impact to air quality therefore this alternative would not result in impairment. Implementation of this alternative would not result in

any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
In addition to the general BMPs mentioned in Section 2.3, a number of BMPs are implemented to minimize potential impacts to air under this alternative:

- ATVs would be transported by trailer from one general area of the park to another and not drive off roads.
- Aerial application of herbicides would only be conducted for sites that meet one of the following criteria:
  - The infestation covers a large area and would be most effectively treated from the air. There is no acre limit for using aerial application, however aerial application sites are typically over 20 acres and have fairly dense exotic plant coverage.
  - The infestation covers a small area but can be successfully treated using a microfoil boom or similar apparatus that allows for a limited band of spray. A microfoil boom can be used to spray widths as small as 12 feet, effectively treating small infestations. Microfoil booms are designed specifically to minimize herbicide drift.
  - The infestation is very remote and treatment using other application methods would require an inordinate amount of time for crews to arrive and apply ground treatment.
  - The infestation is located on rough, steep terrain that prevents ground application and is too dangerous for employees on foot.
  - Herbicides with high volatility would not be used to treat areas located adjacent to sensitive areas because of the potential for unwanted movement of herbicides to these areas.

Potential impacts are the same as under Alternative 1 with the exception of the following treatment methods:

Temporary reduction in air quality from dust from ATVs may occur. Potential impacts include temporary increases in fugitive dust from ATVs, increases in emissions from exhaust and temporary increases in fugitive dust from soil disturbing activities. These changes may be slight and would not be measurable over large treatment areas. The impacts of manual/mechanical treatments on air would therefore be directly adverse, site-specific, short-term, and negligible.

Limited dispersion of chemicals by wind may occur, although resulting changes in air quality may not be detectable. The overall potential for herbicide drift may be minor to moderate since herbicides would be applied in accordance with label specifications and by backpack sprayers, hand sprayers or with the seldom used aerial application method and ATV sprayers. These impacts would be directly adverse, site-specific to local, short-term and negligible to minor.

No known changes in air quality would occur from biological control treatments. The impacts of biological treatments on air would therefore be negligible.

Cumulative Effects
Cumulative impacts would be the same as Alternative 1.

Conclusion
Alternative 2 would not inhibit the maintenance of the desired condition to have NAAQS met, current air quality met and integral vistas protected. The impacts of exotic plant management on air quality would be directly adverse, site-specific, short-term, and negligible to minor. There would be no major adverse impact to air quality therefore this alternative would not result in impairment. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.4 Visual Resources

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to visual resources were derived from available scientific data and literature and SEUG staff's past observations of the effects on visual resources from oil and gas development, prescribed fires, wildfires, and exotic plant management. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Any changes would be below or at the level of detection, and if detected, would have effects that would be considered slight and short-term.

Minor: Changes to visual resources would be measurable, although small, short-term, and site-specific. No visual resource mitigation measures would be necessary.

Moderate: Changes to visual resources would be measurable and would have consequences, although the effect would be relatively local. Mitigation measures would be necessary and likely successful.

Major: Changes to visual resources would be measurable, would have substantial consequences, and would be noticed regionally. Mitigation measures would be necessary and success could not be guaranteed.

Duration: Short-term refers to a period of less than 5 years. Long-term refers to a period of longer than 5 years.

Impacts of Alternative 1 (No-Action Alternative)

Exotic plant management would not inhibit the current visual resources. However, the treatment and removal of exotic plants will have both adverse and beneficial impacts to the parks visual resources.

Some minor, adverse, short-term visual impacts may occur from the use of manual/mechanical treatment, herbicides and pile burning. On a small scale, non-target vegetation may show signs of chemical burns from localized herbicide drift. Moderate visual effects would likely occur in areas where large infestations of exotic plants have been physically removed by mechanical methods, response to chemical treatments and where brush piles are built. These areas may be devoid of vegetation until native vegetation becomes reestablished through reseeding and other treatments. The impacts of the use of mechanical treatments and herbicides on visual resources would therefore be directly adverse, site-specific, short-term, and minor.

Cumulative Effects
Rural development, oil and gas fields, and lights near park boundaries can affect viewsheds and cause light pollution, degrading night sky viewing and decreased visual resource quality. Under this alternative, removal of exotic plants may have short-term, adverse cumulative impacts on each parks viewshed. Burning of brush piles may also have short-term, adverse impacts on viewsheds by restricting visibility in some areas. Also, treatment of some exotic plants may result in temporary removal of vegetation. However, the adverse impacts resulting from removal of vegetation would be short-term, and would only last until native vegetation can reestablish. Once established, however, native vegetation would have long-term beneficial effects by returning the viewshed to a state that is more representative of the historic condition. Short range views along the rivers and in riparian area will be greatly improved. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
The beneficial impacts of exotic plant management would promote natural native vegetative landscapes. Distant views would open up with the removal of large exotic species like tamarisk. Local foregrounds would also be enhanced with the removal of exotics. These impacts will be directly beneficial and adverse with short and long-term minor to moderate impacts depending on the exotic species population size. This alternative would not result in impairment to visual resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

- Biological control treatments would have some adverse and beneficial, short-to-long term, minor to moderate visual impacts to visual resources. Use of tamarisk beetle on tamarisk would initially be adverse, minor and long-term. Some areas will contain brown dead tamarisk or be devoid of

vegetation until native vegetation becomes reestablished through reseeding and other treatments. The end result would be beneficial, long-term and moderate by removing the tamarisk and improving river corridor viewsheds.

IPM would not inhibit visual resources. Although treatment will initially adversely impact visual resources, overall, the final result of removing exotics will be beneficial. The beneficial impacts of exotic plant management would promote natural native vegetative landscapes. Distant views would open up with the removal of large exotic species like tamarisk. Local foregrounds would also be enhanced with the removal of exotics. These impacts will be directly beneficial and adverse with long-term minor to moderate impacts depending on the exotic species population size. This alternative would not result in impairment to visual resources.

Cumulative Effects
Similar to Alternative 1, negligible to minor additive effects would occur to visual resources under Alternative 2 with the addition of the following:

Biological control tamarisk beetles, whether released by the park or migrated into the park from county releases, result in brown and eventually dead tamarisk that may be considered unsightly by many visitors. Although IPM could include higher levels of activity, such as the use of chemical and prescribed fire treatments, BMPs would limit the potential for additive effects to air quality which might degrade visibility of distant views. Operation of equipment, such as ATVs, would also have short-term adverse impacts on viewsheds.

Conclusion
IPM would not inhibit visual resources. Although treatment will initially adversely impact visual resources, overall, the final result of removing exotics will be beneficial. The beneficial impacts of exotic plant management would promote natural native vegetative landscapes. Distant views would open up with the removal of large exotic species like tamarisk. Local foregrounds would also be enhanced with the removal of exotics. These impacts will be directly beneficial and adverse with long-term minor to moderate impacts depending on the exotic species population size. This alternative would not result in impairment to visual resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.5 Water Resources

Methodology and Intensity Thresholds

This analysis considers the environmental consequences of implementing the alternatives based on the potential to increase turbidity and chemical containments in the parks surface and subsurface waters. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Water quality would be affected, or changes would be either non detectable below water quality standards and have effects that would be considered slight, site specific, and short-term.

Minor: Water quality would be measurable, although the changes would be below water quality standards, small, likely short-term, and effects would be site-specific or local. No water quality or hydrology mitigation measures would be necessary.

Moderate: Changes in water quality or hydrology would be measurable and long-term, may exceed water quality standards, but would be relatively local. Necessary water quality or hydrology mitigation measures would likely succeed.

Major: Changes in water quality or hydrology would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary and their success would not be guaranteed.

Duration: Short-term refers to recovery in less than several days. Long-term would refer to recovery, following treatment, requiring longer than several months.

Impacts of Alternative 1 (No-Action Alternative)
In general, potential impacts to water resources would be negligible to moderate. There may be some temporary increase in suspended solids from surface disturbing activities and water quality from pile burning. There may also be changes in water quality from the application of herbicides. However, BMPs would be implemented to minimize the potential for these impacts. Accounting for these BMPs, potential impacts are described below:

Irrigation may occasionally be used on a limited basis at parks to facilitate establishment of native vegetation. The potential effects of current irrigation programs are likely negligible on surface water flows since this treatment is not often used. However, short-term minor surface water depletions could occur at parks that use surface waters to irrigate during periods of drought. The impacts of irrigation on water resources would therefore be directly adverse, site-specific, short-term, and negligible to minor.

Prevention, reseeding, and irrigation would have a beneficial effect of promoting the reestablishment of native vegetation, which could help reduce erosion and sedimentation in surface waters at those parks that use these treatments. Changes in water quality (such as reduction of total suspended solids [TSS] in surface waters) may be measurable and long-term, but would be relatively local. The impacts of prevention, reseeding, and irrigation on water resources would therefore be directly beneficial, site-specific or local, long-term, and moderate.

Minor mechanical disturbance to native plants from tilling or other ground disturbing activity may result in indirect effects, such as increased sedimentation, to surface

waters. Parks currently are not restricted from treatments that involve surface disturbance activities such as tilling. Impacts may be measurable, but small, short-term and localized. The impacts of mechanical disturbance on water resources would therefore be indirectly adverse, site-specific or local, short-term, and minor.

Vehicles, allowed only on established roads, may have to cross intermittent drainages to access exotic plant populations on a case by case basis. Stream crossings could increase localized sedimentation in standing or shallow flowing water at the crossing. However, most drainages are dry during the summer months when most exotic plant control efforts occur. Physical changes to water quality resulting from stream crossings would likely be below water quality standards and criteria, and would be within the range of natural variability. Impacts may be measurable, but small, short-term, and site-specific.

A number of BMPs would be implemented under this alternative to limit the potential for herbicides to affect water resources. These BMPs are designed to always initially consider other alternatives to herbicides, and then only use herbicides where their use is prudent and feasible. If herbicides are used, BMPs would be implemented to limit the potential for coming into contact with and impacting surface waters. In areas where there is the potential to come into contact with water resources, restricting use to herbicides with low leaching potential and low toxicity would further reduce the potential for impacts to water resources. Only those herbicides that have a low toxicity, such as glyphosate (Roundup Pro and Rodeo) would be used within areas near surface waters or in areas with a high leaching potential. Changes in water quality from the use of herbicides are not expected to be detectable. However, parks would implement surface water and ground water monitoring programs as appropriate to confirm that herbicides are not present. The impacts of herbicide use on water resources would therefore be directly adverse, site-specific and local, short-term, and minor.

The potential for directly spilling herbicides into surface waters is unlikely. Herbicides are transferred in controlled settings away from surface water resources. All herbicides are contained in spill-proof containers and are handled in accordance with label specifications. In the unlikely event that a spill occurs, resource managers would immediately contact the Chemical Manufacturing Transportation Emergency Center (Chemtec) of USDA (who has staff with information on how to respond to accidental spills in emergency situations) and would implement standard operating procedures for containing and remediating spills.

Herbicides may pose a minor risk to ground water from leaching. However, to minimize potential environmental effects, herbicides will be selected based on soil texture and depth, distance to water, and environmental conditions. When soil mobility data are available, the Regional IPM Coordinator may specify herbicide-specific vertical buffer zones to protect ground water. Alternative types of treatments, herbicides, or herbicide application rates would be considered for areas with high leaching potential. Using these BMPs, the potential for ground water contamination

would be unlikely. Herbicide application would therefore not likely cause detectable changes in chemical water quality standards that exceed desired water quality conditions. Impacts would be small, short-term, and localized. The impacts of herbicide use on water resources would therefore be directly adverse, local, short-term, and minor.

Some areas experience intense thunderstorms during summer. In the event that a thunderstorm occurs shortly after application, soluble herbicides could be transported in runoff water. This may cause chemical changes in surface water quality that would likely be below water quality standards that would not likely cause long-term degradation of water quality. To avoid transport of herbicides in runoff water after an intense thunderstorm, a weather forecasting site such as NOAA's National Weather Service Forecast Office would be consulted within 15 hours of application to assess weather warnings and forecast. Additionally, weather conditions would be monitored immediately prior to application. The impacts of herbicide use on water resources would therefore be directly adverse, local, short-term, and minor.

Pile burning projects may cause a loss of vegetation from cutting and piling vegetation and could cause negligible temporary increases in erosion and sedimentation. Flash flooding, although infrequent, may wash away unburned piles and cause moderate erosion and sedimentation as well as change channel flows with the additional cut woody debris. Changes in water quality and pH levels (such as reduction of total suspended solids in surface waters) may be negligible and short-term, and would be relatively site-specific. Runoff will likely contain ash and nutrients, which would also have a negligible short-term effect on water quality. The impacts of pile burning on water resources would therefore be directly adverse, site-specific, short-term, and negligible to moderate.

Cumulative Effects

Reduced groundwater by potential development, oil and gas extraction, agricultural uses and other commercial uses threaten ARCH's springs and seeps and the Colorado River and threaten CANY's rivers, springs and seeps. Upstream dams on the Colorado River and its tributaries, especially dams on the Gunnison River, have a relatively small effect on Colorado River flow patterns. The operation of Flaming Gorge dam has altered flow pattern of the Green River to some extent. Road developments in and around the parks, roadbed failures, and erosion may increase sedimentation in surface waters adjacent to roads. Water sources frequently used by visitors have aquatic ecosystems with inputs of lotions, body oils and fluids which may affect the health of other visitors or wildlife. Though the water sources are small at HOVE, and unlikely to be attractive for swimming, the low qualities are more easily affected by contaminates. Frequently used water sources in NABR by visitors, such as the large pool in Armstrong Canyon near Kachina Bridge, have affected aquatic ecosystems with lotions, body oils and fluids. Alternative1, when combined with other impacts, would result in overall negligible to minor additive adverse impacts to surface water quality. Continued exotic plant management would likely have negligible additive adverse impacts on water quality. Herbicides, when used in

accordance with herbicide labels, would not be applied in amounts that might add to current levels in water resources. Alternative 1 would not contribute to increased levels of contaminates in water resources. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
Exotic plant management would not inhibit current water resources. However, the treatment and removal of exotic plants will have both adverse and beneficial impacts to water resources. Ground disturbing activities may result in indirect adverse effects, such as increased sedimentation and turbidity, to surface waters. Applying herbicides in areas with low water tables may also result in adverse effects. Alternative types of treatments, herbicides, or herbicide application rates would be considered for areas with high leaching potential.

Removal of exotic plants that affect riparian areas (such as purple loosestrife, Russian olive, and tamarisk) will help return some surface waters to natural flows, reduce visual obstructions along riverbanks, and create additional habitat if these plants are removed. Exotic plant management will help SEUG parks achieve the desired condition to have surface waters and ground waters perpetuated, natural floodplain values restored, and natural values of wetlands preserved. Overall, the impacts of exotic plant management on water resources will therefore be directly beneficial and adverse, site-specific, short-and long-term, and negligible to moderate. This alternative would not result in impairment to water resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
In addition to the general BMPs mentioned in Section 2.3, a number of BMPs are implemented to minimize potential impacts to water resources under this alternative:

- ATVs will only be allowed on established roads and will avoid wetland areas with standing water or saturated soils, to the extent practical.
- ATVs will not be operated where soil is susceptible to compaction, erosion, or creation of wheel ruts.
- Resource managers that apply herbicides in areas with low water tables would assess the risk of leaching using RAVE or another model.
- All herbicide applied to soil as a spray or granules or applied to foliage with a spray within 500 ft. of open water or with a depth to groundwater of less than 50 ft. will be evaluated using the RAVE system for assessing risk to water quality (see Appendix G). If a site scores above 65, then a wick, basal bark, or cut-stump application will be used. Consideration will be given to toxicity, soil mobility, persistence and selectivity in evaluating risk.

Potential impacts are the same as under Alternative 1 with the exception of the following treatment methods:

Herbicides may pose a minor risk to ground water from leaching. However, to minimize potential environmental effects, herbicides would be selected based on soil texture and depth, distance to water, and environmental conditions. Resource managers considering application of herbicides in areas with low water tables would assess the risk of leaching using RAVE or another model. When soil mobility data are available, the Regional IPM Coordinator may specify herbicide-specific vertical buffer zones to protect ground water. Alternative types of treatments, herbicides, or herbicide application rates would be considered for areas with high leaching potential. Using these BMPs, the potential for ground water contamination would be unlikely. Herbicide application would therefore not likely cause detectable changes in chemical water quality standards that exceed desired water quality conditions. Impacts would be of herbicide use on water resources directly adverse, short-term, site-specific and negligible.

No known direct impacts to surface waters would occur from biological treatments. The impacts of biological treatments on water resources would therefore be negligible.

Cumulative Effects
Cumulative impacts will be similar to Alternative 1. IPM would have negligible adverse additive impacts on water quality. A number of BMPs would be implemented to minimize the potential for direct or indirect impacts. Herbicides would only be used under specific conditions and in accordance with BMPs. Alternative 2 would not contribute to increase contaminates in springs and seeps. Herbicides would be applied in accordance with herbicide labels under both alternatives. The potential for herbicides to contaminate springs and streams may be less likely under Alternative 2 because additional BMPs, such as the RAVE model, would be implemented to carefully control the conditions under which herbicides are applied.

Conclusion
Removal of exotic plants that affect riparian areas (such as purple loosestrife, Russian olive, and tamarisk) would help return some surface waters to natural flows, reduce visual obstructions along riverbanks, and create additional habitat if these plants are removed from shallow channels. Under Alternative 2, the removal of tamarisk could be on a larger scale with the introduction of a bio-control agent. This will allow the rivers to be less channelized and restore proper riparian functions more quickly and effectively. Changes in flows may be detectable in some areas. IPM would help parks achieve the desired condition of perpetuating surface waters and ground waters, restoring natural floodplain values, and preserving natural values of wetlands. The impacts of exotic plant management on water resources would therefore be directly adverse and beneficial, local, short and long-term, and negligible to moderate. This alternative would not result in impairment to water resources. Implementation of this

alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.6 Wild and Scenic Rivers

Methodology and Intensity Thresholds

The potential impacts on wild and scenic rivers were evaluated using literature and by SEUG staff's past observations of the effects on wild and scenic rivers from visitor use, water diversion and irrigation, park and county development activities and exotic plant management. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Effects to wild and scenic river character or experience would be slight, and would be much localized in area and very short in duration (a day or less). The action would not cause a fundamental change in the character of designated wild and scenic rivers.

Minor: Effects to wild and scenic river character or experience would be relatively small, and would be localized in area or short in duration. The action would not cause a fundamental change in the character of designated wild and scenic rivers.

Moderate: Effects to wild and scenic river character or experience, including the size of the area affected and the duration would be intermediate. The action would not cause a fundamental change in the character of designated wild and scenic rivers. Mitigation measures to offset adverse effects would probably be necessary and likely successful.

Major: Effects to wild and scenic river character or experience, including the size of the area affected and the duration would be substantial. The action would cause a fundamental change in the character of designated wild and scenic rivers. Mitigation to offset adverse effects would be needed, but its success not assured.

Duration: Short-term refers to a period of less than 10 years. Long-term refers to a period longer than 10 years.

Impacts of Alternative 1 (No-Action Alternative)

Current exotic plant management will help the parks achieve the desired condition to have these rivers and their surrounding environments protected for the benefit and enjoyment of present and future generations. Impacts can be short to long-term and site-specific. Removal of exotic plants that affect riparian areas (such as purple loosestrife, Russian olive, and tamarisk) will help restore rivers to natural conditions, reduce visual obstructions along riverbanks, and create additional habitat. One adverse impact would be a visual effect, along river corridors, of dead or cut exotic vegetation. This impact will be indirectly adverse, local, short-term and moderate.

Cumulative Effects

Past and present mineral mining, cattle grazing and development of lands in and around ARCH have degraded the quality of the Colorado River, Courthouse Wash and Salt Wash. Operation of Colorado River Basin dams, especially on the Gunnison River, have altered the flow pattern of the Colorado River to some extent. Mining, cattle grazing and development of lands surrounding CANY have degraded the quality of the Colorado and Green Rivers. Operation of the Colorado River Basin dams, especially on the Gunnison River, have altered the flow pattern of the Colorado River to some extent.

Water sources frequently used by park visitors have aquatic ecosystems with inputs of lotions, body oils and fluids which may affect the health of other visitors or wildlife. Continued exotic plant management would likely have negligible additive adverse impacts on wild and scenic rivers. Herbicides, when used in accordance with herbicide labels, would not be applied in amounts that might add to current levels in water resources. Alternative 1 would not contribute to increased levels of contaminates in water resources. When combined with other impacts, this alternative would result in overall negligible to minor additive adverse impacts to wild and scenic rivers. ARCH is proposing to develop a Climbing Management Plan and CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park. All plans would be consistent with this final plan.

Conclusion
A number of BMPs would be implemented to minimize the potential for direct or indirect impacts. Herbicides would only be used under specific conditions and in accordance with BMPs. The benefits of exotic plant management outweigh the adverse effect. Therefore, the impacts of exotic plant management on wild and scenic rivers will be directly beneficial, local, long-term, and moderate to major. This alternative would not result in impairment to wild and scenic rivers. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1.

Cumulative Effects
IPM would also likely have negligible adverse additive impacts on wild and scenic rivers. A number of BMPs would be implemented to minimize the potential for direct or indirect impacts. Herbicides would only be used under specific conditions and in accordance with BMPs. Alternative 2 would not contribute to increased fertilizer or fecal levels in the river. Herbicides would be applied in accordance with herbicide labels under both alternatives. The potential for herbicides to reach the Colorado and Green Rivers may be less likely under Alternative 2 because an additional number of BMPs would be implemented to carefully control the conditions under which herbicides are applied. Under Alternative 2, the removal of tamarisk will more effectively allow the rivers to be less channelized and will restore proper riparian

functions. Alternative 2, when combined with other impacts, would result in overall negligible to minor additive adverse impacts to wild and scenic rivers. CANY in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park. Both would be consistent with this final plan.

Conclusion
IPM will help the parks achieve the desired condition to have these rivers and their surrounding environments protected for the benefit and enjoyment of present and future generations. Impacts can be short to long-term and localized. Removal of exotic plants that affect riparian areas (such as purple loosestrife, Russian olive, and tamarisk) will help restore rivers to natural conditions, reduce visual obstructions along riverbanks, and create additional habitat. One adverse impact would be a visual effect, along river corridors, of dead or cut exotic vegetation. This impact will be indirectly adverse, local, short-term and moderate. However, the benefits of IPM outweigh the adverse effect. Therefore, the impacts of IPM on wild and scenic rivers will be directly beneficial, local, long-term, and moderate to major. This alternative would not result in impairment to wild and scenic rivers. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.7 Floodplains and Wetlands

Methodology and Intensity Thresholds

The potential impacts on floodplains and wetlands were evaluated by comparing their locations and anticipated visitor uses and SEUG staff's past observations of the effects on floodplains and wetlands from recreation, motor vehicle use, water diversion and irrigation, homesteads, and park and county development activities. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Any effects to floodplains or wetlands would be below or at the lower levels of detection. Any detectable effects would be slight. No USACE 404 permit would be necessary.

Minor: Effects to floodplains or wetlands would be detectable, and relatively small and short-term to individual plants. No USACE 404 permit would be necessary. No long-term effects to floodplains and wetlands would occur.

Moderate: The effects to floodplains or wetlands would be detectable and readily apparent, including a short-term effect on individual plants and short- or long- term effect on population of plants. The effect could be site-specific or local.

Major: Effects to floodplains or wetlands would be observable over a relatively large localized or regional area and would be long-term. The character of the wetland or floodplain would substantially change its function over the long-term.

Duration: Short-term refers to a period of less than 10 years. Long-term refers to a period longer than 10 years.

Impacts of Alternative 1 (No-Action Alternative)
Prevention, reseeding, and irrigation would have a beneficial effect of promoting the reestablishment of native vegetation, which could help reduce erosion and sedimentation in surface waters. Native vegetation would restore floodplains and wetlands to their natural state. The impact of cultural treatments would be directly beneficial, site-specific, long-term and moderate.

Ground disturbing activities, such as digging, pulling and tilling, may cause direct impacts to native plants. Impacts may be adverse, short-term and site-specific and minor. Floodplain or wetland functions could be temporarily reduced. However, by removing exotic vegetation, native vegetation would improve and restore natural riparian functions. A USACE 404 permit will not be required since no activities that involve dredging or filling of waters of the U.S. are proposed. The impacts of manual and mechanical treatments on floodplains or wetlands would overall be directly beneficial, site-specific, long-term, and moderate.

Use of herbicides could affect non-target plants by subjecting them to herbicide drift. Non-target plants could experience reduced vigor or death depending on the sensitivity of the plant species to the specific herbicide and the dose the plant was subjected to. To mitigate drift, use of BMPs, such as paint on chemical treatment rather than spraying, will be implemented. Overall, use of chemical controls will have infrequent adverse, short-term, minor impacts on individual wetland plants due to drift during the course of spraying targeted species. Infrequent impacts to individual plants generally have negligible to minor effects on plant populations, wetland communities, or wetland processes. The impacts of chemical treatments on floodplains or wetlands would therefore be directly adverse, site-specific, short-term, and negligible to minor.

The burning of brush piles are not conducted near wetlands and would have no measurable or perceptible effects on wetlands. Burning of brush piles may be conducted within floodplains since the large majority of tamarisk is found throughout floodplains in the parks. Pile burning projects may cause a loss of vegetation from cutting and piling vegetation and could cause negligible temporary increases in erosion and sedimentation. Flash flooding, although infrequent, could wash away unburned piles and cause moderate erosion and sedimentation as well as change channel flows with the additional cut woody debris. The impacts of burning brush piles on floodplains would be directly adverse, site-specific and short-term and negligible to moderate.

Cumulative Effects
Previous impacts to wetlands and floodplains in most areas proposed for exotic species management are due to the presence of exotic plant species, past and present exotic plant management work, and from past and present human disturbances. For

example, grazing, recreation, motor vehicle use, water diversion and irrigation, homesteads, and park and county development activities, such as road building and maintenance have a tendency to introduce exotic plants into the parks. These disturbances vary considerably as to type, intensity, and duration before and after each park was established and continue today. Exotic species are regularly establishing and expanding in all four parks. Annual spring flooding washes exotic species plant material into the parks from the upper Colorado River and Green River watersheds. Irrigation is seldom used at ARCH, CANY, HOVE and NABR and, if used, would not result in surface water depletions. This alternative would have negligible to minor additive effects on wetland communities at these parks. Surface disturbing activities may have short-term effects if conducted in wetlands. However, these effects would not likely be additive and would be temporary, lasting only until native vegetation reestablishes. Any exotic plant control by regional neighbors helps to prevent establishment of new infestations. Removal of tamarisk within floodplain zones will restore proper functioning of floodplains.

This alternative would not contribute to the adverse cumulative impacts of surface water depletions resulting from other activities in the cumulative effects area. This alternative would also have the beneficial effects of rehabilitating native floodplains and wetland communities, which would help offset the adverse cumulative impacts of other actions within the cumulative effects area. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
By controlling exotic plants, floodplains or wetlands would be rehabilitated, thus benefiting native plant species and the habitat they provide. In some areas, exotic plant management may enhance the existing wetland area or floodplain function. Removal of exotic plants that affect riparian areas (such as purple loosestrife, Russian olive, and tamarisk) would help enhance riparian habitat. Effects to wetlands and floodplains would be detectable and readily apparent. Impacts would be site-specific and effects to individual plants could be long-term. USACE permits would not be required for any proposed treatments. The minor short-term adverse impacts would be outweighed by the long-term benefits of habitat rehabilitation. The overall effects of exotic plant management on floodplains or wetlands would therefore be directly beneficial and adverse, site specific, short and long-term, and negligible to moderate. This alternative would not result in impairment to floodplains or wetlands resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Any biological control agent released in a park would be approved by APHIS and would have no demonstrated affinity for native wetland and floodplain plant species. Because biological controls target a specific exotic plant, there would be no expected impacts to non-target wetland plant species. Impacts to target plants would be direct and beneficial to wetland communities. A USACE 404 permit would not be required for any activities associated with biological control treatments. The impacts of biological treatments on wetlands and floodplains would therefore be direct beneficial effects, site specific, short-term to long-term, and moderate.

Cumulative Effects
Cumulative effects are similar to Alternative 1. This alternative would not contribute to the adverse cumulative impacts of surface water depletions resulting from other activities in the cumulative effects area. This alternative would also have the beneficial effects of rehabilitating native floodplains and wetland communities, which would help offset the adverse cumulative impacts of other actions within the cumulative effects area. IPM would have similar adverse impacts and would also have beneficial effects of rehabilitating native wetland communities. Wetland rehabilitation would help offset the adverse cumulative impacts of foreseeable actions within the cumulative effects area.

Conclusion
In some areas, IPM may enhance the existing wetland area or floodplain function. Removal of exotic plants that affect riparian areas (such as purple loosestrife, Russian olive, and tamarisk) would help enhance riparian habitat. Effects to wetlands and floodplains would be detectable and readily apparent. Impacts would be site-specific and effects to individual plants could be long-term. USACE permits would not be required for any proposed IPM treatments. Overall beneficial effects to floodplains and wetlands would be greater under this alternative with the additional treatment of bio-control agents. The minor short-term adverse impacts would be outweighed by the long-term benefits of habitat rehabilitation. The overall effects of IPM on floodplains and wetlands and would therefore be directly beneficial, site specific, long-term, and moderate. This alternative would not result in impairment to floodplain and wetland resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.8 Native Vegetation

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to vegetation were derived from the available scientific data and literature and park staff's past observations of the effects on vegetation from visitor use, oil and gas developments, and exotic plant removal. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: No native vegetation populations would be affected but some individual native plants could be affected as a result of the alternative (site-specific). The effects would be short-term, and on a small scale.

Minor: The alternative would affect some individual native plants and a relatively minor portion of that species' population (site-specific). Impacts would be short-term. Mitigation to offset adverse impacts could be required and would be effective.

Moderate: The alternative would affect individual native plants and a sizeable segment of the species' population long-term and over a relatively large area (site-specific or local). Mitigation to offset adverse impacts could be extensive, but would likely be successful.

Major: The alternative would have a considerable long-term effect on native plant populations over a relatively large local or regional area. Mitigation measures to offset the adverse impacts would be required, extensive, and success would not be guaranteed.

Duration: Short-term refers to a period of less than 10 years. Long-term refers to a period of longer than 10 years.

Impacts of Alternative 1 (No-Action Alternative)
Intrusion into parks by personnel conducting exotic plant management would cause short-term, direct impacts to vegetation from foot en route to exotic plant populations. Individual plants would be trampled resulting in reduced vigor or death depending on the stature and structure of the plant and the amount and duration of pressure applied. To reduce the impacts of park personnel on vegetation, crews will follow field standard operating procedures, such as stay on trails, use slickrock, and work in small teams. These impacts would be adverse, short-term, and negligible to moderate to individual plants. Infrequent impacts to individual plants generally do not affect plant populations, plant communities, or ecological processes. The impacts of intrusion into parks on vegetation resources would therefore be directly adverse, site-specific, short-term, and negligible to minor.

Reseeding and irrigation could have a beneficial effect of promoting the reestablishment of native vegetation at any of the four parks. The impacts of cultural treatments on vegetation resources would therefore be directly beneficial, site-specific and local, long-term, and minor.

Ground disturbing activities, such as digging, tilling and pulling, may cause minor mechanical disturbance to individual native plants. These impacts would be adverse, short-term, and moderate to individual plants. However, infrequent impacts to individual plants generally have negligible to minor impacts to plant populations, plant communities, or ecological processes. Therefore, manual/mechanical treatment would be directly adverse, site-specific, short-term and negligible to minor.

Use of herbicides could affect non-target plants by subjecting them to herbicide drift. Non-target plants could experience reduced vigor or death depending on the

sensitivity of the plant species to the specific herbicide and the dose the plant was subjected to. To mitigate drift, use of BMPs, such as paint on chemical treatment rather than spraying, will be implemented. Overall, use of chemical controls will have infrequent adverse, short-term, minor impacts on individual native plants due to drift during the course of spraying targeted species. Infrequent impacts to individual plants generally have negligible to minor effects on plant populations. The impacts of chemical treatments on native vegetation would therefore be directly adverse, site-specific, short-term, and negligible to minor.

Burning brush piles may have adverse impacts on some individual plants, but would affect a relatively small portion of the overall population. Some scorching of nearby trees and vegetation may occur while burning piles. Building piles in open areas away from trees will reduce this adverse impact to vegetation. Overall, these burn pile projects would have infrequent adverse, short-term, site-specific, minor impacts on individual plants. Infrequent impacts to individual plants generally do not impact plant populations, plant communities, or ecological processes. Pile burning could encourage the establishment of exotic plants in each small burn site. Follow-up treatments will be used to control exotic plants, like cheatgrass, after burning, as needed. The impacts of pile burning on vegetation resources are therefore directly adverse, site-specific, short-term to long-term, and minor.

Cumulative Effects

Wind, water, wildlife, visitors and vehicles regularly introduce exotic plant seeds into the park. Exotic plant populations are regularly establishing and expanding in ARCH, CANY, HOVE and NABR. Annual spring flooding washes unwanted exotic plant seed into the parks. Wildland fire, while not common, also has the ability to increase the amount of available ground for establishment of new exotic plant infestations. Surface disturbances associated with road and trail maintenance projects could lead to the establishment of exotic plants. Grazing by livestock in the past, on park lands affected the distribution, abundance and diversity of native species. Current grazing by livestock on lands adjacent to the park creates adjoining disturbed areas that contribute to the establishment of new exotic plant infestations that might spread into the park. Visitors inadvertently bring in exotic seeds on vehicles and shoes. However, treatment of exotic plants by park neighbors using chemical and biological methods is helping to control the plant infestations.

Under this alternative, all four parks would continue to treat existing and new exotic plant infestations on a priority basis. Neither alternative would result in a cumulative increase in the amount of exotic plant seeds introduced into the cumulative effects area via wind, water, wildlife, or construction disturbance. Exotic plant management within the parks under this alternative, combined with exotic plant management by park neighbors, would have a cumulative beneficial effect of reducing exotic plant seed sources. This would reduce the potential for spread of exotic plants. Current exotic plant management treatments are somewhat effective at reducing exotic plant infestations. This alternative may have negligible beneficial effects on reducing the introduction of exotic plants into the park unless exotic plant infestations outside the

park are also controlled, and disturbances to native plant communities are reduced. Removing exotic plants will be beneficial to native vegetation by reducing competition for water, nutrients and space. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
Exotic plant management would help parks to achieve the desired condition to have, as parts of the natural ecosystems of parks, all native plants maintained. The impacts of exotic plant management on vegetation resources would therefore be directly beneficial and adverse. These areas may be devoid of vegetation until native vegetation becomes reestablished through reseeding and other treatments.

The beneficial impacts of exotic plant management will promote natural native vegetative landscapes. These impacts will be directly beneficial and adverse with long-term negligible to moderate impacts depending on the exotic species population size. This alternative would not result in impairment to native vegetation resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Any biological agent released in the parks would be approved by APHIS and would have no demonstrated affinity for native plant species. Because biological control agents are specific to individual species of exotic plant, there would be negligible impacts to non-target plant species. Impacts to target plants would be direct and beneficial. No specific measures would be implemented to contain biological control agents. However, any biological control agent used would be host specific so each biological control agent would only attack one plant species (the host, or the target exotic plant). The National IPM Specialist would also further review and approve the release of any proposed biological control agents, which would help to confirm that the use of these agents would be appropriate. The impacts of biological treatments on vegetation resources would therefore be direct beneficial effects, site specific, short- to long-term, and moderate.

Cumulative Effects
Cumulative effects are the same as in Alternative 1. Neither alternative would result in a cumulative increase in the amount of exotic plant seeds introduced into the cumulative effects area via wind, water, wildlife, or construction disturbance. However, Alternative 2 would likely allow SEUG resource managers to be more responsive to treating exotic plants established within the parks. Both alternatives may have negligible beneficial effects on reducing the introduction of exotic plants into the park unless exotic plant infestations outside the park are also controlled, and

disturbances to native plant communities are reduced. Removing exotic plants will be beneficial to native vegetation by reducing competition for water, nutrients and space. Under Alternative 2, additional efforts would be made to educate adjacent landowners on the benefits of and techniques for exotic plant management.

Conclusion
IPM would help parks achieve the desired condition to have, as parts of the natural ecosystems of parks, all native plants maintained. By controlling exotic plants using IPM, native plant communities' at all four parks would be rehabilitated - thus benefiting native plant species and the habitat they provide. The minor short-term adverse impacts would be outweighed by the long term benefits to vegetation. The overall impacts of this alternative on vegetation resources would therefore be directly adverse and beneficial, site-specific and local, short- to long-term, and negligible to moderate. This alternative would not result in impairment to native vegetation resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.9 Terrestrial Wildlife

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to terrestrial wildlife were derived from SEUG staff's past observations of the effects on wildlife from visitor use, urbanization, oil and gas developments, and exotic plant removal. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Any effects to terrestrial wildlife would be at or below the level of detection, short-term, site-specific, and so slight that they would not be of any measurable or perceptible consequence to the terrestrial wildlife species' population.

Minor: Effects to terrestrial wildlife would be detectable, although short-term, site-specific, small, and of little consequence to the species' population. Mitigation measures, if needed to offset adverse impacts, would be simple and successful.

Moderate: Effects to terrestrial wildlife would be readily detectable, short- or long-term, and site-specific, with consequences at the population level. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.

Major: Effects to terrestrial wildlife would be obvious, long-term, local or regional, and would have substantial consequences to terrestrial wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse impacts and their success would not be guaranteed.

Duration: Short-term refers to a period of less than 10 years. Long-term refers to a period of longer than 10 years.

Impacts of Alternative 1 (No-Action Alternative)

Intrusion into parks by personnel conducting exotic plant management may cause short-term, negligible harassment to wildlife species. There may be some escape flight response from wildlife during these activities, but this would produce negligible short-term adverse impacts in the form of unnecessary energy expenditures. Overall effects would be slight and of little consequence to wildlife populations. The impacts of intrusion into parks on terrestrial wildlife would therefore be infrequent, directly adverse, site-specific, short-term, and negligible.

Reseeding and irrigation could have a beneficial effect of promoting the reestablishment of native vegetation and potential wildlife habitat at any of the parks. The impacts of cultural treatments on vegetation resources would therefore be directly beneficial, site-specific and local, long-term, and moderate.

Manual or mechanical treatments could have site-specific adverse impacts on ground nesting birds or burrowing animals or their food source. Management practices such as not conducting treatment during sensitive times (i.e. nesting) or leaving patches of exotics where a species is nesting, would limit these effects to being short-term and of little consequence to the species population. Removing exotics, such as tamarisk, will have an adverse impact by temporarily reducing this habitat for birds adapted to using the tamarisk thickets for escape and nesting. The impacts of manual or mechanical treatments on terrestrial wildlife would therefore be direct and adverse, site-specific, short-term, and minor. However, removing exotics like tamarisk will also open up areas and enable native vegetation to become reestablished thus providing a natural ecosystem for wildlife. Overall, the impacts of manual or mechanical treatments would be directly beneficial and adverse, site-specific, short and long-term and minor to moderate.

It is unlikely that terrestrial wildlife species would receive direct exposure to herbicides during application. It is also unlikely that wildlife would be overexposed over time if the herbicides are used according to label specifications. Wildlife species would most likely flee the area or escape to a belowground burrow/den upon the arrival of personnel conducting exotic plant management. Impacts would be small, short-term, and site-specific. The impacts of chemical treatments on terrestrial wildlife would therefore be direct and adverse, site-specific, short-term, and minor.

Direct mortality from fire from brush burning is unlikely for terrestrial wildlife. Wildlife may be indirectly affected by temporary loss of vegetation, which could cause minor losses in habitat. Loss of habitat would be site-specific and short-term and may be detectable, but would not be outside the range of natural variability. The impacts of pile burning on terrestrial wildlife would therefore be indirectly adverse, site-specific, short-term, and negligible

Cumulative Effects
Mining of oil, gas and uranium, agricultural operations, increased visitation, urban development and new roads could affect regional wildlife diversity and abundance by reducing habitats or causing habitat fragmentation and may likely affect wildlife

found inside and outside park boundaries. Air pollution from urban populations and development has produced additional minerals, such as lead and nitrogen, into the park's streams and soils, which may affect aquatic wildlife. Some current exotic plant management projects help to rehabilitate wildlife habitat and migration corridors, which helps offset the adverse impacts of foreseeable actions. Management of exotic species within all four parks would reduce sources of exotic plant seeds that could spread to lands adjacent to the parks, particularly downstream. Continuation of current exotic plant management activities would also cause some escape flight response from wildlife. However, the cumulative effects from this response would likely be negligible because the activities that induce this response would be short-term and local.

Conclusion
Although intrusions into wildlife areas and using mechanical/ manual, chemical treatments and burning brush piles would be directly adverse, site-specific, short-term and minor, exotic plant management would have an overall beneficial impact to terrestrial wildlife. Controlling exotic plants and promoting healthy native plant communities would rehabilitate terrestrial wildlife habitat in a natural state. These beneficial effects would be detectable in some areas over the long-term, and will benefit wildlife populations using these parks. The impacts of exotic plant management on terrestrial wildlife would therefore be directly beneficial and adverse, local, short- and long-term, and negligible to moderate. This alternative would not result in impairment to terrestrial wildlife resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Introductions of biological agents may have unintentional effects on the wildlife community by introducing a new food source. The effect may be positive or negative, depending on what species utilize the new food source and how closely co-evolved various members of the affected ecosystem are (e.g., birds, bats, insects, etc.). If generalists respond positively to the new food source it may increase competition to other species, causing an overall decline in specialist populations. There is also the potential risk of reducing a weed species (such as tamarisk) that is currently used as a food source or for nesting/ foraging by wildlife. However, as native species replace exotic species and plant communities are restored, it is expected that specialized wildlife would prefer the more native communities. The impacts of biological treatments on wildlife would therefore be indirectly beneficial, site-specific to local, long-term and minor to moderate.

Cumulative Effects
Cumulative effects are similar to Alternative 1. IPM would help rehabilitate terrestrial wildlife habitat within the park. The beneficial effects of IPM would help offset some

of the adverse additive impacts of other actions in the cumulative effects area by improving terrestrial wildlife habitat availability and quality, and by helping to restore habitat along migration corridors.

Conclusion
IPM would help parks achieve the desired condition to have, as parts of the natural ecosystems of parks, all native animals maintained. By controlling exotic plants and promoting healthy native plant communities, wildlife habitat would be rehabilitated at all four parks. These beneficial effects would be detectable in some areas, and may benefit wildlife populations that use these areas over the long-term. The minor, short-term, adverse impacts would be outweighed by the long-term benefits of habitat rehabilitation. The impacts of IPM on terrestrial wildlife would therefore be directly and indirectly beneficial and adverse, site-specific and local, long-term, and moderate. This alternative would not result in impairment to terrestrial wildlife resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.10 Aquatic Wildlife and Fisheries

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to aquatic wildlife and fisheries were derived from SEUG staff's past observations of the effects on aquatic wildlife and fisheries from visitor use, urbanization, oil and gas developments, and exotic plant removal. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Any effects to aquatic wildlife and fisheries would be at or below the level of detection, short-term, site-specific, and so slight that they would not be of any measurable or perceptible consequence to the terrestrial wildlife species' population.

Minor: Effects to aquatic wildlife and fisheries would be detectable, although short-term, site-specific, small, and of little consequence to the species' population. Mitigation measures, if needed to offset adverse impacts, would be simple and successful.

Moderate: Effects to aquatic wildlife and fisheries would be readily detectable, short- or long-term, and site-specific, with consequences at the population level. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.

Major: Effects to aquatic wildlife and fisheries would be obvious, long-term, local or regional, and would have substantial consequences to terrestrial wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse impacts and their success would not be guaranteed.

Duration: Short-term refers to a period of less than 10 years. Long-term refers to a period of longer than 10 years.

Impacts of Alternative 1 (No-Action Alternative)
Management practices to limit potential impacts to aquatic wildlife will vary from park to park. However, parks generally have conservation measures that are designed to minimize potential impacts to aquatic wildlife, especially during sensitive periods of the year.

Irrigation may be used on a limited basis at parks to facilitate establishment of native vegetation. Parks currently follow NPS Management policies for avoiding surface water depletions or accretions from irrigation. However, the potential effects of current irrigation programs are likely negligible on surface water flows since this tool is not often used. Impacts would be direct, adverse, site-specific, short-term and negligible. Restoring and reseeding with native vegetation in areas where tamarisk is removed will improve aquatic habitats. These impacts will be directly beneficial, site-specific, long-term and moderate.

Minor mechanical disturbance to native plants from tilling or other ground disturbing activity may result in direct or indirect effects, such as increased sedimentation, including suspended solids, which reduces dissolved oxygen levels and leads to a degraded habitat. Impacts would be detectable, site-specific, and short or long-term. The impacts of manual and mechanical disturbance on aquatic wildlife and fisheries would therefore be directly or indirectly adverse, site-specific, short-term to long-term, and minor.

It is unlikely that aquatic wildlife species would receive direct exposure to herbicides during application, and it is also unlikely that they would be overexposed if the herbicides are used according to label specifications. Use of herbicides registered for use in or near water (such as glyphosate) would not pose a risk to aquatic communities or other standing water environments and would not be detectable. Impacts resulting from the use of herbicides would not be expected to have any long-term adverse impacts on native aquatic wildlife species, their habitats, or natural processes sustaining them. The impacts of chemical treatments on aquatic wildlife and fisheries would therefore be direct, site-specific, short-term, and negligible.

Direct mortality from fire from brush burning is unlikely for aquatic organisms. Aquatic organisms may be indirectly affected by temporary loss of vegetation, which could cause minor increases in erosion and sedimentation. Increases in sedimentation would be site-specific and short-term and may be detectable, but would not be outside the range of natural variability. The impacts of pile burning on aquatic wildlife and fisheries would therefore be indirectly adverse, site-specific, short-term, and negligible.

Cumulative Effects
Improperly applied chemicals or use of unapproved chemicals by private landowners could have moderate adverse impacts on local aquatic resources. Continued exotic plant management conducted in accordance with NPS guidelines and policies would likely have negligible adverse impacts on aquatic wildlife and fisheries. This

alternative would not likely contribute to increased levels of fertilizer in the river. Alternative 1, when combined with other impacts, would result in overall negligible to minor additive adverse impacts to aquatic wildlife and fisheries. ARCH is proposing to develop a Climbing Management Plan which will be consistent with this final plan. CANY is also in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park. Both would be consistent with this final plan. HOVE is currently developing a draft General Management Plan which would be consistent with this final plan also.

Conclusion
Although using irrigation, mechanical/ manual, and chemical treatments would be directly adverse, site-specific, short-term and negligible to minor, exotic plant management would have an overall beneficial impact to aquatic wildlife and fisheries. Controlling exotic plants and promoting healthy native plant communities would rehabilitate aquatic wildlife habitat thus improving the likelihood that aquatic wildlife and fisheries will be preserved in a natural state. The impacts of exotic plant management on aquatic wildlife and fisheries would therefore be directly beneficial and adverse, site-specific, long-term, and moderate. This alternative would not result in impairment to aquatic wildlife and fisheries. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

The additional biomass created by the introduction of biological control agents may indirectly benefit some aquatic species that prey on terrestrial insects. The impacts of biological treatments on aquatic wildlife and fisheries would therefore be indirectly beneficial, site-specific, short-term, and minor.

Cumulative Effects
Cumulative effects are similar to Alternative 1. However, in ARCH, the potential for herbicides to reach the Colorado River, Courthouse Wash or Salt Wash may be lower under Alternative 2 because BMPs would be implemented to carefully control the conditions under which herbicides are applied. ARCH is proposing to develop a Climbing Management Plan which will be consistent with this final plan. In CANY, the potential for herbicides to reach the Green and Colorado Rivers or aquatic systems in Salt Creek may be lower under Alternative 2 because BMPs would be implemented to carefully control the conditions under which herbicides are applied. CANY is also in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park. Both would be consistent with this final plan. HOVE is currently developing a draft General Management Plan which would be consistent with this final plan also.

Conclusion
By controlling exotic plants and promoting healthy native riparian communities, aquatic communities at any of the four parks could indirectly benefit from IPM. Indirect benefits include restoration of ecosystem structure and surface water hydrology. Beneficial effects would be detectable in some areas that have reduced sedimentation once native plant communities are rehabilitated. The minor, short-term, adverse impacts would be outweighed by the long-term benefits to aquatic habitat. The impacts of exotic plant management on aquatic wildlife and fisheries would therefore be indirectly beneficial, directly adverse, local, short- and long-term, and negligible to moderate. This alternative would not result in impairment to aquatic wildlife and fisheries resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.11 Threatened, Endangered and Species of Concern

Methodology and Intensity Thresholds

Identification of state and federally listed species and designated critical habitats was accomplished through discussions with SEUG staff, informal and formal consultation with Utah and Colorado USFWS Field Offices and reviewing the Utah and Colorado Division of Wildlife natural heritage databases. A letter requesting a current list of federal threatened, endangered, and special concern species was sent to the U.S. Fish and Wildlife Service. The Utah Division of Wildlife Resources and Colorado Division of Wildlife were also contacted to identify state threatened, endangered and special concern species.

Negligible: No federal or state listed species would be affected, or the alternative would affect an individual of a listed species or its critical habitat, but the change would be so small that it would not be of any measurable or perceptible consequence to the protected individual or its population. Any impact would be site-specific and short-term. Negligible effect would equate with a "no effect" determination.

Minor: The alternative would affect an individual(s) of a listed species or its critical habitat, but the change would be small. The impact would be site-specific and short-term. Minor effect would equate with a "may effect" determination in USFWS terms, and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species.

Moderate: An individual or population of a listed species or its critical habitat would be noticeably affected. The effect could have some long-term consequence to the individual, population, or habitat. The impact could be site-specific or local in context. Moderate effect would equate with a "may effect" determination in USFWS terms and would be

accompanied by a statement of "likely…" or "not likely to adversely affect" the species. State species of concern could also be affected.

Major: An individual or population of a listed species or its critical habitat would be noticeably affected with a long-term, vital consequence to the individual, population, or habitat. The impact would be local or regional in context. Major effect would equate with a "may effect" determination in USFWS terms and would be accompanied by a statement of "likely…" or "not likely to adversely affect" the species or critical habitat.

Duration: Short-term refers to a period of 1-3 years. Long-term refers to a period longer than 3 years.

Impacts of Alternative 1 (No-Action Alternative)
A number of committed conservation measures (Sec 2.3.1) have been developed to mitigate potential impacts to threatened and endangered species and species of special concern. Although candidate species are not afforded any protection under the ESA, efforts would be made to avoid or minimize potential impacts to these species as well.

Mexican spotted owl-
Under this alternative, there would be adverse, site specific, short-term minor impacts to MSO. The owls that were heard in CANY occupy relatively inaccessible areas like canyon cliff walls. Personnel and vehicle intrusion would therefore be negligible and site specific. Cultural treatments would have negligible impacts as well. However, removal of tamarisk via mechanical or chemical treatments could have an indirect adverse, site-specific, short-term, and minor impact on the owls by decreasing the habitat, like tamarisk, of the MSO's prey.

It is unlikely that MSO would receive direct exposure to herbicides during application, and it is also unlikely that they would be overexposed to herbicides over time when herbicides are applied under label specification. The impacts of chemical treatments on the MSO would therefore be direct and indirect adverse, site-specific, short-term, and minor. It is also unlikely that pile burning would directly affect MSO since piles would not be constructed in areas were MSO are likely to occupy. The impacts of pile burning on the MSO would therefore be indirectly adverse, site specific, short-term, and negligible.

Southwestern willow flycatcher-
Southwestern willow flycatchers are not known to nest within SEUG boundaries, though suitable habitat may be present along small, scattered portions of the Colorado and Green River and their vegetated tributaries.

There is the possibility that exotic plant management treatments in close proximity to riparian areas could have short and long-term indirect impacts to the southwestern willow flycatcher. The presence of staff and volunteers performing exotic control activities and use of some types of mechanized equipment, such as chainsaws, in close proximity to occupied habitats (should occupation ever occur) could disrupt

normal behavior of nesting flycatchers, possibly resulting in nest abandonment or failure. Mechanical or manual removal of tamarisk will have an adverse impact by temporarily reducing this habitat for the southwestern willow flycatcher who has adapted to using the tamarisk thickets for escape and nesting. The impacts of manual or mechanical treatments on the southwestern willow flycatcher would therefore be direct and adverse, site-specific, short-term, and minor to moderate.

Removing exotics like tamarisk would also open up areas and enable native vegetation like the cottonwoods and willows to become reestablished thus providing a natural ecosystem for preserving this species. Reseeding these areas would also have long-term beneficial impacts. The impacts of manual or mechanical and cultural treatments could also be directly beneficial, site-specific, long-term and moderate.

Misuse or accidental spills/drift of certain herbicides for exotic control that can kill or damage established beneficial riparian vegetation (cottonwoods-willows) that flycatchers prefer for nest sites and foraging can have long term indirect impacts for flycatcher nesting success. It is unlikely that the southwestern willow flycatcher would receive direct exposure to herbicides during application, and it is also unlikely that they would be overexposed to herbicides over time when herbicides are applied under label specification. The impacts of chemical treatments on the flycatcher would therefore be direct and indirect adverse, site-specific, short-term, and minor.

Pile burning will not directly affect the southwestern willow flycatcher because brush piles will not be burned in areas that could affect these species during their nesting and migration periods. The impacts of pile burning on the flycatcher would therefore be indirectly adverse, site specific, short-term, and negligible.

California condor-
Under this alternative, the impact to the California condor would be direct, site-specific, short-term and negligible. Although there is potential habitat for the condor, there is no real abundance of large prey to maintain a California condor population. Also there are no known nesting sites or observations of this endangered bird. Any exotic plant management impacting the condor would be unlikely.

Yellow-billed cuckoo-
Although the yellow-billed cuckoo does not require as dense habitat as the southwestern willow flycatcher, the potential impacts for the cuckoo are the same as the flycatcher.

Yellow-billed cuckoos are not known to nest within SEUG boundaries, though suitable habitat may be present along small, scattered portions of the Colorado and Green River and their vegetated tributaries.

There is the possibility that exotic plant management treatments in close proximity to riparian areas could have short and long-term indirect impacts to the yellow-billed cuckoo. The presence of staff and volunteers performing exotic control activities and

use of some types of mechanized equipment, such as chainsaws, in close proximity to occupied habitats (should occupation ever occur) could disrupt normal behavior of nesting cuckoos, possibly resulting in nest abandonment or failure. Mechanical or manual removal of tamarisk will have an adverse impact by temporarily reducing this habitat for the cuckoo which has adapted to using the tamarisk thickets for escape and nesting. The impacts of manual or mechanical treatments on the yellow-billed cuckoo would therefore be direct and adverse, site-specific, short-term, and minor to moderate.

Removing exotics like tamarisk would also open up areas and enable native vegetation like the cottonwoods and willows to become reestablished thus providing a natural ecosystem for preserving this species. Reseeding these areas would also have long-term beneficial impacts. The impacts of manual or mechanical and cultural treatments could also be directly beneficial, site-specific, long-term and moderate.

Misuse or accidental spills/drift of certain herbicides for exotic control that can kill or damage established beneficial riparian vegetation (cottonwoods-willows) that cuckoos prefer for nest sites and foraging can have long term indirect impacts for yellow-billed cuckoo nesting success. It is unlikely that the yellow-billed cuckoo would receive direct exposure to herbicides during application, and it is also unlikely that they would be overexposed to herbicides over time when herbicides are applied under label specification. The impacts of chemical treatments on the cuckoo would therefore be direct and indirect adverse, site-specific, short-term, and minor.

Pile burning will not directly affect the yellow-billed cuckoo because brush piles will not be burned in areas that could affect these species during their nesting and migration periods. The impacts of pile burning on the cuckoo would therefore be indirectly adverse, site specific, short-term, and negligible.

Black-footed ferret-

The impacts of current exotic plant treatment on the black-footed ferret could be site-specific, short-term and negligible. No direct impacts are anticipated to black-footed ferrets, primarily because of their nocturnal nature and their ability to avoid any direct contact with people, equipment, or other animals by escaping into prairie dog burrows. Although there is potential habitat for the ferret, there is no real abundance of prairie dog prey to maintain a black-footed ferret population and no black-footed ferrets have been found in the parks. Any exotic plant management impacting the ferret would be unlikely.

Should exotic plant management activities occur in ferret-occupied habitat, ferret's primary prey species in this area (prairie dogs) may be reduced if desirable vegetation that is used as food by prairie dogs is temporarily reduced or eliminated if herbicide control treatments are improperly performed. Also, use of vehicles in the area for treatments could compact or destroy burrow entrances.

Colorado pikeminnow, Razorback sucker, Humpback chub and Bonytail chub-

Overall, these fish species should benefit from the implementation of the Exotic Plant Management Plan. Removal of riparian exotic plant species, especially tamarisk, will assist in improving habitat for these species by preserving cobble bars and maintaining naturally occurring alluvial sediment deposit dynamics and features that create slower moving water. Erosion within the Green and Colorado River basin has always played a factor in the maintenance of habitats important to these fishes.

There is the potential for erosion due to the manual or mechanical removal of soil stabilizing vegetation on banks, bars, and islands associated with the Green and Colorado Rivers. Loss of vegetation could result in temporary increases in surface water runoff. However, these fish are well adapted to the high silt load conditions of the Green and Colorado Rivers. Potential increases in sediment resulting from the implementation of the EPMP would have negligible effects to these fishes or designated critical habitats, and could be beneficial by limiting productivity of non-native fishes that are not adapted to high silt conditions and by maintaining or restoring un-vegetated spawning and nursery habitat. Impacts would be detectable, site-specific, and short or long-term. The impacts of manual and mechanical disturbance on fish species would therefore be directly or indirectly adverse, site-specific, short-term to long-term, and minor.

It is unlikely that these fish species would receive direct exposure to herbicides during application, and it is also unlikely that they would be overexposed if the herbicides are used according to label specifications. Use of herbicides registered for use in or near water (such as glyphosate) would not pose a risk to these fish and would not be detectable. Impacts resulting from the use of herbicides would not be expected to have any long-term adverse impacts on native endangered fish, their habitats, or natural processes sustaining them. The impacts of chemical treatments on these fish species would therefore be direct, site-specific, short-term, and negligible.

Direct mortality from fire from brush burning is unlikely for fish. These fish may be indirectly affected by temporary loss of vegetation, which could cause minor increases in erosion and sedimentation. Increases in sedimentation would be site-specific and short-term and may be detectable, but would not be outside the range of natural variability. The impacts of pile burning on the fish would therefore be indirectly adverse, site-specific, short-term, and negligible.

Jones cycladenia-

Prior to implementation of mechanical controls, areas that are potential habitat for *Cycladenia humillis var. jonseii* will be surveyed. If they are found in the vicinity of the treatment area, treatments will be limited to ones that are unobtrusive or to times of year when the listed species are not present or less affected by disturbance. The impacts of manual/mechanical treatments will be direct adverse, site-specific, short-term and negligible.

Herbicide use will be avoided in the vicinity of *Cycladenia humillis var. jonseii*. Potential impacts of chemical treatments will be direct, adverse, site specific, short-term and negligible.

Burning of brush piles would not be conducted in or near *Cycladenia humillis var. jonseii* habitat. Therefore impacts will be negligible.

Cumulative Effects
The definition of cumulative effects under Section 7 of the ESA is "those effects of future State or private activities, not involving Federal activities, which are reasonably certain to occur within the action area of the Federal action subject to consultation." However, because the action area for this analysis and decision is limited to the Federal acreage of Canyonlands National Park, there are no cumulative effects under the ESA definition. Therefore, the cumulative impacts analysis at the end of this section refers solely to the NEPA definition of cumulative impacts.

Mining of oil, gas and uranium, agricultural operations, increased visitation, urban development and new roads could affect in T&E species found inside and outside park boundaries by causing habitat fragmentation and a reduction in habitats. Management activities within the parks would likely have negligible beneficial cumulative effects on areas located outside the four park boundaries that are impacted by mining and agricultural activities. If these activities further degrade wildlife habitat quality outside of the parks, exotic plant management activities within the parks may have an indirect effect. These effects could include increasing wildlife use of habitat within the parks as habitat quality improves relative to the quality of habitat available on surrounding lands.

ARCH has three federally listed endangered species, the southwestern willow flycatcher (*Empidonax traillii extimus*), the black-footed ferret (*Mustela nigripe*) and the Jones cycladenia (*Cycladenia humillis var. jonesii*). However, the southwestern willow flycatcher is rare and probably only migratory through the park, there are some appropriate prey available for the ferret, though it has not actually been sighted in the park, and the Jones cycladenia is know to live near the park, but again has not been reported in the park. ARCH also has a number of sensitive bat species but none are federally classified as threatened or endangered.

CANY has six federally listed endangered species; four are fish: Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*) and bonytail chub (*Gila elegans*). The fifth is the southwestern willow flycatcher (*Empidonax traillii extimus*), for which surveys have been completed and the bird has been observed in the park, but no breeding sites have been found (Johnson 1999, 2000). The sixth is the yellow billed cuckoo *(Coccyzus americanus occidentalis)*. As with the southwestern willow flycatcher, survey's conducted in CANY in1999 through 2001, the cuckoo has been observed but no breeding sites have been found (Johnson, 2002). CANY also has a number of sensitive plant species but none are federally classified as threatened or endangered. The park is also in the process of developing a river management plan and a

commercial services plan which would affect the current use of the rivers and the commercial use of the park. Both would be consistent with this final plan.

No threatened or endangered species are known to exist in HOVE at this time. However, the Gunnison sage grouse (*Centrocercud urophasianus* var *gunnisonii*) is a sensitive species found in HOVE. There is a possibility that the Mexican spotted owl (*Strix occidentalis lucida*) and the southwest willow flycatcher (*Empidonaz traillii extimus*) could be found once surveys are conducted. The monument staff is currently developing a draft General Management Plan which would be consistent with this final plan.

Currently the peregrine falcon (*Falco peregrinus*) has been delisted but is still of concern at NABR. A breeding pair of peregrine falcons has nested successfully within the monument since 1993 breeding season. The location of the aerie has changed with each breeding season, but has remained within a discrete area. Ongoing monument operations, construction, visitor use, and maintenance activities may impact plant species of concern, such as the rare Kachina Daisy (*Erigeron kachinensis*). However, these effects (of specific projects) are mitigated through environmental planning such as not using herbicides near rare plant species.

This alternative is not expected to contribute to adverse cumulative impacts on these populations because a number of species-specific conservation measures would be implemented under this alternative to protect habitat of T&E and species of concern. As a result, this alternative is not expected to have additive adverse cumulative impacts on T&E species or species of concern.

Conclusion
Controlling exotics plants and promoting healthy native plant communities would restore and improve quality habitat for all wildlife, including T&E species. Any minor and short-term adverse impacts would be outweighed by the long-term benefits of habitat restoration. These beneficial effects would be detectable in some areas over the long-term, and may benefit some listed species using these areas. The impacts of current management practices overall on T&E species would therefore be directly beneficial and adverse, site-specific, short and long term, and minor to moderate. Exotic plant management may affect, but would not adversely affect federally listed threatened and endangered species. This alternative would not result in impairment to T&E species or associated habitat. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
A Biological Assessment (BA) was prepared for this project to evaluate its potential effects on federally listed T&E species (Appendix K). The BA evaluates the potential effects of implementing the proposed action on T&E species that are known to occur, or that have potential to occur, in the plan area. A number of conservation measures have been developed to mitigate potential impacts to T&E species and are fully

described in the BA as well as in Section 2.3.1. These measures are considered part of the proposed action. Although candidate species are not afforded any protection under the ESA, efforts will be made to avoid or minimize potential impacts to these species.

Based on the analysis in the BA, one of three possible determinations was chosen for each listed species based on the best available scientific literature, a thorough analysis of the potential effects of the plan, and the professional judgment of the biologists and ecologists who completed the evaluation. The three possible determinations are:

"No effect" – where no effect is expected;

"May affect - not likely to adversely affect" – where effects are expected to be beneficial, insignificant (immeasurable), or discountable (extremely unlikely); and

"May affect - likely to adversely affect" – where effects are expected to be adverse or detrimental.

Mexican spotted owl-Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Because biological control agents are specific to a target exotic plant, there would be no known direct impacts to MSO. The additional biomass created by the introduction of biological control agents may indirectly benefit T&E species that prey on terrestrial insects. However, MSO prey on rodents and the impacts of biological treatments to MSO would therefore be negligible.

Summary
It is anticipated that the Mexican spotted owl will benefit overall from the implementation of the EPMP as exotic species spread and introduction is expected to decrease when the full range of IPM is used. Therefore, it is the determination that the proposed implementation of the EPMP *may affect but is not likely to adversely affect the Mexican spotted owl*.

Southwestern willow flycatcher- Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Though flycatchers are documented most frequently nesting in dense willow thickets they have been known to occupy tamarisk thickets. Biological control agents released for tamarisk control may cause the temporary loss of nesting habitat available to this and other migratory bird species. The impacts of biological treatments on the southwestern willow flycatcher would therefore be direct and adverse, site-specific, short-term, and minor to moderate.

The additional biomass created by the introduction of biological control agents may indirectly benefit the southwestern willow flycatcher that preys on terrestrial insects. The impacts of biological treatments on the flycatcher would therefore be indirectly beneficial, short-term and minor.

Summary
There is the potential for direct and indirect impacts. Misuse of herbicides or accidental spills may kill or damage cottonwoods southwestern willow flycatchers use for nesting. Vegetation treatments in close proximity to nesting southwestern willow flycatchers may alter normal behavior, resulting in missed foraging opportunities or failed/abandoned nests. The conservation measures should adequately reduce any adverse impacts to southwestern willow flycatchers and their potential habitat. No birds are known to nest within the SEUG. Implementation of the EPMP is expected overall to improve southwestern willow flycatcher habitat over the long term primarily by removing exotic species and allowing native cottonwoods and willow to re-colonize riparian corridors and allow greater diversity and perhaps abundance of insects eaten by flycatchers. Therefore, implementation of the EPMP with the conservation measures *may affect but is not likely to adversely affect the southwestern willow flycatcher*.

California condor- Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Because biological control agents are specific to a target exotic plant, there would be no known direct impacts to the California condor. The additional biomass created by the introduction of biological control agents may indirectly benefit T&E species that prey on terrestrial insects. However, the condor preys on large mammals and the impacts of biological treatments to the California condor would therefore be negligible.

Summary
There are no direct or indirect impacts to the California condor. No birds are known to nest within the SEUG. It is anticipated that the condor will benefit overall from the implementation of the EPMP as exotic species spread and introduction is expected to decrease when the full range of IPM is used. Therefore, it is the determination that the proposed implementation of the EPMP *may affect but is not likely to adversely affect the California condor*.

Yellow-billed cuckoo-
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Though yellow-billed cuckoo are documented most frequently nesting in cottonwood woodlands they have been known to occupy tamarisk thickets. Biological control agents released for tamarisk control may cause the temporary loss of nesting habitat available to this and other migratory bird species. The impacts of biological treatments on the cuckoo would therefore be direct and adverse, site-specific, short-term, and minor to moderate.

The additional biomass created by the introduction of biological control agents may indirectly benefit the yellow-billed cuckoo that preys on terrestrial insects. The

impacts of biological treatments on the cuckoo would therefore be indirectly beneficial, short-term and minor.

Summary
There is the potential for direct and indirect impacts. Misuse of herbicides or accidental spills may kill or damage cottonwoods cuckoos use for nesting. Vegetation treatments in close proximity to nesting yellow-billed cuckoos may alter normal behavior, resulting in missed foraging opportunities or failed/abandoned nests. The conservation measures should adequately reduce any adverse impacts to yellow-billed cuckoos and their potential habitat. No birds are known to nest within the SEUG. Implementation of the EPMP is expected overall to improve yellow-billed cuckoo habitat over the long term primarily by removing exotic species and allowing native cottonwoods and willow to re-colonize riparian corridors and allow greater diversity and perhaps abundance of insects eaten by cuckoos. Therefore, implementation of the EPMP with the conservation measures *may affect but is not likely to adversely affect the yellow-billed cuckoo.*

Black-footed ferret-
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Biological control treatments would not have any measurable or perceptible effect on the black-footed ferret. The impacts of biological treatments on the ferret would therefore be negligible.

Summary
No direct effects are anticipated to black-footed ferrets. There is the potential for short-term damage to burrow entrances by vehicles used in weed control or for a short-term reduction in their primary food source if desirable vegetation (for white-tailed or Gunnison prairie dogs) is damaged or eliminated by misuse of chemical weed treatments. The conservation measures should adequately reduce any adverse impacts to black-footed ferrets and their potential habitat should weed control become necessary in occupied habitat. No ferrets are known to be present within SEUG at this time. It is anticipated that the black-footed ferret will benefit overall from the implementation of the EPMP due to overall improvement of native vegetation composition, diversity, abundance, and health that supports active and healthy white-tailed or Gunnison prairie dog communities. Therefore, it is the determination that the proposed implementation of the EPMP with the conservation measures *may affect but is not likely to adversely affect the black-footed ferret.*

Colorado pikeminnow, Razorback sucker, Humpback chub and Bonytail chub-
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

The additional biomass created by the introduction of biological control agents may indirectly benefit these fish that prey on terrestrial insects. The impacts of biological

treatments on the fish would therefore be indirectly beneficial, site-specific, short-term, and minor.

Summary
There is the potential for direct and indirect short-term, site-specific impacts. Herbicides can be toxic to fish in general and may affect populations. The conservation measures should adequately reduce likelihood of negative impacts. It is anticipated that these native Colorado and Green River fish will benefit overall from the implementation of the EPMP, as there are situations in the SEUG where particular riparian exotic species (namely tamarisk and Russian olive) grow up to the water's edge and within channel and indirectly threaten critical habitat for riparian and aquatic T&E species. Research has demonstrated that tamarisk contributes to channel narrowing and alters fluvial sediment deposition processes, which in turn degrades reproductive habitat for these fish by converting cobble bars used for spawning into unusable sandbars. Removal of these exotic species is expected to contribute towards the overall restoration of stream geomorphology and channel characteristics, which may promote and contribute to recovery efforts of these fish species.

Therefore, it is the determination that the proposed implementation of the EPMP with the conservation measures *may affect but is not likely to adversely affect these four endangered fish or their habitat.*

Jones cycladenia-
Potential impacts are the same as under Alternative 1 with the exception of the following treatment method:

Any biological agent released in the parks would be approved by APHIS and would have no demonstrated affinity for native plant species. Because biological control agents are specific to individual species of exotic plant, there would be negligible impacts to non-target plant species. Impacts to target plants would be direct and beneficial. No specific measures would be implemented to contain biological control agents. However, any biological control agent used would be host specific so each biological control agent would only attack one plant species (the host, or the target exotic plant). The National IPM Specialist would also further review and approve the release of any proposed biological control agents, which would help to confirm that the use of these agents would be appropriate. The impacts of biological treatments on the Jones cycladenia would therefore be direct beneficial effects, site specific, short- to long-term, and minor.

Summary
Therefore, it is the determination that the proposed implementation of the EPMP with the conservation measures *may affect but is not likely to adversely affect the Jones cycladenia or its habitat.*

Cumulative Effects

Cumulative effects are similar to Alternative 1. Neither alternative is expected to contribute to adverse cumulative impacts on these plant species populations because only target exotic plants would be treated to the extent feasible. The potential for cumulative adverse impacts to state plant species of concern would likely be lower under Alternative 2 because buffer areas would be established around these plants to reduce the potential for impacts. A number of species-specific conservation measures would be implemented under both alternatives to protect T& E habitat. As a result, neither alternative is expected to have additive adverse cumulative impacts on T&E species.

Conclusion
As summarized on Table 4-1, IPM may affect, but would not adversely affect federally listed threatened and endangered species. IPM would help parks maintain the desired condition to have populations of native plant and animal species functioning in as natural condition as possible and extirpated native plant and animal species to parks restored. This alternative would not cause impairment to T&E species or their habitat. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.12 Wilderness

Methodology and Intensity Thresholds
Analyses of the potential intensity of impacts to wilderness were derived from SEUG staff's knowledge of the wilderness and assessing the effect of the alternatives on both the wilderness user and the wilderness setting. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Effects to wilderness character or experience would be slight, and would be much localized in area and very short in duration (a day or less). The action would not cause a fundamental change in the character of recommended wilderness.

Minor: Effects to wilderness character or experience would be relatively small, and would be localized in area or short in duration. The action would not cause a fundamental change in the character of recommended wilderness.

Moderate: Effects to wilderness character or experience, including the size of the area affected and the duration would be intermediate. The action would not cause a fundamental change in the character of recommended wilderness. Mitigation measures to offset adverse effects would probably be necessary and likely successful.

Major: Effects to wilderness character or experience, including the size of the area affected and the duration would be substantial. The action would cause a fundamental change in the character of recommended wilderness. Mitigation to offset adverse effects would be needed, but its success not assured.

Duration: Short-term refers to a transitory effect, one that largely disappears over a period of hours or days. The duration of long-term effects is months or years.

Impacts of Alternative 1 (No-Action Alternative)
A temporary change in the four definitions of Wilderness character and associated values would occur during exotic plant management activities. Some aspects of exotic plant management may also be intrusive on the Wilderness experience. Potential impacts of various treatments on Wilderness are listed below:

Noise from chainsaws or mowers, which would only be selected by using minimum requirement analysis, would have a minor adverse effect on Wilderness character. The "imprint of man's work" and the lack of "solitude and primitive experience" would be noticeable but would be short-term and site-specific.

The visual intrusion of treated areas with cut stumps, dead vegetation, unnatural openings and burn piles would not look like they had been "affected primarily by the forces of nature" and again would have the "imprint of man's work". This visual man-made intrusion will have a minor to moderate, short-term, site-specific impact on Wilderness character.

The presence of park personnel and equipment could directly or indirectly impact visitor solitude and self-discovery in Wilderness areas by affecting the "solitude and primitive unconfined type of recreation" they can experience in treated areas. This impact will be direct, adverse, minor, short-term and site-specific.

Cumulative Effects
Past land uses, including ranching and agriculture, mining of gas, oil and uranium and developing seismic lines affect Wilderness areas. Existing roads, paved and unpaved, within recommended and potential Wilderness areas have affected its "pristine" nature. Many of the above impacts are not very evident to the public. Examples of these disturbances include barbed wire fragments and changes in native plant communities. Wilderness designation of an area affects motorized access and methods/tools that can be used in large areas of the park, sometimes substantially increasing the amount of effort or funds required to accomplish projects compared to other areas of the park. Park operations using mowers, ATVs, aircraft or large work crews can degrade the Wilderness experience, even though minimum requirement analyses are used. Oil and gas well activities outside park boundaries and traffic such as overflights or scenic airplane tours in areas adjacent to Wilderness could degrade Wilderness experience, both from sight and sound. ARCH is proposing to develop a Climbing Management Plan and CANY is also in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park. All plans would be consistent with this final plan.

Conclusion

All these intrusions are site-specific and short-term adverse impacts on Wilderness and they will be noticeable to Wilderness visitors. The impacts of exotic plant management on Wilderness would therefore be direct and indirect, site-specific, short-term, and moderate. The reduction or elimination of exotic plants would help to rehabilitate naturalness sought by visitors to Wilderness areas. A beneficial change in Wilderness character and quality would occur that would be measurable, but site-specific. The overall, impacts of exotic plant management on Wilderness would therefore be directly beneficial and adverse, site-specific, short and long-term, and moderate. This alternative would not result in impairment to Wilderness resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
In addition to the BMPs in Section 2.3, the following will be implemented under this alternative:

- With regard to using aircraft and ATVs, the Minimum Requirement Decision Guide (Appendix H) will be used to determine whether the action is first necessary, then determines the alternatives (equipment, device, force, or practice) for how to accomplish the action that will achieve both Wilderness and IPM objectives.

Potential impacts are the same as under Alternative 1 with the exception of the following treatment methods:

Although aircraft are rarely used, they would be used only on major projects once every 5 to 10 years and could affect Wilderness character by demonstrating the "imprint of man's work" and affecting a "solitude and primitive experience". Therefore aircraft would have an adverse, short-term, local, minor impact to Wilderness character.

Any biological control agent released in a park would be approved by APHIS and would have no demonstrated affinity for native species. This method of treatment would affect the "forces of nature" and the "outstanding opportunities for solitude or a primitive and unconfined type of recreation". Because biological control agents are specific to a species of exotic plant, there would be negligible adverse impacts to native plant species. No specific measures would be implemented to contain biological control agents. Impacts to native or desirable (non-target) plants would be indirect and beneficial. The impacts of biological treatments on preserving Wilderness characteristics would therefore have indirect beneficial effects and be site-specific to local, long-term, and minor to moderate.

Cumulative Effects
Cumulative effects are similar to Alternative 1. However, IPM would help offset potential additive impacts from foreseeable actions in the cumulative effects area. IPM would help to rehabilitate native plant communities and wildlife habitat in

Wilderness areas. Negligible to minor short-term additive effects would likely occur from IPM because general BMPs and species-specific BMPs would be implemented.

Conclusion
There would be beneficial change in Wilderness character and quality that would be measurable and site-specific. The minor, short-term, adverse impacts would be outweighed by the long-term benefits to Wilderness preservation.
A temporary change in Wilderness character and associated values would occur during exotic plant management activities. Some aspects of IPM may intrude on the Wilderness experience. The presence of mechanized equipment, such as aircraft and ATVs, would be most notable. The presence of park personnel and equipment could impact visitor solitude and self-discovery in Wilderness areas. A reduction or elimination of exotic plants would ultimately restore the character sought by visitors to Wilderness areas. The impacts of IPM on Wilderness would therefore be directly beneficial and indirectly adverse, site-specific, short-term and long-term, and minor to moderate. This alternative would not result in impairment to Wilderness resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.13 Archeological Resources

Methodology and Intensity Thresholds

In order for an archeological resource to be eligible for the National Register of Historic Places it must meet one or more of the following criteria of significance: A) associated with events that have made a significant contribution to the broad patterns of our history; B) associated with the lives of persons significant in our past; C) embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; D) have yielded, or may be likely to yield, information important in prehistory or history. In addition, archeological resource must possess integrity of location, design, setting, materials, workmanship, feeling, association (National Register Bulletin, Guidelines for Evaluating and Registering Archeological Properties).

For purposes of analyzing impacts to archeological resources either listed in or eligible to be listed on the National Register, the thresholds of change for intensity of impacts are defined below:

Negligible: Impacts to archeological resources either beneficial or adverse are at the lowest levels of detection, barely perceptible and not measurable.

Minor: *Adverse:* disturbance of a site(s) results in little, if any, loss of significance or integrity and the National Register eligibility of the site(s) is unaffected.

Beneficial: maintenance preservation of a site(s).

Moderate: *Adverse:* disturbance of a site(s) does not diminish the significance or integrity of the sites to the extent that its National Register eligibility is jeopardized.

Beneficial: stabilization of the site(s).

Major: Adverse: disturbance of a site(s) diminishes the significance and integrity of the sites to the extent that it is no longer eligible to be listed in the National Register.

Beneficial: stabilization of the site(s).

Duration: Short-term refers to a transitory effect, one that largely disappears over a period of days or months. The duration of long-term effects is essentially permanent.

Impacts of Alternative 1 (No-Action Alternative)
Exotic plant management activities would only be used where necessary to promote the reestablishment of native plant communities.

Ground disturbing restoration or re-vegetation activities such as cultivation, raking, digging, and vehicle and foot traffic could potentially damage previously undiscovered archeological sites. These types of activities would not be allowed within the boundaries of unsurveyed areas. The above activities would only be allowed within areas that have been surveyed and treatments performed only after park resource managers have inspected potential worksites, consulted with SHPO and appropriate mitigation strategies have been developed. The removal of exotic plant species from around archeological sites will be beneficial by preventing exotics from degrading site integrity. The impacts of cultural controls to archeological resources would therefore be directly adverse, site-specific, short to long-term and negligible to minor.

Ground-disturbing activities, such as digging and pulling, could damage sensitive and fragile archeological sites. Surface disturbing activities, such as digging, pulling, tilling or use of heavy equipment, will not be allowed with the boundary of identified and eligible archeological resources. Only handcutting of exotic vegetation and applying a basal chemical to stump will be permitted. Portable spraying allows for treatment of individual plants and the spray can be directed within an inch of the target plant. Exotic vegetation will be cut into manageable sizes and left. No ground disturbance will be permitted. No dragging material and building brush piles permitted. The impacts of manual and mechanical treatments to archeological resources would therefore be adverse, site specific, short-term and negligible.

The potential short and long-term effects of herbicides on archeological resources made of various materials, such as wood and stone, are not well understood. Use of herbicides within the boundaries of archeological resources would be restricted. Because of unknown effects, herbicides would not be directly applied to rock art or archeological resources with sandstone grout, hearth features, or cultural resources comprised of organic material, bone, pollen, seeds, and materials made from plant

fiber. Physical disturbance to archeological resources would be avoided. However, herbicides may be used in lands surrounding archeological resources in accordance with BMPs (page 71). The adverse impacts of chemical treatments to archeological resources would therefore be adverse, site specific, short-term and negligible.

Burning brush piles could impact archeological resources. The smoke from burning the piles could have an adverse affect to rock art. BMPs would be used to mitigate the impact of smoke on archeological resources. Therefore, pile burning will have a direct adverse, short-term, site-specific, negligible to minor impact to archeological resources.

Cumulative Effects
Past land practices (prior to park establishment), such as ranching and farming, and oil, gas and uranium exploration probably disturbed, damaged, or destroyed some archeological resources and artifacts. Looters may have also disturbed, damaged and removed sensitive resources for selling and collecting. Road and trail maintenance and construction and seismic lines could have adversely affected archeological resources. Utility line improvements generally occur in previously disturbed areas and would not likely contribute to adverse cumulative impacts to cultural resources. Trail upgrades or development could impact archeological resources. Compliance with NHPA, however, is required for all of these projects to evaluate and mitigate potential impacts. Visitor use could cause loss or damage to cultural resources, particularly from the collection of artifacts from the backcountry. Fire could cause direct loss of archeological resources and could uncover lithic scatters and some artifacts that would otherwise be unknown.

Implementation or continuation of exotic plant management activities under any of the alternatives would have negligible additive effects on archeological resources. Under all alternatives, all four parks would avoid surface-disturbing activities in areas that have not been surveyed. However, in the event that resources are discovered, exotic plant management would stop under both alternatives until these resources can be evaluated by a qualified professional archeologist. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
Use of current management practices would not alter or diminish the significance or integrity of the sites of any National Register eligible or listed archeological resources. This alternative is not expected to be the most effective at adequately managing range expansions of existing aggressive species nor is it expected to adequately prevent new species introductions, which could result in long-term minor impacts through degradation of context of archeological resources. This alternative would not result in impairment to archeological resources. Implementation of this

alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1 with the exception of the following treatments:

- There are no known direct impacts from biological control to archeological resources. Impacts of biological control agents to archeological resources would therefore be negligible.

In addition to the BMPs in Section 2.3, the following additional BMP's will be implemented under this alternative given that complete surveys have been conducted in the following areas:

Regarding exotic plant treatment within the Tuxedo Bottom area in Canyonlands National Park the following mitigation measures are required:

- No work will be done within the upstream portion of the burn area without archeological staff present.

Regarding exotic plant treatment within the Spanish Bottom area in Canyonlands National Park the following mitigation measures are required:

- No mechanical/manual or chemical treatment will be done in the talus area.
- Only mechanical/manual, chemical and biological treatments can be conducted within the flats and along the river's edge.
- No cheatgrass will be removed from the archeological resources.

Regarding exotic plant treatment within the Upheaval Bottom area in Canyonlands National Park the following mitigation measures are required:

- No mechanical/manual or chemical treatment will be allowed without prior consultation with park cultural resource staff.

Regarding exotic plant treatment within the Anderson Bottom area in Canyonlands National Park the following mitigation measures are required:

- No mechanical/manual or chemical treatment will be allowed without prior consultation with park cultural resource staff.

The Goodman Point Unit of Hovenweep National Monument contains perhaps the highest density of archeological resources on the Colorado Plateau. There is long-term, ongoing archeological research taking place throughout the unit. Because of the special nature of the resource, the high potential for adverse effects on the resource, and the presence of researchers, the following mitigation measures are required:

- Additional NEPA and NHPA compliance is required. Avoid all exotic plant treatments within Goodman Point Unit until compliance is completed.
- The Cultural Resource Program Manager must be contacted at least 1 week before the commencement of work. The Program Manager will contact the researchers with the IPM schedule.
- Specific target areas for exotic plant treatment must be identified on a 7.5 minute topographical map.
- Depending on the areas targeted, it will be at the discretion of the Program Manager to decide whether archeological staff will need to be present during exotic plant treatment.

Cumulative Effects
Cumulative effects are the same as Alternative 1.

Conclusion
IPM would not inhibit the maintenance of the desired condition to have archeological resources protected in an undisturbed condition. In general, disturbance to archeological resources would be negligible to minor and site-specific within a relatively small area. BMPs would be implemented to minimize the potential for accidental impacts to unknown resources. It is expected that under Alternative 2 managers will have more flexibility in treating the most acres and most exotic species than under Alternative 1 and will be most effective and efficient in treating species that may threaten context and structural integrity of archeological resources in the parks. For example, under Alternative 2, additional BMPs would be implemented to minimize potential impacts of ATVs and other vehicles to archeological resources. ATVs would follow established roads to minimize the potential for additional impacts to archeological resources. The impacts of exotic plant management on archeological resources would therefore be adverse, negligible to minor, site-specific, and short-term. This alternative would not result in impairment to archeological resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

§106 Summary
After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR Section 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementation of the preferred alternative would have no adverse effect on the archeological resources of the Southeast Utah Group parks.

4.6.14 Ethnographic Resources

Methodology and Intensity Thresholds

As defined by the National Park Service, an ethnographic resource is a 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. Some places of traditional cultural use may be eligible for inclusion in the National Register of Historic Places as traditional cultural properties (TCPs) because of their association with cultural practices or beliefs of a living community that (a) are rooted in that community's history and (b) are important in maintaining the continuing cultural identity of the community (*National Register Bulletin, Guidelines for Evaluating and Documenting Traditional Cultural Properties*).

For purposes of analyzing potential impacts to ethnographic resources, the thresholds of change for the intensity of an impact are defined below.

Negligible: Impact(s) would be barely perceptible and would neither alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs.

Minor: *Adverse:* impact(s) would be slight but noticeable but would neither appreciably alter resource conditions, such as traditional access or site preservation, nor the relationship between the resource and the affiliated group's body of practices and beliefs.

Beneficial: would allow access to and/or accommodate a group's traditional practices or beliefs.

Moderate: *Adverse:* impact(s) would be apparent and would alter resource conditions. Something would interfere with traditional access, site preservation, or the relationship between the resource and the affiliated group's practices and beliefs, even though the group's practices and beliefs would survive.

Beneficial: would facilitate traditional access and/or accommodate a group's practices or beliefs.

Major: *Adverse:* impact(s) would alter resource conditions. Something would block or greatly affect traditional access, site preservation, or the relationship between the resource and the affiliated group's body of practices and beliefs, to the extent that the survival of a group's practices and/or beliefs would be jeopardized.

Beneficial: would encourage traditional access and/or accommodate a group's practices or beliefs.

Duration: Short-term refers to a transitory effect, one that largely disappears over a period of days or months. The duration of long-term effects is essentially permanent.

Impacts of Alternative 1 (No-Action Alternative)

Exotic plant management would not adversely impact areas where Native Americans gather plants or practice religious activities. Parks would continue to consult with tribes to identify traditional use plants and religious sites. Traditional use plants identified by tribes would be avoided to the extent feasible to minimize impacts. Some impacts from physical disturbance or herbicide application may occur to non-

target traditional use or medicinal plants. These impacts would be adverse, short-term, and minor to individual plants. Infrequent impacts to individual plants generally do not impact plant populations, plant communities, or ecological processes.

Cumulative Effects
Past land practices (prior to park establishment), such as ranching and farming, and oil, gas and uranium exploration probably disturbed, damaged, or destroyed some archeological resources and artifacts, ethnographic resources, and historic structures. Looters may have also disturbed, damaged and removed sensitive resources for selling and collecting. Road and trail maintenance and construction and seismic lines could adversely affect cultural resources. Utility line improvements generally occur in previously disturbed areas and would not likely contribute to adverse cumulative impacts to cultural resources. Trail upgrades or development could impact ethnographic resources. Compliance with NHPA, however, is required for all of these projects to evaluate and mitigate potential impacts. Visitor use could cause loss or damage to ethnographic resources, particularly from accessing and impacting springs and traditional use plants. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
Exotic plant management would not inhibit the maintenance of the desired condition to have access to and ceremonial use of Native American sacred sites by Native American religious practitioners since treatments are few and performed outside of ceremonial use periods. The impacts of exotic plant management on ethnographic resources would therefore be directly adverse, site-specific, short-term, and minor. This alternative would not result in impairment to ethnographic resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
Parks would identify religious sites and traditional use plant species based on consultation with tribes. NPS staff would receive training on identification of traditional use plants and would avoid treating non-target plants to the extent feasible. Mechanical methods that disturb relatively large areas, such as tilling, would not be used in areas where traditional use plants are known to occur. ATVs and off-road vehicle traffic would be limited in areas where traditional use plants are known to occur. Herbicides would be applied according to labels. Native Americans use many areas within parks as spiritual sites. Park staff is aware of the general areas where such activities take place and would avoid any exotic plant management activities during periods when Native Americans use these areas. Specific BMPs that would be implemented under this alternative include:

- Parks would identify traditional use plant species based on consultation with tribes.
- NPS staff would receive training on identification of traditional use plants and would avoid treating non-target plants to the extent feasible.

The spring in the Hackberry Unit in HOVE has been identified as a possible Traditional Cultural Site Property by Hopi Elders whom are among several of the monument's consulted Native American tribes. The following mitigation measures are required.

- No manual/mechanical and chemical treatment will take place within 300 feet of the spring.
- Biological control agents may be allowed in this area.

Cumulative Effects
Cumulative effects are the same as Alternative 1.

Conclusion
IPM would not inhibit the maintenance of the desired condition to accommodate access and ceremonial use of sacred sites by Native American religious practitioners and other Tribal members. IPM would not adversely impact areas where Native Americans gather plants. Traditional use plants identified by tribes would be avoided to the extent feasible to minimize impacts. These impacts would be adverse, short-term, and minor to individual plants. Infrequent impacts to individual plants generally do not impact plant populations, plant communities, or ecological processes.

It is expected that under Alternative 2 managers will have more flexibility in treating the most acres and most exotic species than under Alternative 1 and will be most effective and efficient in treating species that may threaten context and integrity of ethnographic resources in the parks. For example, under Alternative 2, additional BMPs would be implemented to minimize potential impacts of mechanical/ manual and chemical treatment to ethnographic resources. Only biocontrol methods would be use to minimize the potential for additional impacts to ethnographic resources. Bio-control treatments are not ground disturbing and can be more of a natural process (no chemicals or mechanical treatment) to treat an exotic species.

The impacts of exotic plant management on ethnographic resources would therefore be directly adverse, site-specific, short-term and minor. This alternative would not result in impairment to ethnographic resources. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

§106 Summary
After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR Section 800.5, *Assessment of Adverse Effects*), the National Park

Service concludes that implementation of the preferred alternative would have no adverse effect on the ethnographic resources of the Southeast Utah Group parks.

4.6.15 Historic Structures

Methodology and Intensity Thresholds

According to the *NPS-28: Cultural Resource Management Guideline*, "a historic structure is "a constructed work . . . consciously created to serve some human activity." Historic structures are usually immovable, although some have been relocated and others are mobile by design. They include buildings and monuments, dams, millraces and canals, nautical vessels, bridges, tunnels and roads, railroad locomotives, rolling stock and track, stockades and fences, defensive works, temple mounds and kivas, ruins of all structural types, and outdoor sculpture".

In order for a historic structure to be listed on the National Register of Historic Places, it must meet one or more of the following criteria of significance: A) associated with events that have made a significant contribution to the broad patterns of our history; B) associated with the lives of persons significant in our past; C) embody the distinctive characteristics of a type. Period or methods of construction, or represent the work of a master, or possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; D) have yielded, or may be likely to yield, information important in prehistory or history. In addition, the structure must possess integrity of location, design, setting materials, workmanship, feeling, association (National Register Bulletin, How to Apply the National Register Criteria for Evaluation).

For purposes of analyzing potential impacts to historic structures, the thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impacts to historic structures either beneficial or adverse, are at the lowest levels of detection, barely perceptible and not measurable.

Minor: *Adverse:* impact would not affect a character defining features of a National Register of Historic Places eligible or listed structure or building.

Beneficial: stabilization/ preservation of character defining features in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Moderate: *Adverse:* impact would alter a character defining features of the structure or building but would not diminish the integrity of the resource to the extent that its National Register eligibility is jeopardized.

Beneficial: rehabilitation of a structure or feature in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Major: Adverse: impact would alter a character defining feature(s) of the structure or building, diminishing the integrity of the resource to the extent that it is no longer eligible to be listed in the National Register.

Beneficial: restoration of a structure or building in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Duration: Short-term refers to a transitory effect, one that largely disappears over a period of days or months. The duration of long-term effects is essentially permanent.

Impact of Alternative 1 (No Action Alternative)
Re-vegetation activities such as cultivation, raking, digging, and vehicle and foot traffic could potentially damage previously undiscovered structures. These types of activities would be planned and performed in areas suspected or known to contain resources of historic value only after resource managers inspected and cleared potential worksites and consulted SHPO and only after appropriate mitigation strategies have been developed. The removal of exotic plant species from around historic structures will be beneficial by preventing exotics from degrading structural integrity. The impacts of cultural controls to historic structures would therefore be directly beneficial, site-specific, short to long-term and negligible to minor.

Ground-disturbing activities, such as digging and pulling, could damage historic structures such as foundations or fences. These types of activities would only be performed in areas suspected or known to contain resources of historic value only after park resource managers inspected and consulted SHPO, and only after appropriate mitigation strategies have been developed. The adverse impacts of mechanical treatments to historic structures would therefore be adverse, site-specific, short-term and negligible to minor.

The potential short and long-term effects of herbicides on historic structures made of various materials, such as wood and stone, are not well understood. Use of herbicides within the boundaries of historic resource sites would be restricted. Because of unknown effects, herbicides would not be directly applied to historic structures with sandstone grout, hearth features, or cultural resources comprised of organic material, bone, pollen, seeds, and materials made from plant fiber. Physical disturbance to historic structures would be avoided. Herbicides would not be directly applied to historic structures or building features. However, herbicides may be used in lands surrounding historic sites in accordance with BMPs.

Alteration of historic structures features would not be altered and the overall integrity of the resource will not be diminished since these areas would not be physically disturbed and since herbicides would not be directly applied to these structures. Negligible effects would occur on the historical nature of the built environment. This impact would not affect the character of features of any National Register eligible or listed historic structures or historic districts. The impacts of exotic plant management on historic structures would therefore be negligible, site-specific, and short -term.

Cumulative Effects
Past land practices (prior to park establishment), such as ranching and farming, and oil, gas and uranium exploration probably disturbed, damaged, or destroyed some historic structures. Looters may have also disturbed, damaged and removed sensitive resources for selling and collecting. Road and trail maintenance and construction and seismic lines could adversely affect historic structures. Utility line improvements generally occur in previously disturbed areas and would not likely contribute to adverse cumulative impacts to cultural resources. Compliance with NHPA, however, is required for all of these projects to evaluate and mitigate potential impacts. Visitor use could cause loss or damage to historic and prehistoric structures, particularly in the backcountry. Fire could cause direct loss of historic or prehistoric structures that have wooden components.

In ARCH, flash flooding can limit access to certain areas and could cause direct loss or damage to historic structures, particularly the Rock House (which is within the 100-year floodplain). The Wolfe Ranch National Historic District is within the floodplain of Salt Wash. Although no floodplain determination has been completed, the ranch has been flooded several times during the past 50 years (NPS 1989). Restoration/rehabilitation of historic structures, such as Wolfe Ranch in ARCH, Fort Bottom cabin and ruins on the rivers in CANY, and Cajon Pueblo in HOVE would help to protect historic structures from deterioration.

Implementation or continuation of exotic plant management activities under any of the alternatives would have negligible additive effects on historic structures. Under both alternatives, all four parks would avoid surface-disturbing activities in areas that have not been surveyed or if known historic or prehistoric structures are present archeological staff will be consulted. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
This alternative is not expected to be the most effective at adequately managing range expansions of existing aggressive species nor is it expected to adequately prevent new species introductions, which could result in long-term minor impacts through destabilization and degradation of context of historic structures. This alternative would not result in impairment to historic structures. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS Management Policies 2006.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts to historic structures are the same under Alternative 1 with the addition of the following treatment:

There are no known direct impacts from biological control to historic structures. Impacts of biological control agents to historic structures would therefore be negligible.

Cumulative Effects
Cumulative effects are the same as Alternative 1.

Conclusion
IPM would not inhibit the maintenance of the desired condition to have historic structures protected in an undisturbed condition. In general, disturbance to historic structures would be negligible to minor and site-specific within a relatively small area.

It is expected that under Alternative 2 managers will have more flexibility in treating the most acres and most exotic species than under Alternative 1 and Alternative 2 will be most effective and efficient in treating species that may threaten context and structural integrity of historic structures in the four parks. The removal of exotic species from around historic structures could have a beneficial impact by stabilizing and preserving the historic structure or district with native vegetation. The impacts of exotic plant management on historic structures would therefore be beneficial, negligible to minor, site-specific, short-and long-term. This alternative would not result in impairment to historic structures. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

§106 Summary
After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR Section 800.5, *Assessment of Adverse Effects*), the National Park Service concludes that implementation of the preferred alternative would have no adverse effect on the historic structures of the Southeast Utah Group parks.

Table 4-2. ASSESSMENT OF EFFECT ON CULTURAL RESOURCES

Treatment Area	# of cultural sites potentially affected	Action/ Treatment	Effect*	Mitigation
ARCH				
Visitor Center Complex	1	Annual treatment of Russian thistle and puncturevine	NHPA	
Lower Courthouse Wash	3	Removal of Russian olive	NHPA	
Side Canyon to Courthouse Wash	0	Removal of Siberian elm and tamarisk	NHPA	
Middle Courthouse Wash	0	Removal of tamarisk and Russian olive	NHPA	
Sevenmile Wash	0	Removal of tamarisk	NHPA	

Treatment Area	# of cultural sites potentially affected	Action/ Treatment	Effect*	Mitigation
Winter Camp Wash	0	Removal of tamarisk	NHPA	
Middle Salt Wash	2	Removal of Russian knapweed	NHPA	
Wolfe Ranch	0	Removal of tamarisk	NHPA	
Colorado River Corridor	0	Removal of Russian knapweed	NHPA	
Salt Spring	0	Removal of Russian knapweed	NHPA	
Herdina Park/Willow Flat	0	Removal of tamarisk	NHPA	
Middle Salt Valley Wash	1	Removal of tamarisk	NAE	Archeological monitor during activity.
Salt Valley Road	0	Removal of horehound mint	NHPA	
Cordova Canyon/Upper Salt Wash	0	Russian knapweed	NHPA	
Fish Seep Draw	0	Removal of tamarisk	NHPA	
Park Roadside	2	Removal of puncturevine	NHPA	
CANY				
Syncline Loop Trail	2	Removal of tamarisk	NHPA	
Lathrop Canyon	4	Removal of tamarisk	NAE	No work within the lithic scatter site.
Horseshoe Canyon	5	Removal of tamarisk	NHPA	
Green River Corridor	0	Removal of Russian knapweed	NHPA	
Tuxedo Bottom	2	Removal of tamarisk	NAE	No work on upper portion of burn area without an archeological monitor.
Upheaval Bottom	1	Removal of tamarisk	NAE	No treatment will be allowed without prior contact with archeological staff.
Anderson Bottom	1	Removal of Russian knapweed	NAE	No treatment will be allowed without prior contact with archeological staff.
Queen Anne Bottom	1	Removal of Russian knapweed	NHPA	
Turks Head Bottom	0	Removal of perennial pepperweed	NHPA	
Willow Flat Area	3	Removal of halgeton and diffuse knapweed along road.	NHPA	
Spanish Bottom Fire	4	Treatment of burn area to control cheatgrass, perennial pepperweed, Russian knapweed and tamarisk.	NAE	No work in talus areas. No removal of cheatgrass within archeological sites.

Treatment Area	# of cultural sites potentially affected	Action/ Treatment	Effect*	Mitigation
Middle Salt Creek	1	Protecting cottonwoods by removal of tamarisk	NHPA	
Squaw Flat Campground	4	Removal of crested wheatgrass.	NHPA	
Peek-a-boo	0	Removal of ripgut brome	NHPA	
HOVE				
Goodman Point Unit	All sites	Removal of Canada thistle	NAE	No work allowed in Unit without prior discussion with archeologist. Additional NEPA compliance required.
Hackberry/ Horseshoe Unit	2	Removal of tamarisk	NAE	Avoid any manual, mechanical and chemical treatment methods within 300 ft of Hackberry Spring.
NABR				
Armstrong Canyon	4	Removal of tamarisk	NHPA	
Entrance Road	0	Control tumble mustard	NHPA	
Sewage Pond	0	Removal of reeds	NHPA	
White Canyon Bottom	0	Removal of crested wheatgrass	NHPA	

* NHPA- No Historic Properties Affected; NAE-No Adverse Effect; AE-Adverse Effect

4.6.16 Visitor Use and Experience

Methodology and Intensity Thresholds

Visitor records and staff observations of visitation patterns combined with assessment of what is available to visitors under current management were used to estimate the effects of the actions of both alternatives. The impact on the ability of the visitor to experience a full range of SEUG resources was analyzed by examining the resources impacted. The following definitions are used to define intensity levels:

Negligible: The effect on availability of desired visitor experiences, or the number of visitors affected, would be slight or nonexistent.

Minor: The effect on availability of desired visitor experiences, or the number of visitors affected, would be relatively small. The effect would be limited to relatively few individuals, be localized in area or short in duration, and/or affect recreation opportunities common in the park or region.

Moderate: The effect on availability of desired visitor experiences, or the number of visitors affected, would be intermediate. The effect would involve an intermediate number of visitors, portion of the park, duration, and/or affect recreation opportunities uncommon in the park or region. The visitor would likely be able to express an opinion about the changes.

Major: The effect on availability of desired visitor experiences, or the number of visitors affected, would be substantial. The effect would involve a substantial number of visitors, portion of the park, duration, and/or affect recreation opportunities uncommon or unique in the park or region. The visitor would likely be able to express a strong opinion about the changes.

Duration: Short-term effects last only during the proposed treatment period (i.e. treatment of a particular site at a particular point in time). Long term effects refer to lasting longer than the treatment period.

Impacts of Alternative 1 (No-Action Alternative)
Operation of equipment, such as chainsaws, mowers and other vehicles would have a short-term effect on visitor experience at the SEUG parks. This noise intrusion to visitors will be a direct adverse, short-term, site-specific and minor impact.

Visual intrusion of treated areas that have cut stumps, brown tamarisk, dead vegetation, and brush piles will be a direct adverse, short-term, site-specific, and negligible to minor impact.

Rehabilitation of native plant communities by reseeding and irrigation at parks would be readily apparent to some visitors. Vistas will be opened up and walking through vegetation would be easier, especially through tamarisk. These impacts will likely have long-term, moderate, beneficial effects to visitor experience.

Chemical treatment may require visitor use closures for visitor protection during herbicide application and while the herbicide dries. The chemical smell of herbicides will also impact visitors. Exotic plant management activities will be timed to coincide with low visitor use periods.

The displacement and discomfort of visitors would be a rare adverse, short-term, and site-specific and minor due to the wide distribution of exotic plants. However, the health and safety to visitors outweigh the short-term affects of restricting their access to chemical treatment areas.

Visitor access may also be restricted from some areas during the burning of brush piles. These closures would also be rare since burns are conducted during low visitation periods.

The repeated presence of park personnel, and equipment could impact visitor solitude in certain areas of the parks. The site-specific, short-term impacts in the parks would be noticeable to visitors.

Cumulative Effects
Park operations using mowers, ATVs, aircraft or large work crews can degrade the visitor experience. Oil and gas and other development activities outside park boundaries and the associated traffic in areas adjacent to the parks could degrade

visitor experience, both from sight and sound. The quality of visitor experience has also been reduced due to infestations of exotic plants. However, exotic plant management at all four parks (cutting, pulling, and chemical application) has helped to improve the quality of visitor experience. Under Alternative 1, visitor experience would be expected to improve at current levels. ARCH is proposing to develop a Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
In general, exotic plant management would have a long-term, beneficial effect on visitor use and experience. However, the beneficial effects of exotic plant management would vary from park to park. Some aspects of control may intrude on the visitor experience: mechanized and motorized equipment such as chainsaws, and brush cutters, would cause a certain level of noise when used within the parks, thereby compromising the preservation of natural conditions (including the lack of manmade noises). Visitors would likely be aware of the beneficial effects of exotic plant management through visitor contacts and would also likely express positive opinions about the changes. The impacts of exotic plant management on visitor use an experience would therefore be directly beneficial and adverse, site-specific, short-term to long-term, and negligible to moderate.

Impacts of Alternative 2 (Preferred Alternative)
In addition to the BMPs in Section 2.3, the following BMPs would be implemented under this alternative to limit potential impacts to visitor use and experience. These BMPs include:

- Each park's interpretive services would help visitors understand the need for exotic plant management and how BMPs are used to minimize potential impacts to resources. SEUG will disseminate information to the public and staff on various control projects as to how and why particularly loud techniques, such as aircraft, ATVs, chainsaws and mowers are necessary to accomplish project goals.

Potential impacts are the same as under Alternative 1 with the exception of the following treatment methods and techniques:

Use of ATVs and aircraft would be detectable to visitors in the short-term and may have short-term, negligible minor effects on visitor experience.

Operation of equipment would have a short-term effect on visitor experience. Whenever possible, IPM activities will be timed to avoid peak visitor use periods. Use of ATVs, aircraft and heavy equipment would be detectable to visitors in the short-term and may have short term negligible to minor effects on visitor experience.

The impacts of equipment on visitor use and experience would therefore be directly adverse, site specific, short-term, and minor.

There are no known direct impacts from biological control to visitor use and experience. Impacts of biological control agents to visitor use would therefore be negligible.

Cumulative Effects
Cumulative effects are the same as Alternative 1.

Conclusion
In general, IPM would have a long-term, beneficial effect on visitor use and experience by returning the four parks to a more natural state. Many parks receive complaints from visitors when they observe exotic plants within the park. Rehabilitation of native plant communities would be readily apparent to some visitors and likely long-term in some areas. Visitors would likely be aware of the beneficial effects of IPM and would also likely express positive opinions about the changes. The overall impacts of IPM on visitor use and experience would therefore be directly beneficial and adverse, site-specific, short-term to long-term, and minor to moderate.

4.6.17 Human Health and Safety

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to human health and safety were derived from the SEUG staff's past observations of the effects on human health and safety from visitor use, exotic plant management efforts, from available literature, and from herbicide labels and material safety data sheets. The thresholds of change for the intensity of an impact are defined as follows:

Negligible: The impact to human health would be so small that it would not be of any measurable or perceptible consequence and/or will affect few visitors or staff.

Minor: The impact to human health is slight but would be small and localized and of little consequence, and/or will affect some visitors or staff.

Moderate: The impact to human health is readily apparent, would be measurable and consequential, but more localized and/or will affect many visitors and staff.

Major: The impact to human health is severely adverse. The change would be measurable and possibly permanent, and/or will affect the majority of visitors or staff.

Duration: Short-term effects last only during the proposed treatment period (i.e. treatment of a particular site at a particular point in time). Long term effects refer to lasting longer than the treatment period.

Impacts of Alternative 1 (No-Action Alternative)

Exotic plant infestations would be primarily controlled by hand tools, chainsaws, mowers, chemical applications using a backpack sprayer and to a lesser extent by re-vegetation of disturbed areas. Possible effects of mechanical and chemical treatments include cuts, burns, allergies, and skin irritation to individuals performing the work. Due to the uneven terrain in the parks, minor injuries or falls may result. Due to the hot summers in this region, dehydration, heat exhaustion or heat stroke could occur. The use of personal protective equipment (PPE) such as gloves, long sleeves, long pants, chaps, and boots with good soles and adhering to park SOP's for running chainsaws, mowers and backpack sprayers should minimize these risks. Therefore cultural, mechanical, and chemical treatments would have a direct adverse, site-specific, short-term, negligible to minor impact to human health and safety.

The herbicides proposed for use, have very low acute toxicity to humans and personal protective equipment (PPE) is used during application to reduce the potential for chronic exposure of employees. Safety protocols for storing, mixing, transporting, handling spills, and disposing of herbicides and containers are an integral part of both alternatives. Chemical treatments may have a direct adverse, site-specific, short-term, and negligible to minor impacts to park employees implementing the treatments.

Treated areas subject to visitation are marked during the no-entry period as described on the herbicide label or until dry to advise visitors against entering treated areas and thus exposing themselves to the chemicals. Chemical treatments may have indirect adverse, site-specific, short-term, negligible impacts to park visitors.

Brush piling and burning will be conducted with the appropriate personal protective equipment (PPE) and in accordance with the 2005 Fire Management Plan. Because of these and other safety precautions to minimize risk, these methods of control could have direct adverse, short- term, negligible to minor impacts to the individuals performing the work. Visitor access may also be restricted from some areas where brush pile burning is conducted. The displacement of visitors would have an indirect adverse, site-specific, short-term and negligible impact to visitor safety.

Vehicle travel to remote exotic plant infestations may have a direct adverse impact to human health and safety.

Cumulative Effects

Nearby urban development, increased visitation and park operations and maintenance has impacted overall health and safety of park visitors and employees. Air pollution caused from urban populations, development and vehicles contain mercury, radiation, and other volatile organic compounds (VOC's) which are easily inhaled. The continued increase in population in the Moab, Utah area would continue to have increased numbers of people seeking places for recreation. Regarding park operations and maintenance, park construction projects have safety plans associated with them and would continue to have a short- term, negligible, adverse impact on human health and safety. However, exotic plant management will not likely contribute to adverse cumulative impacts to human health and safety. ARCH is proposing to develop a

Climbing Management Plan, CANY is in the process of developing a river management plan and a commercial services plan which would affect the current use of the rivers and the commercial use of the park and HOVE has a draft General Management Plan nearing completion. All plans would be consistent with this final plan.

Conclusion
In general, using current exotic plant management practices will have a direct and indirect adverse, site-specific, short-term, negligible to minor impact on human health and safety.

Impacts of Alternative 2 (Preferred Alternative)
Potential impacts are the same as under Alternative 1 with the exception of the following treatment methods:

ATVs may have a direct adverse impact to park employees whom are operating them. Proper PPE and training will be required for anyone driving an ATV. Impacts of using ATVs for chemical application of herbicides or supply shuttling would be directly adverse, short-term, site-specific and minor.

Individuals who may travel within a helicopter for crew or supply shuttles will be briefed on proper flight procedures and will be required to wear the proper PPE.

The use of biological control agents may have a beneficial long term impact on human safety since this control treatment will be the least physical to park employees and will not expose anyone to chemical vapors. Biological treatments may have an indirect beneficial, site-specific, short and long term, negligible impact to humans.

Cumulative Effects
Cumulative effects are similar to Alternative 1. However, using IPM methods would have negligible to minor adverse additive impacts on visitor use and experience. Minor adverse additive impacts could occur for short periods when exotic plants within the park are treated. It is anticipated that park values and character would benefit overall because size, spread, and new introductions of exotic species is expected to decrease when a full range of IPM techniques are implemented. Using IPM methods would have long-term, moderate, beneficial impacts on human health and safety since IPM methods would provide more tools to implement that may be safer for park employees and park visitors. Under Alternative 2, additional information would be disseminated about IPM programs to educate the public about exotic management programs. These education efforts, coupled with the likely increased success of IPM compared with current exotic plant management programs, would likely help to further improve the quality of visitor experience.

Conclusion

The desired condition to have visitor and employee safety and health protected would not be inhibited by IPM. Whenever possible, exotic plant management activities will be timed to avoid peak visitor use periods. IPM methods would provide more tools to use to control and/or remove exotic plants which would provide a safer, effective and more natural environment to work in and experience.

4.6.18 Soundscape

Methodology and Intensity Thresholds

Analyses of the potential intensity of impacts to soundscape considered noise context, amplitude, and time factors, including duration, frequency of occurrence, and sensitive time periods. The technique used to assess noise impacts from exotic plant management in this document is consistent with methods being developed for *NPS Reference Manual 47, Soundscape Preservation and Noise Management* (NPS in preparation), in accordance with *Management Policies* 2006 and *Director's Order #47: Soundscape Preservation and Noise* M*anagement.* The thresholds of change for the intensity of an impact are defined as follows:

Negligible: Noise may be generated by exotic plant management activities during daylight hours. Noise is rarely audible at 100 feet or more from the source. When noise is present, it is at very low levels and occurs only for short durations in most of the area.

Minor: Noise generated by exotic plant management activities may predominate during daylight hours, but for the majority of the time the noise is at low levels. When noise is at medium or high levels, it occurs only for a short duration in site-specific areas. Human-caused noise is rarely audible at 500 feet or more from the source.

Moderate: Noise generated by exotic plant management activities predominates during daylight hours, but it is at medium or lower levels for a majority of the time. Localized areas may experience noise at medium to high levels during half of the daylight hours.

Major: Noise generated by exotic plant management activities predominates during daylight hours, and is at greater than medium levels a majority of the time that noise is present. Large areas may experience noise at medium to high levels during a majority of the daylight hours.

Duration: Short-term refers to a transitory effect, one that largely disappears over a period of minutes or hours. The duration of long-term effects is days or weeks.

Impacts of Alternative 1 (No-Action Alternative)

Some degradation due to noise (undesirable human-caused sound) would result from some mechanical, cultural, and chemical management techniques, including tree and shrub removal, larger scale restoration projects, and brush pile burning activity. All involve the use of noise-generating equipment such as chainsaws, vehicles and

aircraft. Helicopters, although rarely needed, may be used for shuttling in crews and supplies to remote exotic plant infested areas. Each of these tools, especially chainsaws and helicopters, are quite loud (in excess of 100 decibels) and operators are directed to use hearing protection equipment. Hand tools will be primarily used and only where hand tools are not feasible, chainsaws may be used.

Any use of gas-powered equipment for exotic tree removal in more closed canyon environments will be limited to less than four hours per day, three days/week, and scheduled (to the degree practicable) during low visitor use seasons (late summer or winter) to reduce impacts to park visitors. Further, the use of such equipment would be very infrequent in light of the number of infestation locations present in the parks that require this type of management (from single events of hours to periods of one to two weeks per year per location for one to two years). This is not frequent or repetitive enough to substantively interfere with human activities in the area or with wildlife behavior and projects would be timed to the degree possible to occur before or after expected seasons of high visitor use and periods of critical wildlife behavior (e.g. nesting), as outlined in BMPs relevant to all wildlife, including listed species. Nor would such infrequent noise chronically impair the solitude and tranquility (natural soundscape) associated with the parks.

Noise would be temporary and quickly dissipated in the open environments in the SEUG parks. Human-caused noise would be short-term and site-specific. Audible human-caused noise would be experienced during periods of equipment operation between sunrise and sunset. Exotic plant activities are usually not conducted at night. Therefore, no human-caused noise resulting from exotic plant management would be audible between sunset and sunrise.

Cumulative Effects
Noise impacts in all four parks are most often caused by vehicle traffic and humans (sightseers, campers, hikers, etc.). Aircraft over-flight noise is pervasive and vehicle noise in accessible areas of ARCH (Park Avenue, the Windows, Delicate Arch, and Devil's Garden trailheads, Wolfe Ranch and Devil's Garden campground), of CANY (Grandview Point Overlook, Green River Overlook, and Willow Flat and Squaw Flat campgrounds), of NABR (loop road, overlooks and campground) and throughout HOVE can be heard mostly during high visitor use season.

Under both alternatives, exotic plant management would have negligible, additive, short-term adverse impacts on soundscapes. Short-term and localized human-caused noise would result from operation of equipment (vehicles, chainsaws, and ATVs) between dusk and dawn.

Conclusion
Exotic plant management would not inhibit the maintenance of the desired condition to have, to the greatest extent possible, the natural soundscapes of parks preserved. SEUG would disseminate information to the public and staff on various control projects as to how and why particularly loud techniques, such as ATVs and aircraft,

are necessary to accomplish project goals. The impacts of exotic plant management on soundscapes would therefore be adverse, site-specific, short-term, and minor. This alternative would not result in impairment to soundscapes. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Impacts of Alternative 2 (Preferred Alternative)
The impacts are the same as under Alternative 1.

Cumulative Effects
Cumulative effects are the same as Alternative 1 with the addition of the following:

Under Alternative 2, additional information would be disseminated about IPM programs to educate the public about the need for noise generating equipment to accomplish project goals.

Conclusion
IPM would not inhibit the maintenance of the desired condition to have, to the greatest extent possible, the natural soundscapes of parks protected. The impacts of exotic plant management on soundscapes would therefore be directly adverse, site-specific, short-term, and minor. This alternative would not result in impairment to soundscapes. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.6.19 Socioeconomics

Methodology and Intensity Thresholds
Impact topics were identified through the scoping process, and concerns covered by this section include effects on commercial access through the parks and possible conflicts between the proposed alternatives and local and state plans, policies, or controls. The intensity thresholds are defined as follows:

Negligible: Any effects to socioeconomic conditions would be below or at the level of detection. The effect would be slight and short-term.

Minor: The effects to socioeconomic conditions would be detectable although short-term. Any effects would be small, and if mitigation were needed to offset potential adverse impacts, it would be simple and successful.

Moderate: The effects to socioeconomic conditions would be readily apparent and likely long-term. Any effects would result in changes to socioeconomic conditions on a local scale. If mitigation is needed to offset potential adverse impacts, it could be extensive, but would likely be successful.

Major: The effects to socioeconomic conditions would be readily apparent, long-term and would cause substantial changes to socioeconomic conditions in the region. Mitigation measures to offset potential

adverse impacts would be extensive and their success could not be guaranteed.

Duration: Short-term refers to a period of up to 5 years. The duration of long-term effects is essentially permanent.

Impacts of Alternative 1 (No-Action Alternative)
The reduction of exotic plants in each park would reduce the spread of exotic plants onto private or federal lands adjacent to each park and reduce the individual landowner's exotic plant control costs. The overall beneficial effects would vary from park to park. However, at those parks that have limited programs, the spread of exotic plants onto private or federal lands may increase resulting in moderate adverse, local and long-term impacts. This increase could result in additional financial burdens on local landowners.

Cumulative Effects
Under either alternative, implementation or continuation of exotic plant management activities would have minor to moderate beneficial additive effects to exotic management efforts by neighbors throughout southeastern Utah. It is expected that under Alternative 2 managers will have the most flexibility in treating the more acres and controlling the more exotic species than under Alternative 1 and will be the most effective and efficient in treating species that move across park and county lines.

Conclusion
Exotic plant management would not inhibit the maintenance of the desired condition to provide an understanding to park visitors, the non-visiting public, gateway communities and regions, of human interactions with park resources. The impacts of exotic plant management on social and economic conditions would therefore be indirectly beneficial since the parks are reducing and controlling exotics which will a positive impact to adjacent landowners and neighboring communities. This beneficial impact will be local, ongoing and long-term, and moderate. However, Alternative 1 limits the use of techniques that are expected to be important in preventing and managing the spread of exotic species over a large area and could result in minor to moderate adverse effects to the greater region since implementation will likely result in additional financial burdens on local landowners.

Impacts of Alternative 2 (Preferred Alternative)
The reduction of exotic plants in each park would decrease the spread of exotic plants onto private or federal lands adjacent to each park and reduce the individual landowner's exotic plant control costs. While these landowners would benefit, there would be no appreciable effect on local communities' overall population, income, or employment base.

Other impacts such as volunteer participation, local employment and/or cooperative efforts with Grand, San Juan and Montezuma Counties for weed management activities, infusion of budgeted dollars for weed management equipment into local economies, etc. are expected to be mostly beneficial, though variable over time and

not easily measurable in quantifiable terms. Among the two alternatives these impacts are expected to be similar and of no measurable consequence to the human environment.

Cumulative Effects
Cumulative effects are the same as Alternative 1.

Conclusion
Implementation of Alternative 2 may have moderate beneficial impacts to the region since it will treat the most acres and result in the most safe, effective, and efficient management of exotic species both in and outside the parks. The availability and access to all management techniques allows the most flexibility and creativity in solving exotic species issues that affect the larger region. Some parks may use contractors to assist with IPM treatments, which would have beneficial effects for local businesses. IPM would not inhibit the maintenance of the desired condition to have an understanding of park visitors, the non-visiting public, gateway communities and regions, and human interactions with park resources provided. The impacts of IPM on social and economic conditions would therefore be indirectly beneficial, local, long-term, and moderate.

CHAPTER 5-CONSULTATION AND COORDINATION

This section summarizes agencies contacted during preparation of this document. A list of reviewers and preparers is also provided.

5.1 EXTERNAL SCOPING

External (public) scoping was conducted to inform various agencies and the public about the proposal to implement exotic plant management at Southeast Utah Group parks and to generate input on the preparation of this EPMP EA/AEF.

External scoping was initiated with the distribution of a scoping letter to inform the public of the proposal to implement exotic plant management, and to generate input on the preparation of this EPMP EA/AEF. The scoping letter from SEUG dated June 25, 2008 was mailed to 37 addresses. Addressees included: various federal and state agencies, affiliated Native American tribes, and local and state governments.

Information on the EPMP EA/AEF was also posted on NPS Planning, Environment, and Public Comment website (PEPC) at http://parkplanning.nps.gov/. The public was given 30 days to comment on the project during the scoping period. No comments were received from the internet postings or mailings. Addressees included:

Federal Agencies
Bureau of Land Management
US Fish and Wildlife Service

In accordance with the ESA, Section 7 consultation with the USFWS concerning impacts to threatened and endangered species was initiated during the initial drafting of this EPMP/EA/AEF. Letters initiating informal consultation and requesting a list of federal threatened and endangered species were sent to Colorado and Utah Service Offices on June 25, 2008. Response to the informal consultation letters was received from the Utah USFWS office on July 30 and the Colorado USFWS office on September 17 respectively. The US Fish and Wildlife Mountain Prairie Region was consulted via the internet (USFWS 2008b) to generate a list of threatened, endangered and candidate species for Grand and San Juan Counties in Utah. The Colorado USFWS submitted a list of threatened, endangered and candidate species for Montezuma County, however, they determined that there are no threatened and endangered species within HOVE and therefore only the Utah USFWS will have the lead on our determinations.

State Agencies
Colorado State Historic Preservation Office
Utah State Historic Preservation Office
Dead Horse State Park in Utah

County Agencies
Grand County Weed Board
Montezuma County Weed Board
San Juan County Board of Commissioners

List of Consulted Native American Tribes and Pueblos
Hopi Tribal Council
Jemez Pueblo
Jucarilla Apache Nation
Laguna Pueblo
Navajo Nation
Pueblo of Acoma
Pueblo of Cochiti
Pueblo of Isleta
Pueblo of Nambe
Pueblo of Picuris
Pueblo of Pojoaque
Pueblo of San Clara
Pueblo of San Ildefonso
Pueblo of Santo Domingo
Pueblo of Taos
Pueblo of Tesuque
Pueblo of Zuni
San Felipe Pueblo
San Juan Pueblo
Sandia Pueblo
Santa Ana Pueblo
Southern Ute Tribe
Ute Indian Tribe
Ute Mountain Tribe
Ysleta Del Sur Pueblo
Zia Pueblo

5.2 INTERNAL SCOPING

Internal scoping was conducted by an interdisciplinary team of professionals from the Southeast Utah Group. Interdisciplinary team members met on April 3, 2008 to discuss the purpose and need for the project; various alternatives; potential environmental impacts; past, present and reasonable foreseeable projects that may have cumulative effects and possible mitigation measures. The team also gathered background information and discussed public outreach for the project. Over the course of the project, team members have conducted individual meetings to evaluate the proposed plan and discussed the impact analyses associated with this assessment. The results of multiple meetings are documented in this EPMP EA/AEF.

5.3 ENVIRONMENTAL ASSESSMENT REVIEW

The EPMP EA/AEF will be released for public review in February 2009. To inform the public of the availability of the EPMP EA/AEF, NPS will publish and distribute a letter or press release to various agencies, tribes, and members of the public on the SEUG's mailing list, as well as place an ad in the local newspapers. Copies of the EPMP EA/AEF will be provided to interested individuals upon request. Copies of the document will also be available for review at each park's visitor center and on the internet at http://parkplanning.nps.gov.

The EPMP EA/AEF is subject to a 30-day public comment period ending March 6, 2009. During this time the public is encouraged to post comments online at http://parkplanning.nps.gov/ or mail comments to Superintendent; Southeast Utah Group; 2282 West Resource Blvd, Moab, UT, 84532. Following the close of the comment period, all public comments will be reviewed and analyzed prior to the release of a decision document. NPS will issue responses to substantive comments received during the public comment period, and will make appropriate changes to the EPMP EA/AEF as needed.

5.4 LIST OF PREPARERS

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