National Park Service
U.S. Department of the Interior

Great Basin National Park
Nevada

INVASIVE PLANT MANAGEMENT PLAN

Environmental Assessment

September 2013

SUMMARY

Great Basin National Park is examining ways to manage and control exotic invasive plant infestations and prevent introduction of additional invasive plants. Areas of greatest concern to park managers are along the most heavily used transportation corridors within the park, in park riparian zones, and within disturbed areas. These areas total about 1430 acres and should be monitored and managed intensely to avoid or limit the spread of invasive exotic plants. Opportunistic monitoring and management would need to be employed in the remaining 75,750 acres of the park. Actions to control invasive plants would help the park meet its management mandates under the NPS Organic Act and conform to applicable Director's Orders.

Three alternatives are presented: 1) Alternative 1, the No Action Alternative, would not allow management actions to monitor, control, or eradicate current populations of invasive plants; and 2) Alternative 2, Implement full Integrated Pest Management strategy, which would allow an intensively coordinated approach to invasive plant management, including using manual treatments, herbicides, and biological controls along with habitat restoration and education to raise public awareness; and 3) Alternative 3, No Herbicide use, which would allow almost all avenues of IPM treatments and management except for use of any type of herbicide.

The Preferred Alternative is Alternative 2. This alternative would have negligible to minor, adverse, short-term impact on human health and safety and water quality and quantity. There would be would be minor, beneficial, short-term and moderate to major, beneficial, long-term effects to management of non-native plant species, unique or important wildlife or wildlife habitat, floodplains and wetlands, species of special or their habitat, and long term management of resources or land/resource productivity. There would be negligible, adverse, short-term and minor, beneficial, long-term impacts to unique, essential, or important fish or fish habitat. Effects to cultural resources would be negligible to minor, adverse, and long-term for archeological sites and minor to moderate, beneficial, and long-term effect for historic structures.

Long-term benefits derived from this alternative outweigh short-term adverse impacts. Alternative 2 is also the environmentally preferred alternative.

There will be a 30-day comment period on the Environmental Assessment (EA). Comments may be submitted online at: http://parkplanning.nps.gov/invasiveplant, or in writing to the following address:

Planning
Great Basin National Park
100 Great Basin National Park
Baker, NV 89311

ABBREVIATIONS

BCT – Bonneville Cutthroat Trout
BLM – Bureau of Land Management
CEQ – Council on Environmental Quality
EA – Environmental Assessment
EPA – Environmental Protection Agency
FIFRA – Fungicide and Rodenticide Act
GMP – General Management Plan
GPRA – Government Performance and Results Act
GRBA – Great Basin National Park
HNF – Humboldt-Toiyabe National Forest
IPM – Integrated Pest Management
NARA – National Archives and Records Administration
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NRHP – National Register of Historic Places
PEPC – Planning, Environment and Public Comment
RMP – Resource Management Plan
SOMC – Species of Management Concern
PPE- Personal protective equipment
JHA-Job Hazard Analysis
NR-National Register
COTR-Contracting Officer Technical Representative

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 PURPOSE AND NEED

1.1 INTRODUCTION

This Environmental Assessment (EA) is being prepared for the Invasive Plant Management Plan for Great Basin National Park (GRBA), Baker, Nevada 89311. The Planning, Environment and Public Comment (PEPC) number for this project is 38924. The office preparing this document is the Resources Management Division at GRBA.

1.1.1 Project Background

This EA would disclose the potential impacts of proposed changes in invasive plant management strategies, treatment, and techniques within the park. It examines the impacts resulting from the use of Integrated Pest Management (IPM) techniques, an approach that combines manual, chemical, biological, and cultural control methods, as well as selected combinations of these methods.

"The term 'integrated pest management' means a sustainable approach to managing pests by combining biological, cultural, physical, and chemical (herbicide) tools in a way that minimizes economic, health, and environmental risks." (The Food, Conservation, and Energy Act of 2008.)

1.1.2 Background of the Park

The authorizing legislation for Great Basin National Park was signed on October 27, 1986, which incorporated two areas: a 76,460-acre portion of the Humboldt-Toiyabe National Forest (HNF) and the former 640-acre Lehman Caves National Monument. Wheeler Peak, at 13,063 ft. elevation, overlooks the two basins of Spring and Snake Valleys. GRBA also manages an 80 acre administrative site of basin environment in the town of Baker, NV. The park is predominantly bordered by Bureau of Land Management (BLM) lands and a small area of private lands.

Purpose and Significance of Great Basin National Park

Great Basin National Park was established "…to preserve for the benefit and inspiration of the people a representative segment of the Great Basin of the Western United States possessing outstanding resources and significant geologic and scenic values …"The park boasts the second highest peak in the state of Nevada, Wheeler Peak, at 13,063 ft. It also is home to highly decorated Lehman Caves, along with 42 other caves. Several of the caves are home to endemic invertebrate species, including some that are new to science. Several old-growth bristlecone pine groves are nestled at high elevations, with trees dated over 3,000 years old. The Park is home to the only remaining glacier in Nevada; it also contains several rock glaciers and other glacial features. A wide diversity of wildlife and vegetation is found throughout the Park, and the Park is pursuing several restoration projects to enhance native species and habitats.

Great Basin National Park lies within a moderately intact natural landscape spanning the southern Snake Range and adjoining valleys. These areas include a wide diversity of Great Basin ecosystems, ranging from desert upland shrub lands, through subalpine bristlecone pines and alpine habitat. The area contains multiple terrestrial and aquatic ecosystems, some uncommon or rare in the Great Basin. These ecosystems provide habitat for a number of Species Of Management Concern (SOMCs), including 21 geographically limited or endemic plant species, 7 limited or endemic invertebrate species, 3 limited or endemic mollusk species, 3 limited or endemic fish species, 6 monitored bird species, and 7 declining or geographically limited mammal species (Nachlinger et al. 2001).

1.2 PURPOSE AND NEED

The purpose of this invasive plant management plan is to provide guidelines for management actions that would be taken to reduce impacts of invasive plants to park ecosystems. The need for the action is that invasive plants are spreading and increasing in abundance throughout Great Basin National Park., and this is contrary to NPS Management Policies of preserving and restoring native plant populations (4.4.1)

Decision to be made:

Great Basin National Park would decide to take no actions to attempt to control invasive plant populations, or adopt an invasive plant management plan based on the Integrated Pest Management (IPM) strategy that includes monitoring and treatment with a wide range of approved control agents, or adopt an invasive plant management plan partially based on the Integrated Pest Management (IPM) strategy that includes monitoring and treatment using manual and biological control methods only

1.3 PROJECT GOALS

Goals as identified in the park's General Management Plan (GMP) and Resource Management Plan (RMP) include managing the park to maintain the greatest degree of biological diversity and ecosystem integrity within the provisions of the authorizing legislation and eliminating or mitigating any impacts that threaten biological resources.

The goals of an Integrated Pest Management (IPM) strategy include increased monitoring in high risk areas, promptly eliminating new invasive species populations, preventing or disrupting the spread of established invasive plant populations, protecting sensitive and unique plant communities, using newly developed, approved herbicides and biological controls, and increasing the use of education and restoration.

Overall, the park's main goal is to significantly reduce in-park acreage dominated by excluding invasive non-native plants within ten years.

1.4 PROJECT AREA LOCATION

The project area covered by this Environmental Assessment includes the entire 77,100 acre park footprint and the 80 acre Baker Administrative Site

The park borders Bureau of Land Management (BLM) and private lands. Located in east-central White Pine County, Nevada, the park encompasses 77,100 acres of the Southern Snake Range (N – 38.98°, W - -114.30°; 77,180 acres). The park is 300 miles north of Las Vegas, 250 miles southwest of Salt Lake City, and only a few miles south of U.S. Highway 50. The nearest town is Baker, about 5 miles from the current park headquarters.

Figure 1. Location of Great Basin National Park.

1.5 SCOPE OF ENVIRONMENTAL ASSESSMENT

This EA analyzes two Action Alternatives and the No Action Alternative and their impacts on the human and natural environment. It fully describes project alternatives, existing conditions in the project area, and equally analyzes the effects of each project alternative on the environment.

This EA was prepared pursuant to the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4341 et seq.), as amended in 1975 by P.L. 94-52 and P.L. 94.83. Additional guidance includes NPS Director's Order 12 (NPS, 2001a) which implements Section 102(2) of NEPA and the regulations established by the Council on Environmental Quality (CEQ) (40 CFR 1500-1508). The project must comply with requirements of NEPA as well as other legislation that governs land use, natural resource protection, and other policy issues within the park.

1.6 RELATED LAWS, LEGISLATION, AND MANAGEMENT GUIDELINES

Many regulations and Executive Orders are typically addressed in NEPA documents. The following is a summary of all relevant guidance documents and regulations and a description of their relationship to the Master Plan. Other applicable regulations, plans, and standards that were taken into consideration in the development of this EA and the analysis of the impacts are described in Chapter 4.

National Park Service Organic Act

The NPS Organic Act directs the NPS to manage units "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 a manner as would leave them unimpaired for the enjoyment of future generations." (16 U.S.C. § 1). Congress reiterated this mandate in the Redwood National Park Expansion Act of 1978 by stating that the NPS must conduct its actions in a manner that would ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress." (16 U.S.C. § 1 a-1). The Organic Act prohibits actions that permanently impair park resources unless a law directly and specifically allows for the acts. An action constitutes an impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources and values." (Management Policies 1.4.3).

Great Basin National Park Site Legislation

Public Law 99-565 established Great Basin National Park "to preserve for the benefit and inspiration of the people a representative segment of the Great Basin of the Western United States possessing outstanding resources and significant geological and scenic values." It further stated that the Park Service is "to protect, manage, and administer the park in such a manner as to conserve and protect scenery, the natural, geologic, historic and archeological resources of the park, including fish and wildlife and to provide for the public use and enjoyment of the same in such a manner as to perpetuate these qualities for future generations."

National Environmental Policy Act (NEPA)

The purpose of NEPA is to encourage productive and enjoyable harmony between humans and

the environment; to promote efforts that would prevent or eliminate damage to the environment and stimulate the health and welfare of mankind; and to enrich the understanding of the ecological systems and natural resources important to the nation. NEPA requirements are satisfied by successful completion of an environmental assessment or environmental impact statement, in addition to a decision document.

Great Basin National Park General Management Plan 1993
"Nonnative species would be eradicated or controlled if they threaten to spread or compete with park resources and if control is feasible."

GRBA Resource Management Plan 1999
1) Adopt and utilize IPM strategy to help solve insect and weed pest problems. The focus would be on prevention and early detection of pest problems, emphasizing manual and biological controls whenever possible. All control programs should be monitored to evaluate their effectiveness in eliminating the target species and their actual impacts on non-target organisms. Continue to provide training for park personnel including the Integrated Pest Management Coordinator. 2) Continue to monitor invasive plant species throughout the park for potential impacts on the park's natural ecosystem. Prepare an Exotic Plant Management Plan based on IPM that categorizes the threat of each alien species, establishes strategies for control and preventing dispersal, and that identifies alien species present in the local area that might pose a threat if they are introduced into the park. The Exotic Plant Management Plan should be coordinated with identification of cultural landscapes.

NPS Management Policies 2006, Section 4.4.5 Integrated Pest Management Program
"The Service conducts an integrated pest management (IPM) program to reduce risks to the public, park resources, and the environment from pests and pest- related management strategies. IPM is 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."

National Historic Preservation Act of 1966 as Amended (NHPA)
§106 of the National Historic Preservation Act, as amended in 1992 (16 USC 470 *et seq.)*; and the accompanying Federal Regulations 36CFR800, requires any management action involving federal land, or employing federal funding, take into consideration the impacts of the action on historic properties (archaeological sites, ethnographic resources, and historic structures) that are listed on or eligible to be listed on the National Register of Historic Places. The process outlined by 36CFR800 includes: review, inventory, evaluation, consultation with the Advisory Council on Historic Preservation (ACHP), the State Historic Preservation Officer (SHPO) and a Tribal Historic Preservation Officers (THPO).

Programmatic Agreement Among the National Park Service (Department of the Interior), the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers, for Compliance with Section 106 of the National Historic Preservation Act, 2008 (Nationwide Programmatic Agreement)
The Nationwide Programmatic Agreement provides regulatory compliance guidance for NHPA and outlines a streamlined review in project areas and types that meet specific criteria for

expedited procedure.

National Park Service's Director's Order-28 *Cultural Resource Management Guideline*
The NPS guidelines for Cultural Resource Management requires that the National Park Service manage cultural resources in its custody through effective research, planning, and stewardship. Included in DO-28 is the requirement to consult with Tribes about any project that might have interest including ethnographic resources identified as any, "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".

National Park Service *2006 Management Policies* Section 5 Cultural Resource Management
Management Policy guidelines for Cultural Resources outlines the NPS responsibility to act as steward for cultural resources including "archaeological resources, cultural landscapes, ethnographic resources, historic and prehistoric structures, and museum collections," through a program of research and identification, planning and consultation, and stewardship to ensure cultural resources are preserved and protected with appropriate treatments, to make them available for public understanding and enjoyment.

Archaeological Resources Protection Act of 1979
The act (PL96-95, 93 Stat. 712, 16 USC Section 470aa et seq. and 43 CFR 7, subparts A and B, 36 CFR) secures the protection of archaeological resources on public or Indian lands and fosters increased cooperation and exchange of information between private, government, and the professional community in order to facilitate the enforcement and education of present and future generations. It regulates excavation and collection on public lands and Indian lands. It requires notification of Indian tribes.

NPS Strategic Plan for Managing Invasive Nonnative Plants in National Parks (NPS, 1996): Prevent invasion; increase public awareness; inventory and monitor nonnative plants; conduct research and transfer technology; integrate planning and evaluation; and manage invasive nonnative plants.

National Park Service Resource Management Guidelines NPS-77, 4:12
"Management of populations of exotic plant and animal species, up to and including eradication, would be undertaken wherever such species threaten park resources or public health…High priority would be given to the management of exotic species that have a substantial impact on park resources and that can be reasonably expected to be successfully controlled. NPS strives to protect and preserve all species of native flora and fauna within all management areas."

Regulatory measures that guide invasive plant management in Great Basin National Park include the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Executive Order 13112 on Invasive Species, Government Performance Results Act of 1993 (GPRA), Nevada Noxious Weed List, Pesticide Handling Certification, NPS Management Policies, and Natural Resources Management Guideline – Director's Order (DO)-77.

Title 7 USC 136r-1 Federal Insecticide Fungicide and Rodenticide Act
SEC. 303 Integrated Pest Management states: "The Secretary of Agriculture, in cooperation with

the Administrator, shall implement research, demonstration, and education programs to support adoption of Integrated Pest Management. Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks. The Secretary of Agriculture and the Administrator shall make information on Integrated Pest Management widely available to pesticide users, including Federal agencies. *Federal agencies shall use Integrated Pest Management techniques in carrying out pest management activities and shall promote Integrated Pest Management through procurement and regulatory policies and other activities"* http://trac.syr.edu/laws/07/07USC00136r-1.html

The Food Quality Protection Act

On October 10, 2006 the Food Quality Protection Act mandated new procedural regulations for the registration review of pesticides. Under these rules, EPA will review each pesticide's registration every 15 years to assure it still meets the FIFRA standards for registration, and that as the ability to assess risk evolves and as policies and practices change, all registered pesticides continue to meet the statutory standard of no unreasonable adverse effects…Changes in science, public policy, and pesticide use practices will occur over time. Through the new registration review program, the Agency will periodically reevaluate pesticides to make sure that as change occurs, products in the marketplace can continue to be used safely…The public will always be assured that pesticide registrations are updated to meet current scientific and regulatory standards.
http://www.epa.gov/pesticides/regulating/laws/fqpa/fqpa_implementation.htm#registration

The Food Conservation, and Energy Act of 2008

Section 1201(a) of the Food Security Act of 1985 (16 U.S.C. 3801(a)) as amended by inserting after paragraph (15), as redesignated by subsection (a) (1), the following new paragraphs: "(16) INTEGRATED PEST MANAGEMENT .-The term 'integrated pest management" means a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."
http://www.nationalaglawcenter.org/farmbills/#08

Archives Records Administration

The Federal Records Act is the basic law regarding federal government recordkeeping responsibilities and activities (44 USC 2901; 3101-3107; 3301-3324). Records are defined in 44 USC 3301; 44 U.S.C. 2107 directs transfer of records appropriate for permanent preservation; 44 U.S.C. 2905 sets standards for the selective retention of records. The National Archives and Records Administration (NARA) has government-wide responsibility for records management, and retains the ultimate authority over disposal of records. NARA regulations are contained in 36 CFR Chapter XII; Subchapter B. Part 380 of the Departmental Manual contains DOI guidance on records management. 36 CFR 1228 (Subpart L) describes the transfer of records to the National Archives.
www.archives.gov/about/laws/nara.html

Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance October 2009

Section 2 € promote pollution prevention and eliminate waste by: (vii) Implementing Integrated

pest management and other appropriate landscape management practices.
http://edocket.access.gpo.gov/2009/pdf/E9-24518.pdf

Public Contracts and Property Management, Facility Management, 2001 Code of Federal Regulations (C.F.R.) Title 41, Volume 2, 102.74.35
Executive agencies are directed to provide IPM services.

Department of Interior Manual, Sec.517 Integrated Pest Management Policy; Including the Use of Pesticides and Biological Control Agents

1.1 Purpose-The purpose of this document is to incorporate Integrated Pest Management (IPM) in all Department pest management activities. As defined in 7USC136r-1, *"Integrated Pest Management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks."*

1.2 Scope-This chapter applies to all Department and Bureau activities involving planning, procurement, prevention, design, detection, control, and management of native and nonnative pest species on DOI lands and properties.
http://elips.doi.gov/app_DM/act_getfiles.cfm?relnum=3742

National Park Service Management Policies 2006, Section 4.4.5 Integrated Pest Management Program
The Service conducts and integrated pest management (IPM) program to reduce risks to the public, park resources, and the environment from pests and pest-related management strategies. IPM is 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. Pest or pesticide use is also noted in Management Policies Section 4.4.4.1 Introduction or Maintenance of Exotic Species 4.4.4.1.4.4.1.2 Genetic Resources Management Principle; Partnerships, Sec. 5.3.1.5 Protection and Preservation of Cultural Resources, 9.1.6.2 Response to Contaminants
http://www.nps.gov/policy/MP2006.pdf

Standard Concession Contract Language; Federal Register, July 19, 2000
Concession Managers are directed to "use an integrated pest management program to manage weeds, harmful insects, rats, mice and other pests on Concession Facilities and that weed and pest management activities shall be in accordance with Applicable Laws and guidelines established by the Director."

1.7 ISSUES AND IMPACT TOPICS

1.7.1 Scoping

Internal Scoping: Internal Scoping was conducted on March 15, 2012, through interdisciplinary team meeting of Great Basin National Park staff. Preliminary issues were identified using the PEPC Environmental Screening Form. Issues identified during internal scoping were:

- **Human health and safety:** How would the use of manual treatments, herbicide

treatments, and biological controls in high visitor use areas, riparian areas, and near water affect human health and safety?

- **Introduce or promote non-native species (plant or animal):** How would the use of manual treatments, herbicide treatments, and biological controls impact non-native plant species?
- **Unique or important wildlife or wildlife habitat:** How would the use of manual treatments, herbicide treatments, and biological controls maintain the natural ecosystems of all plant and animals native to the parks ecosystems?
- **Water quality or quantity:** How would the use of manual treatments, herbicide treatments, and biological controls affect water quality and quantity?
- **Floodplains or wetlands:** How would the use of manual treatments, herbicide treatments, and biological treatments affect floodplains or wetlands?
- **Species of special concern (plant or animal; state or federal listed or proposed for listing) or their habitat:** How would the use of manual treatments, herbicide treatments and biological treatments affect wildlife and plant species of management concern and their habitats?
- **Unique, essential or important fish or fish habitat:** What would be the effect of manual treatments, herbicide treatments, and biological treatments on aquatic species of management concern?
- **Cultural Resources:** What would be the effect of manual treatments, herbicide treatments, and biological treatments on cultural resource sites, including archaeological sites and artifacts, historic structures and a designated historic district?
- **Long-term management of resources or land/resource productivity:** What would be the effect of manual treatments, herbicide treatments, and biological treatments on long-term management of resources or land/resource productivity?

Additional meetings were held on October 11, 2012 and December 7, 2012 to discuss the progress of the plan.

External Scoping: On February 10th, 2012, a scoping letter was sent to individuals and groups on the GRBA NEPA mailing list (see Appendix D for scoping mailing list), a scoping letter was sent to all consulting Tribes (see section on conformance for a list of Consulting Tribes), and a press release was sent to local newspapers and radio stations for publication and Public service announcements. Information was also available on the National Park Service Planning, Environment & Public Comment (PEPC) website at: http://parkplanning.nps.gov/ . The public was informed that the park was preparing an EA for a proposed Invasive Plant Management Plan utilizing IPM strategy. At the end of 45 days, the park had received three comment responses from local residents and no written comments from groups or Tribes. Comments that rose to the level of issues as a result of external scoping include:

- Impacts to water quality
- Impacts to aquatic species
- Impacts to wetlands
- Public health and safety

Comments about all of these issues appear to originate directly from concerns relating to the use

of herbicides in the general vicinity of surface water resources, as reflected in the following specific comments. As a result this EA includes a "No Herbicide Use" alternative (Alternative 3).

- Using biological control and/or native plant/grass sp. to outcompete weeds and the need for spraying (herbicide use)
- No spraying (herbicide use) in Snake Creek watershed
- Need to list where the Park currently sprays, for what, when, (name of) chemical, (targeted) weed

Comments also included additional recommendations that did not rise to the level of issues:

- Allow harvesting certain invasive plants (as herbs) for personal use
- Renaming the plan to Invasive Plant Plan
- Adding Russian olive, salt cedar to list of (targeted) invasive plants
- Removal of willows lining stream banks

1.7.2 Issues and Impact Topics Identified for Further Analysis

Issue and Impact Topics	Reasons for Retaining Impact Topic
Human health or safety 1. How would the use of manual treatments, herbicide treatments, and biological controls in high visitor use areas, riparian areas, and near water affect human health and safety?	Improper application of herbicides can affect human health directly and indirectly. About 90,000 visitors come to GRBA annually and many of these visitors' frequent areas that commonly contain invasive plants such as campgrounds and trailheads. Visitors may be indirectly exposed to herbicides used in these areas. Another common location for invasive plants is in riparian corridors close to available water, and herbicides improperly applied in these areas could potentially enter local surface water supplies. Visitors and local downstream residents who use local water resources for drinking, cooking, bathing, ranching and agriculture could potentially be exposed to low levels of herbicide.
Introduce or promote non-native species (plant or animal) 2. How would the use of manual treatments, herbicide treatments, and biological controls impact non-native plant species?	The primary intent of this plan is to provide for actions to eradicate or control various invasive plant species in order to protect and encourage native plant ecosystems. Lack of effective treatment of invasive plants (No-Action Alternative) would result in promotion or unimpeded spread of invasive plants.
Unique or important wildlife or wildlife habitat	The primary intent of this plan is to provide for actions to eradicate or control various invasive

3. How would the use of manual treatments, herbicide treatments, and biological controls maintain the natural ecosystems of all plant and animals native to the park's ecosystems?	plant species in order to protect and encourage native plant ecosystems. Supporting native ecosystems by removal of invasive plants will promote healthy wildlife habitat and thereby the wildlife that depends on those habitats. Lack of effective treatment of invasive plants (No-Action Alternative) would result in promotion or unimpeded spread of invasive plants and thereby impact native plant ecosystems and their dependent wildlife.
Water quality 4. How would the use of manual treatments, herbicide treatments, and biological controls affect water quality	Park streams are headwaters for riparian communities, ground water recharge, and drinking water for the local community. Improper use of herbicide treatments could result in low levels of herbicides entering the local surface and groundwater systems and affect water quality.
Floodplains or wetlands 5. How would the use of manual treatments, herbicide treatments, and biological treatments affect floodplains or wetlands?	The Park's GMP states that because of the relative scarcity of water in the South Snake Range, riparian areas and wetlands are critical park resources. These areas are ecologically significant and support greater biodiversity than adjoining uplands. NPS management policies state that the Service would protect watershed and stream features primarily by avoiding negative impact to riparian processes and by allowing natural fluvial processes to proceed unimpeded. Executive Order 11990 *Protection of Wetlands* requires federal agencies to avoid, where possible, adversely impacting wetlands. 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. Lack of effective treatment of invasive plants (No-Action Alternative) would result in promotion or unimpeded spread of certain invasive plants within floodplain and wetland areas and thereby potentially negatively impact the natural appearance and function of wetlands and floodplains .

Species of special concern (plant or animal; state or federal listed or proposed for listing) or their habitat 6. How would the use of manual treatments, herbicide treatments and biological treatments affect wildlife and plant species of management concern and their habitats?	The park maintains a list of wildlife and plant species of management concern (SOMC) and manages these species and their habitats for their continuity (NPS 77 Natural Resources Management Guidelines). The GMP emphasizes that Species Of Management Concern would be given special consideration in planning activities. NPS Management Policies (2006, Section 4.4.1) state that the Service would maintain as part of the natural ecosystems of parks, all plant and animals native to park ecosystems. Lack of effective treatment of invasive plants (No-Action Alternative) could result in promotion or unimpeded spread of certain invasive plants within habitats that support SOMCs.
Unique, essential or important fish or fish habitat 7. What would be the effect of manual treatments, herbicide treatments, and biological treatments on aquatic species of management concern?	The parks' aquatic ecosystems include 10 perennial streams totaling over 40 miles, many miles of ephemeral streams, and over 400 springs with an assortment of associated wetlands. All 10 perennial streams contain cold water trout fisheries and of that, 16 miles contain the SOMC Bonneville cutthroat trout. Toquerville Springsnails occur in only 2 springs in Snake Creek on the east side of the park. SOMC's could be exposed to low levels of herbicides. Lack of effective treatment of invasive plants (No-Action Alternative) could result in promotion or unimpeded spread of certain invasive plants within riparian habitats that provide food sources for native fish populations. Replacement of native riparian plants with exotic plants has potential to alter populations of insects that native fish prefer to eat.
Cultural Resources 8. What would be the effect of manual treatments, herbicide treatments, and biological treatments on cultural resource sites, including archaeological sites and artifacts, historic structures and a designated historic district?	The National Park Service acts as steward to many important cultural resources, and is charged with preserving these resources for the enjoyment present and future generations. Great Basin National Park contains 211 documented cultural resource sites from archaeological dating to over 10,000 years ago continuing through historic period. Cultural resources include numerous archaeological sites and artifacts, potential ethnographic resources, over 26 historic structures, and 1

	National Register designated historic district and cultural landscape. With less than 10% of the Park area surveyed there is a high potential for more cultural resources to be identified including potential ethnographically important resources and cultural landscapes. Certain mechanical methods of invasive plant control, such as digging and pulling, have the potential to disturb cultural materials and structures and thereby produce negative impacts to those resources.
Long-term management of resources or land/resource productivity. 9. What would be the effect of manual treatments, herbicide treatments, and biological treatments on long-term management of resources or land/resource productivity?	Infestations of invasive plants have the potential to negatively impact land/resource productivity by eliminating habitat for useful plants or those that provide preferred wildlife forage. They also have potential to disrupt natural plant community succession, possibly resulting in a preference toward unnatural climax communities. Lack of effective treatment of invasive plants (No-Action Alternative) could result in promotion or unimpeded spread of certain invasive plants and thereby alter normal patterns of native plant succession and resource availability.

1.7.3 Impact Topics Considered but Dismissed

The following issues developed from the scoping process were dropped from further analysis. Rationales for dropping the issues are identified below.

Table 2, Impact Topics Considered But Dismissed

Topic	Reasons for Dismissing Topic
Geological resources - soil, bedrock, streambeds, etc.	Integrated Pest Management techniques would not impact soil characteristics. Manual methods of invasive plant removal would cause only surficial disturbances and those effects are considered negligible.
Geohazards	There is no potential to be affected by or cause additional geological hazards.
Air Quality	Integrated Pest Management techniques would be directly applied to invasive plants at surface level and would not impact air quality.

Soundscapes	Integrated Pest Management techniques being considered produce little unnatural sound and no use of aircraft is being considered, therefore it would not impact the parks' soundscapes.
Stream flow characteristics	The use of Integrated Pest Management techniques would not change stream flow characteristics in GRBA.
Marine or estuarine resources	There are no marine or estuarine resources in or near the park.
Land use, including occupancy, income, values, ownership, type of use	GRBA does not have any inholdings within its boundaries.
Rare or unusual vegetation-old growth timber, riparian, alpine	Rare or unusual vegetation is generally found in areas of the park above 10,000 ft. These areas do not have any of the target invasive species identified, therefore no impacts are expected.
Unique ecosystems, biosphere reserves, World Heritage sites	GRBA does not have biosphere reserves, or World Heritage sites within its boundaries and there would be no expected impacts to unique ecosystems.
Recreation resources, including supply, demand, visitation, activities, etc.	The use of Integrated Pest Management techniques would have short term-negligible effects on recreation resources due to temporary closures after spraying would not impact recreation resources.
Visitor experience, aesthetic resources	The use of Integrated Pest Management techniques to control invasive plants could be planned and timed to minimize impacts to visitor experience and aesthetic resources. In very few instances would there be need for temporary closures after application of herbicides and those would generally be less than 24 hours.
Museum collections (objects, specimens, and archival and manuscript collections)	Implementation of any of the alternatives considered in this document is not expected to add more than a small number of reports, plans, and data to be catalogued and/or archived.
Socioeconomics, including employment, occupation, income changes, tax base, infrastructure, concessions	There would be no socio-economic impact to Park Residents or the surrounding communities.
Environmental Justice-Minority or low income populations, ethnography, size, migration patterns, etc.	The actions proposed in this analysis would not have disproportionate health or environmental effects on minorities or low-income populations or communities as defined in the Environmental Protection Agency's

	Environmental Justice Guidance (1998).
Energy Resources	None of the alternatives will impact any existing or future energy resources.
Other agency or tribal land use plans or policies	There are no other agency or tribal land use plans which would be affected by the use of Integrated Pest Management techniques.
Resource, including energy conservation potential, sustainability	This plan would not impact energy conservation and potential sustainability.
Urban quality, gateway communities, etc.	The use of Integrated Pest Management techniques would not have an effect on urban quality or the gateway community of Baker, NV.
Other important environmental resources (e.g. geothermal, paleontological resources)?	The use of Integrated Pest Management techniques such as digging with metal tools could potentially impact paleontological resources, but the intensity would be negligible. The alternatives considered would have no effects on other environmental resources.
Alter or impact caves or areas of karst geology	Invasive plant management would not be used in caves and, although on some occasions there could be limited herbicide spraying or mechanical removal over karst areas, the effects would be negligible and would not alter or impact karst geology.
Change night sky conditions, natural night sky or glare	Integrated Pest Management Techniques would be applied to invasive plants during daylight hours and would not impact the night sky.
Change or impede accessibility	There would be no change to accessibility.
Change the amount of emissions from vehicles or increase other air pollutants	The use of Integrated Pest Management techniques would not change the amount of emissions from vehicles or air pollutants.
Alter scenic viewsheds, be visually intrusive or add to a degraded visual conditions	The use of Integrated Pest Management techniques will not alter or degrade visual conditions.
Involve handling/storage of hazardous substances or work in areas of potential contamination.	Herbicides biological control materials and their use do not constitute hazardous materials handling or storage.
Change congestion levels, traffic volumes or traffic for pedestrians, bicyclists or vehicles	There would be no effect to visitor traffic volumes or routes.
Affect current or planned visitor access, services, or parking	The use of Integrated Pest Management techniques to control invasive plants would not affect visitor access, services, or parking.
Wilderness Areas	There are no wilderness areas within the park boundaries.
Prime Farmlands	The parks' enabling legislation does not

	specify or designate any unique farmlands within the park boundaries.
Climate Change	Techniques used to eradicate or control invasive plants do not contribute significantly to natural agents that drive or influence climate change.

2.0 ALTERNATIVES

2.1 INTRODUCTION

All alternatives are consistent with the legal requirements, established standards and guidelines for the management of natural and historic resources in accordance with the mission of the NPS.

The alternatives were developed though collaboration with the park's interdisciplinary team during the internal scoping process.

2.2 ALTERNATIVE 1, NO ACTION

Under this alternative, the park would not treat invasive plants by any method, nor would the park restore any areas infested with invasive species solely for the purpose of native plant restoration. The park would also not conduct education and outreach programs about invasive plants. The park would not monitor invasive plant populations to document size and number of infestations.

2.3 ALTERNATIVE 2, IMPLEMENT FULL IPM STRATEGY – PREFERRED ALTERNATIVE

The Preferred Alternative would implement a full IPM strategy that includes inventory, monitoring and documentation, manual treatments, herbicide treatments, biological treatments, education and outreach, seed collection and storage, and restoration within Great Basin National Park and the Baker Administrative Site. (See Appendix C for examples of selected IPM treatment strategies of invasive plants.) Only licensed contractors or National Park Service staff certified to use herbicides would be able to apply herbicides or instruct NPS crews and/or volunteers in treatment methods.

Future inventory and treatment areas would be chosen based on verified locations of individuals and populations of invasive species. Treatments would be particularly concentrated in areas of disturbance that invasive plants prefer (within 100 feet of roads and campgrounds and 200 feet of trailheads), and in ecological communities considered susceptible to invasive plant invasion due to their productive soils, variable disturbance regimes, soil moisture availability, and high traffic and recreational use (Figure 2). These areas encompass approximately 1430 acres within the park. Weed inventories and treatments would not be limited to these areas but they are considered the most likely to require future inventory and treatments.

Riparian, wet meadows and Great Basin wildrye plant communities are susceptible to invasion by exotic forbs, such as knapweed, whitetop, loosestrife, salt cedar, and Russian olive, as well as introduced perennial grasses such as crested wheatgrass, due to their productive soils, variable disturbance regimes, soil moisture availability and high traffic and recreational use.

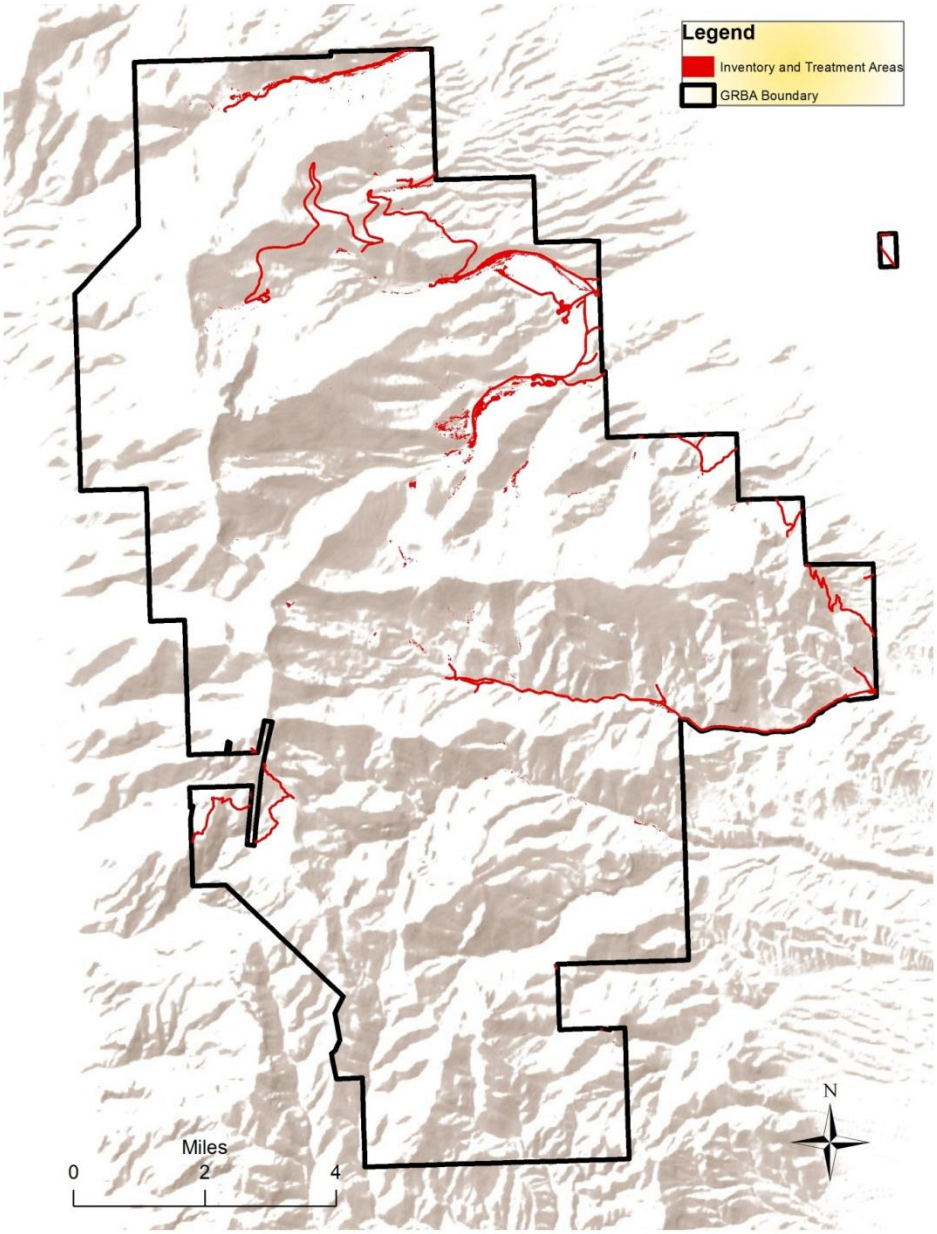

Figure 2. Intensive weed inventory and treatment areas (1,430 acres).

Manual Treatments

Manual treatments would include: cutting, pulling, removing and collecting seeds, or digging plants to prevent re-sprouting and re-growth. Methods may include hand pulling; hand tools

including: trowels, shovels, Pulaskis, hand saws, axes, machetes, hoes, brush hooks, pruners, loppers, and hand clippers; and power tools including chainsaws, weed trimmer, mowers, and motorized wheel barrows. Manual treatments are species-selective, meaning only the target plants are impacted.

Herbicide treatments

Herbicides would be used on invasive plant species that cannot be effectively controlled by other methods. Use of herbicides would follow all permitted state and federal guidelines. Only, herbicides registered and approved by EPA's Office of Pesticide Programs would be used and applications would be consistent with product labeling. The decision to use herbicides or not, types of herbicides to be used, application concentrations, rates, and times would depend on treatment objectives, topography, size of infested area, invasive plant density, proximity of sensitive species, plant phenology, soil texture, distance to water, potential risks for ground water contamination, weather conditions, and season. Herbicide application planning would consider potential impacts to non-target plants and would ensure minimum risk to human health and safety. (See Appendix B for Herbicide and Biological Control List) The two methods proposed, backpack spraying and cut stump applications, are considered species selective. Aerial spraying or boom spraying are not species selective and are not proposed.

Biological Treatments

Biological treatments include insects, fungi, and bacteria which reduce the abundance and vigor of an invasive plant species. They may be used alone or in conjunction with herbicide and/or manual treatments. Use of biological controls would follow all permitted state and federal guidelines. Only, biological control agents registered and approved by USDA's Animal and Plant Health Inspection Service (APHIS) would be used and releases would be consistent with permit requirements. (See Appendix B For Herbicide and Biological Control List).

Education and Outreach

Education and outreach is important to foster an increased interest and understanding of invasive plant management issues, techniques, and identification. Education programs would include staff training, visitor awareness, safety messages, current treatment locations, and public education through the use of video and electronic media, printed materials, interpretive talks, school programs, public field days, and volunteer opportunities. A point of contact would be identified for reporting invasive plant observations.

Restoration

Restoring native vegetation would provide increased resiliency to an environment influenced by climate change. In addition, carbon sequestration would be enhanced in native communities compared to annual grass communities that burn at more frequent intervals (Bradley et al. 2006). Restoration treatments are practices that promote growth of desirable plants and reduce opportunities for invasive plants. Treatments include seeding, planting, and mulching. Seeding is used to encourage re-establishment of native plants and prevent establishment of invasive plants. Seeding is required in areas where native plant populations existed prior to disturbance or invasion and where diversity is not adequate within and surrounding treated infestations. Active restoration speeds recovery towards a healthy plant community. Methods vary and often include a combination of soil scarification, collection and storage of native seed, spreading of native seed

and mulch, addition of soil amendments, and planting native species. New methods of restoration management would be used to achieve desired conditions and goals.

2.4 ALTERNATIVE 3, NO HERBICIDE USE

Under this action alternative all components of IPM strategy would be implemented with the exclusion of use of herbicide treatments.

2.5 MITIGATION

As described in Table 2, mitigations would only apply to the Preferred Alternative.

Table 3. Mitigations for Invasive Plant Management Plan.

Resources Area	Mitigation	Responsible Party
Water Quality	All herbicide treatments will be performed or supervised by licensed personnel according to and consistent with label instructions. No herbicides will be applied to or in the immediate vicinity of streams or open surface water unless product is specifically designed and approved by the EPA for such use. All herbicides or biological controls to be used shall be reviewed and approved by the National Park Service's Regional Integrated Pest Management Coordinator.	Park's Invasive Plant Coordinator
Health and Human Safety	Herbicide application areas will be closely monitored to assure that any potential for negative impacts to humans is minimized. Herbicide will be applied only to targeted plants using hand or backpack sprayers. Areas in which herbicides have been applied will be appropriately signed and/or flagged to warn visitors and staff to avoid the area. Residents will be notified prior to application.	Park's Invasive Plant Coordinator
Unique or important wildlife or wildlife habitat; Species of Special Concern; Unique or important fish or fish habitat	Herbicide application areas will be closely monitored to assure that any potential negative impacts to native vegetation, wildlife, and aquatic species is minimized. Herbicide will be applied only to targeted plants using hand or backpack sprayers.	Park's Invasive Plant Coordinator
Introduce or promote non-native species	Use of weed free soil, mulch and straw for projects within park boundaries.	Park's Invasive Plant Coordinator
Introduce or promote non-native species	Prior to beginning any construction project, all equipment and vehicles will be thoroughly pressure washed to remove foreign soil and vegetative matter to minimize potential of introduction of nonnative plants to the project	Park's Invasive Plant Coordinator, Contracting

	area.	Officer Technical Representative (COTR)
Cultural resources	National Historic Preservation Act, Section 106 procedures are to be followed on all treatment areas involving ground disturbing activity including review, inventory, evaluation for National Register (NR) eligibility and consultation. Cultural resource staff will be consulted in areas identified for herbicide or biological controls to avoid damage to potential ethnographically important plants. Tribal consultation may be required for identification of ethnographically important plants.	Cultural Resource Staff
Introduce or promote non-native species	Horses and other livestock should be fed weed-free feed 2-3 days prior to entering the park and during their stay in the park. Horses and other livestock should be brushed and cleaned prior to entering the park. Instructions to potential visitors will be posted on Park's website.	Park's Invasive Plant Coordinator, Law Enforcement

2.6 ALTERNATIVES AND ACTIONS CONSIDERED BUT DISMISSED

The alternative below was developed based on the results of internal and external scoping. The following section discusses the alternative considered but eliminated from further study. This alternative was eliminated from detailed study because it did not meet the purpose and need of the invasive plant management plan, are not technically or economically feasible, or conflict with an existing park plan or policy. One alternative was considered, but eliminated from further detailed study.

2.6. 1 Develop a plan that considers all treatments except biological treatments.

Newly emerging biological control agents may have a great promise for controlling some of the most aggressively invasive non-native plants. Given that in some cases no other techniques have been shown to be significantly effective in controlling large infestations of certain invasives, the use of these agents could more likely meet the goals of a comprehensive invasive plant management plan.

2.7 HOW ALTERNATIVES MEET PROJECT OBJECTIVES

Action alternatives selected for analysis must meet all objectives to a large degree. Action alternatives must also address the stated purpose of taking action and resolve the need for action. Alternatives that did not meet the plan objectives were dismissed from further analysis (see the *Alternatives Considered but Dismissed* section above). All action alternatives would meet all objectives to a large degree and address the project's stated purpose and need.

2.8 COMPARISON OF ALTERNATIVES

Table 4. Comparison of Alternatives for Invasive Plant Management Plan.

Actions	Alternative 1-No Action	Alternative 2- Preferred Alternative Implement Full IPM strategy	**Alternative 3- No Herbicide Use**
	The No Action Alternative would not treat invasive plants by any method, nor would the park restore any areas infested with invasive species solely for the purpose of native plant restoration. The park would not conduct education and outreach programs about invasive plants. The park would not monitor invasive plant populations to document size and number of infestations.	The Proposed Action would implement a full IPM strategy (see References section for website) that includes inventory, monitoring, and documentation, manual treatments, herbicide treatments, biological treatments, education and outreach, seed collection and storage, and restoration, including the use of fire, throughout Great Basin National Park. Future inventory and treatment areas would be chosen based on locations of invasive species individuals and populations, areas of disturbance where invasive plants occur (within 100 feet of roads and campgrounds and 200 feet of trailheads), and ecological communities considered susceptible to invasive plant invasion.	The Proposed Action would implement a full IPM strategy except for the use of herbicide treatments. All other components of Alternative 2 would apply.
Inventory and Monitoring	None	Inventory and monitoring of invasive plant populations would occur mainly in	Same as in Alternative 2

		the Intensive Inventory and Treatment areas indicated in figure 2. Inventory and monitoring in other park areas would probably occur opportunistically.	
Manual Treatments	None	Includes cutting, pulling, removing, and collecting seeds, or digging plants to prevent re-sprouting and re-growth.	Same as Alternative 2, but with a greater emphasis.
Herbicide Treatments	None	Includes the use of hand sprayers, pellets, dry powders at the direction of park staff with applicator certification. Application is dependent upon treatment objectives, topography, size of infestation, plant density, proximity of sensitive species, plant phenology, soil texture, distance to water, potential risks for ground water contamination, weather conditions, and season.	No herbicide treatments would be used.
Biological Treatments	None	Includes the use of specific insects, fungi, and bacteria. May be used alone or conjunction with herbicide and/or manual treatments.	Same as Alternative 2, except there would be no use of herbicides in conjunction with biological controls or manual treatments.
Education and Outreach	None	Includes staff training, visitor awareness, safety messages, current treatment	Same as Alternative 2.

		locations, and public education through the use of video and electronic media, printed materials, interpretive talks, school programs, public field days and volunteer opportunities. A point of contact would be identified for reporting invasive plant populations.	
Restoration	None	Includes the use of native seed collection, seeding, planting, and mulching.	Same as Alternative 2.

2.9 IMPACT SUMMARY

Table 5. Impact Summary for Invasive Plant Management Plan Alternatives.

Impact Topic	Alternative 1-No Action	Alternative 2-Preferred Alternative Implement full IPM strategy	Alternative 3-No Herbicide Use
Human health and safety 1. How would the use of manual treatments, herbicide treatments, and biological controls in high visitor use areas, riparian areas, and near water affect human health and safety?	The park would not treat invasive plants by any method, thus there would be no foreseeable risks to human health and safety.	Non-restricted herbicides proposed for use in this alternative have very low toxicity to humans. They are not mobile when applied by licensed personnel under proper conditions according to label instructions, and therefore provide minimal risk for contamination of drinking water supplies. Personal protective equipment used during treatment will mitigate risk of staff exposure. Treatment areas would be closed to the public to prevent inadvertent exposure during herbicide application or risk of injury during manual removal. This	Risks to human health and safety from herbicide exposure would not occur. Risks of minor injuries to staff would be increased due to increased need for manual treatments. This alternative would have indirect, negligible, adverse, short-term impacts to human health and safety.

		alternative would have direct and indirect, negligible, adverse, short-term impacts to human health and safety.	
Introduce or promote non-native species (plant or animal) 2. How would the use of manual treatments, herbicide treatments, and biological controls impact non-native plant species?	Current populations of invasive plants would increase and additional non-native species could invade the park. This alternative would have major, adverse, long-term effects in the introduction or promotion of non-native plant species.	Non-native invasive plant infestations would be controlled or eradicated. Outreach and education would teach park visitors and neighbors how to recognize and report occurrences of invasive plants. Restoration would encourage native plants to compete with invasives for available habitat. Biological controls are often non-native species, but are not considered to be risks for invasion. This alternative would result in minor, beneficial, short-term and major, beneficial, long-term effects in the introduction or promotion of non-native plant species.	Non-native invasive plant infestations would be controlled or eradicated but not as effectively as in Alternative 2. Other programs and methods identified in Alternative 2 would be implemented and there would be a greater reliance on manual removal. This alternative would result in negligible to minor, adverse and beneficial, short-term but minor to moderate, beneficial, long-term effects in the control of non-native plant species.
Unique or important wildlife or wildlife habitat 3. How would the use of manual treatments, herbicide treatments, and biological controls maintain the natural ecosystems of all plant and animals native to the parks ecosystems?	Invasive weeds would not be treated and would increase in number and area, gradually altering native habitat for wildlife. Dependent wildlife could move or their numbers could be decreased. The No Action alternative would have moderate to major, adverse, long-term impacts on wildlife populations and wildlife habitat.	Invasive plants would be inventoried and aggressively treated using manual, herbicide and biological control methods. Unique or important wildlife and wildlife habitat would improve toward more natural conditions. Impacts of this alternative on unique or important wildlife and wildlife habitat would have negligible to minor, adverse, and short-term effects but moderate to major, beneficial, and long-term effects.	Same as Alternative 2 Improvement toward more natural conditions could be relatively or significantly slower. Certain invasive plant populations may not respond to other control methods, and may remain at current levels or increase. Under this alternative impacts on unique or important wildlife and wildlife habitat would be negligible to minor, adverse, and short-term, but minor to moderate, beneficial, and long-term.
Water quality or quantity 4. How would the use of manual treatments, herbicide treatments, and	The No Action alternative would have negligible, short-term, adverse effects on water quality based on the cumulative effects and no effects to	Water quality could be slightly degraded by increased turbidity resulting from run-off across disturbed soil surfaces in mechanically treated areas. Trace amounts of herbicide could potentially enter streams and	Effects would be similar to those in Alternative 2, except that without the use of herbicide controls there would be a greater use of soil disturbances from mechanical removal methods, thus increasing

biological controls affect water quality or quantity?	water quantity.	groundwater. Only herbicides approved by the EPA for use near or in water can be used. The alternative would have negligible, adverse, short-term effects on water quality and no effects on water quantity.	potential for increased stream turbidity. There would be no trace amounts of herbicides entering streams and groundwater. The alternative would have negligible, adverse, short-term effects on water quality and no effects on water quantity.
Floodplains and Wetlands 5. How would the use of manual treatments, herbicide treatments, and biological treatments affect floodplains or wetlands?	The No Action alternative would not manage invasive plants in wetlands, one of the area's most prone to invasive plants. Plant and animal diversity in wetlands would be reduced as invasives increase in number and area. This would result in moderate, adverse, and long-term effects.	Alternative 2 would promote native plant biodiversity in wetlands by eliminating competition from non-native invasives. Only herbicides approved by the EPA for use near or in water can be used. This alternative would have a moderate, beneficial, and long-term effect to floodplains and wetlands.	Treatments in wetlands and floodplains would rely heavily on manual methods for invasive plant removal. Alternative 3 would have negligible, adverse, short-term effects, but minor, beneficial, long-term effects to floodplains and wetlands.
Species of special concern (plant or animal; state or federal listed or proposed for listing of their habitat 6. How would the use of manual treatments, herbicide treatments and biological treatments affect wildlife and plant species of management concern (SOMCs) and their habitats?	The park would not treat invasive plants by any method. There would be no restoration of any areas infested with invasive species. Ultimately, non-native vegetation would dominate and alter critical habitats for several sensitive wildlife species. Although the park does not have any state or federally listed species or any proposed for listing there are a number that are considered to be SOMCs. The No Action alternative would have direct	Integrated Pest Management would help the park achieve the desired condition to preserve, protect, and promote native wildlife species (particularly SOMCs) as part of the natural ecosystem. The impacts of this alternative on SOMCs and their habitat would be direct and indirect, moderate to major, beneficial, and long-term.	Effects would be similar to Alternative 2 but control of invasive populations overall would be less effective and achieving the desired conditions would take longer. The overall impacts of this alternative on SOMCs and their habitat would be direct and indirect, moderate to major, beneficial, and long-term.

	and indirect, moderate to major, adverse, and long-term impacts on critical habitats for sensitive wildlife species.		
Unique, essential or important fish or fish habitat 7. What will be the effect of manual treatments, herbicide treatments, and biological treatments on aquatic species or management concern?	No treatment would be implemented. Untreated populations of invasive plants in or adjacent to riparian areas would have the potential to indirectly affect aquatic resources, and fish habitat. The displacement of native vegetation increases the potential for increased shading and accumulation of excess organic material in the aquatic systems, which could degrade BCT habitat. . Effects would be minor to moderate, adverse and long-term.	These control measures would have very low potential to adversely affect fish and aquatic invertebrate species if herbicides are applied in accordance with the label directions. Some types of manual treatments could cause introduction of small amounts of silt into streams potentially affecting survivability of BCT eggs. direct, negligible, adverse, short-term and indirect, minor, beneficial, short and long-term impacts to unique, essential, or important fish or fish habitat.	No herbicides would be used, thus no potential to affect fish or fish habitat. Increased need for manual removal could produce more turbidity in streams adjacent to treatment areas. This effect would be slightly greater than in Alternative 2. Impacts to unique, essential, or important fish or fish habitat would be direct, negligible, adverse, and short-term, but indirect, minor, beneficial, and long-term.
Cultural Resources 8. What would be the effect of manual treatments, herbicide treatments, and biological treatments on cultural resource sites, including archaeological sites and artifacts, historic structures and a designated historic district?	Allowing invasive plant growth to continue unchecked could produce damage to cultural resources. Invasive plant growth around archaeological sites and historic structures could increase potential for fire and erosion that could impact NRHP eligibility. There could be adverse, direct, site specific, long term, minor to moderate impacts to	Archaeological and historic sites could be adversely affected by manual treatments that disturb subsurface deposits and alter context for information potential. This could compromise the sites for NRHP eligibility. Use of herbicide treatments would reduce this risk. This alternative would have minor to major, direct and indirect, beneficial impacts for historic structures and features. Monitoring and/or mitigations would be required to avoid adverse or potentially adverse effects to subsurface archeological	Increased need for use of manual treatments in the absence of herbicide treatments has greater potential for impacting subsurface archaeological and historical sites. Monitoring and/or mitigations would be required to avoid adverse or potentially adverse effects to archeological sites. Effects to archeological sites would be negligible to minor, adverse, and long-term when monitoring and mitigations are applied. This alternative would have

	cultural resources in both historic structures and archaeological sites.	sites. Effects to archeological sites would be negligible, adverse, and long-term when monitoring and mitigations are applied.	minor to major, direct and indirect, beneficial impacts for historic structures and features.
Long–term management of resources or land/resource productivity 9. What will be the effect of manual treatments, herbicide treatments, and biological treatments on long-term management of resources or land/resource productivity?	No attempt would be made to control invasive plants and eventually large areas of the park would be overrun by non-natives, which would reduce productivity and effectiveness of attempts to manage wildlife populations. The No Action alternative would result in major, adverse, and long-term impacts.	Adopting Alternative 2 will allow greater control over long–term management of resources or land/resource productivity by controlling or removing invasive plants that disrupt native plant communities and habitats that wildlife depend upon. Impacts would be minor, beneficial, and short-term and moderate to major, beneficial, and long-term.	Similar to Alternative 2 but with reduced effectiveness. This alternative would have minor to moderate, beneficial, and long-term impacts.

2.10 ENVIRONMENTALLY PREFERRED ALTERNATIVE

The CEQ Regulations implementing NEPA and the NPS NEPA guidelines require that "the alternative or alternatives which were considered to be environmentally preferable" be identified (Council on Environmental Quality Regulations, Section 1505.2). Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best protects, preserves, and enhances historic, cultural, and natural resources.

The Council on Environmental Quality defines the environmentally preferred alternative as "…the alternative that would promote the national environmental policy as expressed in the National Environmental Policy Act's §101." Section 101 of the National Environmental Policy Act states that "… it is the continuing responsibility of the Federal Government to … (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; (2) assure 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 to health or safety, or other undesirable and unintended consequences; (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice; (5) achieve a balance between population and resource use which would permit high standards of living and a wide sharing of life's amenities; and (6) enhance the quality of renewable resources and approach the maximum attainable recycling of deplete-able resources."

Great Basin National Park has determined that the environmentally preferred alternative for this

project is Alternative 2-Implement Full IPM Strategy, the same as the preferred alternative. IPM is 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.

Effective management of large populations of non-native invasive species such as spotted knapweed, musk thistle, and bull thistle cannot be accomplished through the use of Alternative 3-No Herbicide Use. Although the use of manual treatments is effective in treating small localized occurrences of non-native species, it is limited in use for large populations because of timeliness in treatment, reduced coverage area, personnel availability, and cost effectiveness.

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

In order to have a more concise, streamlined, and user-friendly document, this chapter provides a description of the Affected Environment for a resource followed by an evaluation of the Environmental Consequences of the alternatives. It is organized by impact topics, which allows a standardized comparison among alternatives, based on issues.

The Affected Environment section describes the resources within Great Basin National Park that could be affected as a result of implementation of any of the proposed Invasive Plant Management Plan alternatives.

The resource descriptions provided in this chapter serve as a baseline with which to compare the potential effects of the management actions considered in this EA.

3.1.1 Geographic Analysis Area

The geographic area for the analysis of impact considered in this EA encompasses 77,100 acres in Great Basin National Park and the 80 acre Baker Administrative Site. Invasive plant management practices would be generally concentrated in areas identified in Figure 2.

3.2 AFFECTED ENVIRONMENT

This section describes the geographic areas, resources, and human environment that could be affected by alternatives within this Environmental Assessment. The various regulatory instruments cited under *Regulatory Framework* in each of the following sections will guide management actions and their scope is described earlier in Chapter 1.6 Related Laws, Legislation, and Management Guidelines.

3.2.1 Human health or safety

Approximately 90,000 visitors come to GRBA each year. The primary attractions are touring Lehman Cave, driving the Wheeler Peak Scenic Drive, hiking trails, and camping. Portions of the project area are located in these areas, except for Lehman Cave. The project area(s) could be visible to park visitors, staff, and volunteers when resource staff are monitoring, inventorying, treating and restoring areas of invasive plant encroachment. Staff performing field treatments are exposed to safety risks during work. Some water flowing out of the park is used for drinking and household purposes by neighbors.

Regulatory Framework
National Park Service Management Policies 2006, Section 4.4.5 Integrated Pest Management Program

General Authorities Act of 1970

3.2.2 Introduce or promote non-native species (plant or animal)

Over the years a number of invasive plants have become established within Great Basin National Park and continue to increase in population and area. Many are concentrated along transportation corridors, heavy visitor use areas, and riparian zones. See Figure 2.

Regulatory Framework
National Park Service Resource Management Guidelines NPS-77, 4:12

NPS Strategic Plan for Managing Invasive Nonnative Plants in National Parks (NPS, 1996)

Great Basin National Park General Management Plan 1993

GRBA Resource Management Plan 1999

3.2.3 Unique or important wildlife or wildlife habitat

Upland – The high plant diversity of the park (>860 species locally) is due to variation in elevation, temperature, aspect and moisture, as well as geographic isolation of the South Snake Range. Notable native plants species include a number of endemic species, bristlecone pine (*Pinus longaeva*), the oldest sexually reproducing organism on Earth, isolated populations of ponderosa pine, and a variety of alpine species.

Sagebrush and aspen plant communities are currently of high management concern. Both sagebrush and aspen systems are currently outside their natural range of variation due to humans. The combination of historic overgrazing and active fire exclusion has caused landscape-level changes in plant successional patterns. The virtual elimination of fire as a natural ecosystem process in conjunction with intensive, historical overgrazing by non-native ungulates has shifted

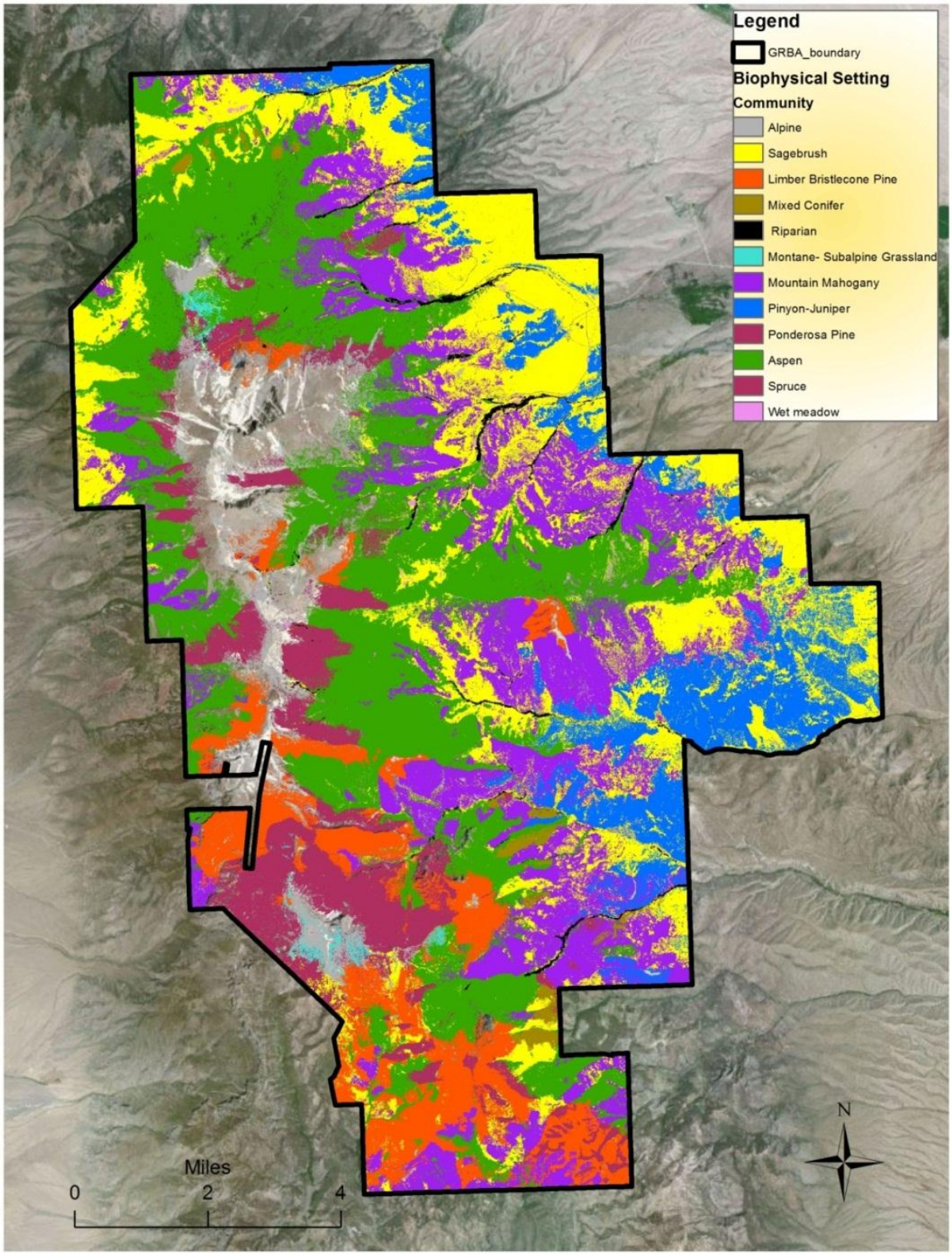

Figure3. Biophysical Setting Map for Great Basin National Park.

the landscape away from a diversity of seral stages and community types and towards a preponderance of late-successional woody plant communities with heavy fuel loading. Sagebrush ecosystems have been identified as the most endangered ecosystem type in the United States (Center for Science, Economics and Environment 2002). Due to piñon and juniper encroachment and annual grass proliferation, early successional states of sagebrush have been virtually eliminated in the park. Annual grass invasion of sagebrush is one the greatest threats to the ecosystem..

One important strategy to increase the resiliency of Great Basin ecosystems to future disturbances and climate change is to maintain or restore a diverse native plant community. Native plant diversity acts as an insurance policy against future climate variation by including a suite of species adapted to different environmental conditions (Pellant 2007). At GRBA, invasive plants are known to occur most often in the riparian, wet meadow, and montane sagebrush steppe settings.

Regulatory Framework
National Park Service Organic Act

Great Basin National Park Enabling Legislation

Great Basin National Park General Management Plan 1993

GRBA Resource Management Plan 1999

3.2.4 Water quality and quantity

The project area encompasses parts of all 10 perennial streams in Great Basin National Park. These are all steep, mountain streams, with flows that vary from less than 1 cfs during winter baseflow to more than 300 cfs during summer runoff. Many springs are also included in the project area, including Rowland Spring, the largest spring in the Park, with a mean annual flow of about 3 cfs. Six sub-alpine lakes are in the project area, with surface areas ranging from 0.2 to 3.4 acres. Water quality in all the streams, springs, and lakes is near pristine, although some minor impacts, especially increased turbidity, can occasionally result from rainwater runoff from nearby roads, campgrounds, and other disturbances.

Regulatory Framework
1972 Clean Water Act

Water Quality Improvement Act of 1970

NPS *Management Policies 2006*

3.2.5 Floodplains or Wetlands

Wetland ecosystems occupy much less than 1% of the park and occur as a mosaic of several plant associations, often dominated by graminoids and rushes (*Juncus* spp). Shrub lands

dominated by willows (*Salix* spp.), Wood's rose (*Rosa woodsi*), western serviceberry (*Amelanchier alnifolia*), and aspen (*Populus tremuloides*) are immediately adjacent to wet meadows. Wet meadows are associated with snowmelt and groundwater and are typically not subjected to high disturbance events such as flooding.

Riparian ecosystems (floodplains) are the interface between aquatic and terrestrial ecosystems.. These ecosystems occupy less than 1% of the total landscape in the park, but their biological importance is disproportionate to their areal extent. Riparian areas are narrow corridors of taxonomically distinct, dense plant populations relative to surrounding upland areas, with the resultant oasis effect leading to an enrichment of resident and migratory wildlife (Knopf et al. 1988, Szaro 1989). This ecological system encompasses a broad array of riparian species. These systems generally consist of the following four basic vegetation forms: 1) willows and other shrubs; 2) sedges and other herbaceous vegetation; 3) aspen; and 4) conifers. This ecological system occurs as a mosaic of multiple communities that are tree dominated with a diverse shrub component.

Regulatory Framework
Executive Order 11990 *Protection of Wetlands*

Section 404 of the Clean Water Act

National Park Service policies for wetlands as stated in 2006 *Management Policies*

Director's Order 77-1 Wetlands Protection

National Park Service Organic Act, 1916

NPS Strategic Plan for Managing Invasive Nonnative Plants in National Parks (NPS, 1996)

National Park Service Resource Management Guidelines NPS-77, 4:12

GRBA General Management Plan 1993

GRBA Resource Management Plan 1999

3.2.6 Species of special concern (plant or animal; state or federal listed or proposed for listing) or their habitat

There are no state or federally listed species or habitat for state or federally listed species known to occur in Great Basin National Park. Projects to improve habitat for sage grouse, a species proposed for listing, are currently occurring in the park. Twenty two mammals, 19 birds, 4 reptiles, 1 amphibian, 4 cave invertebrates and 15 plant SOMCs occur or potentially occur in the park. These species are considered sensitive because they are locally rare, endemic to the park area, are subject to political concern, are indicator species, are vulnerable to local population declines, or are subject to human disturbance during vulnerable portions of their life cycle. Many of these species are difficult to detect (i.e. nocturnal fossorial or secretive), have limited or

degraded habitat associations (i.e. riparian, alpine cave, or sagebrush), or are patchily distributed and/or present in low densities. All sensitive species depend on native plant communities for habitat. Given the loss and conversion of sagebrush and aspen habitat, restoration of native plant communities is a priority for management of sensitive species.

Regulatory Framework
National Park Service Organic Act, 1916

National Park Service Management Policies 2006, Section 4.4.5 Integrated Pest Management Program

NPS Strategic Plan for Managing Invasive Nonnative Plants in National Parks (NPS, 1996)

National Park Service Resource Management Guidelines NPS-77, 4:12

GRBA General Management Plan 1993

GRBA Resource Management Plan 1999

3.2.7 Unique, essential or important fish or fish habitat

The Bonneville cutthroat trout (*Onchorynchus clarki utah*; BCT) is the only salmonid native to east-central Nevada and to Great Basin National Park. A number of treatment watersheds contain the Bonneville cutthroat trout. BCT have been petitioned for listing on the Endangered Species List twice, most recently pulled in 2007. The BCT that have been isolated for over 10,000 years in Snake Valley have genetics unique to this area and which differentiates them from the other 2 sub-species of BCT. BCT need clear, cool water in order to thrive. They depend on large woody debris, cover that provides shade, deep pools to over winter, and riffle sections with gravel for spawning.

Regulatory Framework
National Park Service Organic Act, 1916

National Park Service Management Policies 2006, Section 4.4.5 Integrated Pest Management Program

NPS Strategic Plan for Managing Invasive Nonnative Plants in National Parks (NPS, 1996)

National Park Service Resource Management Guidelines NPS-77, 4:12

GRBA General Management Plan 1993

GRBA Resource Management Plan 1999

3.2.8 Cultural Resources

The National Park Service acts as steward to many important cultural resources, and is charged

with preserving these resources for the enjoyment present and future generations. Great Basin National Park contains 213 documented cultural resource sites from archaeological dating to over 10,000 years ago continuing through historic period. Cultural resources include numerous archaeological sites and artifacts, over 75 historic structures, and 1 National Register designated historic district. With less than 10% of the Park area surveyed there is a high potential for more cultural resources to be identified including potential ethnographically important resources and cultural landscapes.

Regulatory Framework
National Historic Preservation Act of 1966 as Amended (NHPA)

Programmatic Agreement Among the National Park Service (Department of the Interior), the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers, for Compliance with Section 106 of the National Historic Preservation Act, 2008 (Nationwide Programmatic Agreement)

National Park Service's Director's Order-28 *Cultural Resource Management Guideline*

National Park Service *2006 Management Policies* Section 5 Cultural Resource Management

Archaeological Resources Protection Act of 1979

3.2.9 Long-term management of resources or land/resource productivity

Numerous native plant communities and wildlife habitats exist within GRBA and as responsible stewards for long-term management of these important and unique ecosystems it is crucial to maintain land resource productivity by limiting the spread and growth of non-native plants. Wildlife diversity and populations depend on healthy and diverse habitats but habitat diversity is reduced by widespread invasion of non-native plants.

Regulatory Framework
National Park Service Organic Act

4.0 ENVIRONMENTAL CONSEQUENCES

The Environmental Consequences portion of each impact topic analyzes both beneficial and adverse impacts that could result from implementing any of the alternatives described in Chapter 2: Alternatives.

The analysis includes a summary of laws and policies relevant to each impact topic, definitions of impact thresholds (negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative effects. As required by the CEQ, a

summary of the environmental consequences of each alternative is provided in Table 4 in Chapter 2: Alternatives.

4.1 GENERAL METHODS FOR ANALYZING IMPACTS

The NPS based the impact analyses and conclusions on scientific literature; information and insights provided by NPS experts, other agencies, and the public; and best professional judgment.

For each impact topic, impacts are defined in terms of thresholds of effect, context, intensity, duration, and timing. Impacts and cumulative effects are discussed in each impact topic. Definitions of intensity levels vary by impact topic. Where it is not specifically stated otherwise under each impact topic, the following definitions apply.

Under each impact topic is a brief description of relevant components of existing conditions and information for determining the effects of implementing each alternative. The effects based on the following factors:

Type: Whether the impact would be beneficial or adverse.

Intensity: Identify the intensity of the effect as negligible, minor, moderate, or major. Intensity is defined individually for each impact topic.

Duration: Duration of impact is analyzed independently for each resource. Depending on the resource, impacts may last for the construction period, a single year, or other time period. For purposes of this analysis, impact duration is described as short- or long-term as defined for each resource.

- *Short-term* impacts are temporary, transitional, or construction-related impacts associated with project activities.
- *Long-term* impacts are typically those effects that would last several years or more or would be permanent.

Context: Context is the setting within which an impact would occur.

- *Local impacts* would generally occur within the immediate vicinity of the proposed project.
- *Regional impacts* would occur on surrounding lands and/or in adjacent communities.

Impact: The following types of impact must be considered and examined for any park proposal and alternatives.

- *Direct Impact:* effects are caused by an action and occur at the same time and place as the action.
- *Indirect Impacts:* effects are caused by the action and occur later or farther away, but are still reasonably foreseeable.
- *Cumulative Impacts:* effects of the alternatives in conjunction with past, present, or reasonably foreseeable future actions.

4.2 THRESHOLDS FOR IMPACT ANALYSIS

The intensity and duration of effects vary by resource; therefore, the definitions for each impact topic are described separately before each impact topic. These definitions were formulated through the review of existing laws, policies, and guidelines; and with assistance from park, region and other resource specialists.

Impact Criteria and Thresholds

4.2.1 Human health or safety

How would the use of manual treatments, herbicide treatments, and biological controls in high visitor use areas, riparian areas, and near water affect human health and safety?

Impact Intensity	Intensity Description
Negligible	The impact to human health would be so small that it would not be of any measurable or perceptible consequence and/or would affect few visitors or staff.
Minor	The impact to human health is slight but would be small, localized and of little consequence, and/or would affect some visitors or staff.
Moderate	The impact to human health is readily apparent, would be measurable and consequential, localized and would affect many visitors and staff.
Major	The impact to human health is severely adverse. The change would be measurable and possibly permanent, and would affect the majority of visitors or staff.
Duration	Short-term effects last only during the proposed treatment period. Long term effects last longer than the treatment period.

Alternative 1- No Action

Impact analysis

The park would not treat invasive plants by any method, thus there would be no foreseeable risks to human health and safety. There would be no impacts to human health and safety.

Cumulative Impacts

The park would not treat invasive plants by any method, thus there would be no foreseeable risks to human health and safety. There would be no impacts to human health and safety.

Conclusion

The park would not treat invasive plants by any method, thus there would be no foreseeable risks to human health and safety. There would be no impacts to human health and safety.

Alternative 2- Implement full IPM strategy

Invasive plant infestations would be primarily controlled by direct field applications. Minor injuries to workers can potentially occur in these situations. The use of personal protective equipment (PPE), adhering to park safety policy and regular tailgate safety sessions to review job hazard analysis (JHA) mitigate personal risk to park staff. Personal protective equipment (PPE) is used during application to reduce the potential for chronic exposure.

The non-restricted herbicides proposed for use have very low toxicity to humans. Whenever possible, invasive plant management activities would be timed to avoid peak visitor use. Safety protocols for storing, mixing, transporting, handling spills, and disposing of herbicides and containers are an integral part of this alternative and are required by law. Herbicide treated areas would be monitored until dry to prevent direct staff and visitor exposure.

Herbicide treatments apply a chemical to a plant to remove the plant. The three main herbicide characteristics are: adsorption, or how the herbicide binds to the soil; solubility, how the herbicide dissolves in water; and persistence, the rate of herbicide degradation by environmental factors. Herbicide adsorption is the strongest when clay and organic matter are present. Herbicide leaching and runoff can be minimized by applying labeled rates at proper times, using the proper method of application. Persistence is dependent on sunlight, temperature, soil pH, microbial activity, and other soil characteristics. Short-lived herbicides can minimize leaching and runoff potential (Brooks 1998). All herbicides applied in the park would follow label directions. Few herbicides would be applied in or near water sources, and those would be limited in distribution and approved by the EPA specifically for that use.

Implementation of Alternative 2 would have direct and indirect negligible, adverse, short-term effects to human health and safety.

Cumulative Impacts

Increased visitation, park operations and maintenance could result in greater areas of disturbance which would cause a greater need for invasive plant treatments. However this effect would be more than offset by successful previous treatments and increased control. Cumulative impacts resulting from this alternative would have negligible, adverse, short- term effects to human health and safety.

Conclusion

In general, using IPM practices for invasive plant management would have a direct and indirect adverse, short-term, negligible impact on human health and safety. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

Alternative 3, No Herbicide Use

Impact analysis

Potential impacts are the same as under Alternative 1 because there would be no risks to human health and safety associated with the application of herbicides. There would be no impacts to human health and safety.

Cumulative Impacts
The park would not treat invasive plants by any method, thus there would be no foreseeable risks to human health and safety. Cumulative effects are similar to Alternative 1. There would be no impacts to human health and safety.

Conclusion
Potential impacts under Alternative 3 are the same as under Alternative 1 because there would be no risks to human health and safety associated with the application of herbicides This alternative would have indirect, negligible, adverse, short-term impacts to human health and safety. Implementation of this alternative would not result in any unacceptable impacts and is consistent with §1.4.7.1 of NPS *Management Policies* 2006.

4.2.2 Introduce or promote non-native plant species

How would the use of manual treatments, herbicide treatments, and biological controls affect outcomes of efforts to control introduction and spread of non-native plant species?

Impact Intensity	Intensity Description
Negligible	There would be no or very few invasive plant populations present in the park and new infestations would not occur or be small and few in number. Very little park acreage would be impacted by invasive plants. Little effort and expense would be required to control what invasions do occur. Mitigation to limit adverse impacts would be minimal and successful.
Minor	There would be a few invasive plant populations present in the park and some new infestations could occur. A small portion of park acreage would be impacted by invasive plants. Some effort and expense would be required to control invasions. Mitigation to offset adverse impacts would be substantial, but would be successful.
Moderate	There would be a substantial number of invasive plant populations present in the park and significant new infestations could occur. A moderate proportion of park acreage would be impacted by invasive plants. Significant effort and expense would be required to control these populations. Mitigation to offset adverse impacts could be extensive, but would likely be successful.
Major	There would be a large number of invasive plant populations present in the park and extensive new infestations could occur. A substantial proportion of park acreage would be impacted by invasive plants. Great effort and expense would be required to control large populations. Extensive mitigation measures to offset adverse impacts would be required and success would not be guaranteed.
Duration	Short term refers to a period of a minimum of two years. Long term refers to a period of greater than two years.

Alternative 1- No Action
Impact analysis

Invasive plant populations would not be manually removed or treated with herbicides. No biological controls would be used. No educational programs would be conducted. Invasive plant populations would not be inventoried and documented. No restoration activities would be implemented. Implementation of the No Action Alternative would result in minor, adverse, short-term and major, adverse, long-term effects.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause moderate, adverse, short to long term effects.

Conclusion
Based on the action and the cumulative impacts, the no action alternative would have major, adverse, long-term effects in the introduction or promotion of non-native plant species.

Alternative 2- Implement full IPM strategy
Impact analysis
Implementing the full IPM strategy would allow invasive plant populations to be monitored and treated aggressively, gradually allowing control and replacement by native plants. The result of Alternative 2 would result in minor, beneficial short-term and major, beneficial long-term effects.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause short term increases in invasive plant populations. However, this alternative would allow the parks invasive plant staff to treat invasive plant populations and new infestations aggressively. This alternative would result in a minor, adverse, short-term effects and negligible, adverse, long-term effects.

Conclusion
Implementation of the full IPM strategy would assist the park in achieving its goals of monitoring, removing, treating and controlling invasive plant populations within the park boundaries. This alternative would result in minor, beneficial, short-term and major, beneficial, long-term effects in the introduction or promotion of non-native plant species.

Alternative 3-No Herbicide Use
Impact analysis
Treatment options would be limited to manual and biological, and educational methods which may not be sufficiently aggressive to control current invasive plant populations. Invasive plant populations probably would increase in number and area. This alternative would result in minor, beneficial, short and long-term effects.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel

reduction treatments and other ground disturbing activities are likely to cause increases in number of invasive plant populations. This would result in minor, adverse, short and long-term effects.

Conclusion
Based on the action and the cumulative impacts, implementation of Alternative 3 would result in negligible to minor, adverse and beneficial, short-term and minor to moderate, beneficial, long-term effects in the control of non-native plant species.

4.2.3 Unique or important wildlife or wildlife habitat

How would the use of manual treatments, herbicide treatments, and biological controls maintain the natural ecosystems that support unique or important wildlife?

Impact Intensity	Intensity Description
Negligible	No wildlife populations or wildlife habitat would be affected but some individuals could be affected. The effects would not be measureable.
Minor	Small portions of some wildlife populations or wildlife habitat would be affected. Mitigation to offset adverse impacts would be required and would be effective.
Moderate	Individual wildlife populations or wildlife habitat would be affected over a relatively large area. Mitigation to offset adverse impacts could be extensive, but would likely be successful.
Major	There would be considerable effects on wildlife populations or wildlife habitat over a substantially large area. Extensive mitigation measures to offset adverse impacts would be required and success would 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.

Alternative 1- No Action
Impact analysis
Invasive weeds would not be manually removed or treated with herbicides. No biological controls would be used and educational programs would not be conducted. Invasive plant populations would not be inventoried and documented. Restoration actions would not be conducted in sagebrush communities. Failing to treat non–native annual grasses in sagebrush restoration areas would allow the proliferation of cheatgrass and eventual loss of native plant communities, further degrading this habitat type in the park. Non-native annual grasses and forbs have profound impacts on native plant communities, resulting in an increase in fire frequency and eventual loss of native plant communities. Lack of invasive plant control in riparian areas and wetlands would allow the unabated invasion of these highly sensitive and productive habitats by non-native forbs. Non-native forbs would reduce the productivity and functioning of riparian

areas and wetlands and degrade their value for wildlife habitat. This alternative would result in moderate, adverse, long-term effects.

Cumulative Impacts
Wind, wildlife, visitors, and vehicles are likely vectors for the introduction of invasive plants into the park. Prescribed fire, flooding and manual fuels treatments also can increase invasive plant infestations by disturbing soils and dispersing seeds. Climate change is projected to increase the competitive advantage of invasive relative to native plant communities. Surface disturbances associated with road and trail maintenance projects can also lead to the establishment of invasive plants. Trespass grazing by livestock on park lands decreases the abundance and diversity of native plant species and promotes the invasion of the park by non-native species. Grazing by livestock on lands adjacent to the park creates adjoining disturbed areas that contribute to the establishment of new invasive plant infestations that have potential to spread into the park. Visitors and park employees inadvertently bring in exotic seeds and plant parts on vehicles, pets and shoes. Non-native annual grasses and forbs have profound impacts on native plant communities which alters wildlife habitat and wildlife populations. Impacts to wildlife populations and wildlife habitat would be moderate to major, adverse, and long-term.

Conclusion
The no action alternative would have moderate to major, adverse, long-term impacts on wildlife populations and wildlife habitat.

Alternative 2- Implement full IPM strategy
Impact analysis
Invasive plants would be aggressively inventoried and treated using manual, herbicide and biological control methods. Proactive educational programs would be conducted to prevent and limit the expansion of invasive plants. Sagebrush restoration would be conducted and recovery of these areas would benefit from control of non-native annual grasses. Riparian and wetland habitat would see decreases in non-native plants. Restoration would have the beneficial effect of promoting the re-establishment of early seral states of sagebrush vegetation. An array of seral states and a heterogeneous plant community are most resistant to invasion by invasive species and support diverse wildlife communities.

Any biological agent released in the parks would be approved by USDA's Animal Plant Health Inspection Service (APHIS) and would have no potential negative effects on native plant species. Because biological control agents are specific to individual invasive species, there would be negligible impacts to non-target plant species. Impacts to target plants would be direct and beneficial. Any biological control agent used would be host specific. The Regional IPM Specialist would also review and approve the release of any proposed biological control agents. The native plant communities and the wildlife that depend on those habitats would see minor, beneficial short-term and major, beneficial long-term effects.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause some impacts to

wildlife and wildlife habitat. These are expected to be negligible to minor, adverse, and short-term.

Conclusion
Integrated Pest Management (IPM) would help the park to achieve the desired conditions to have all native plants and native plant communities maintained as part of the natural ecosystem, thereby maintaining a diversity of wildlife and wildlife habitat. The overall impacts of this alternative on unique or important wildlife and wildlife habitat would have negligible to minor, adverse, and short-term effects but moderate to major, beneficial, and long-term effects.

Alternative 3-No Herbicide Use
Impact analysis
The park would use manual and biological control methods in an effort to promote native habitat which sustains healthy wildlife. Proactive educational programs would be conducted to prevent and limit the expansion of invasive plants. Sagebrush restoration would be conducted and recovery of these areas would benefit from control of non-native annual grasses. Riparian and wetland habitat would see decreases in non-native plants. Restoration would have the beneficial effect of promoting the re-establishment of early seral states of sagebrush vegetation. An array of seral states and a heterogeneous plant community are most resistant to invasion by invasive species and support diverse wildlife communities.

Any biological agent released in the parks would be approved by USDA's Animal Plant Health Inspection Service (APHIS) and would have no potential negative effects on native plant species. Because biological control agents are specific to individual invasive species, there would be negligible impacts to non-target plant species. Impacts to target plants would be direct and beneficial. Any biological control agent used would be host specific. The Regional IPM Specialist would also review and approve the release of any proposed biological control agents.

Under this alternative impacts on unique or important wildlife and wildlife habitat would be minor to moderate, beneficial, and long-term.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause some impacts to wildlife and wildlife habitat. These are expected to be negligible to minor, adverse, and short-term.

Conclusion
The overall impacts of Alternative 3 on unique or important wildlife and wildlife habitat would result in fewer benefits than alternative 2. Impacts would be negligible to minor, adverse, and short-term, but minor to moderate, beneficial, and long-term.

4.2.4 Water quality or quantity
How would the use of manual treatments, herbicide treatments, and biological controls affect

water quality?

Impact Intensity	Intensity Description
Negligible	No change or change not measurable or perceptible. Treatments would not result in measurable changes to natural water quality conditions in streams, springs, or lakes.
Minor	A detectable change which would be localized. Treatments on or near stream, spring, or lake banks could result in small but detectable changes in water quality at that location.
Moderate	A clearly detectable and measurable change with impacts downstream of the treatment area. Treatments would result in measurable changes to water quality downstream of the treatment area.
Major	A substantial, highly noticeable, and measureable impact. Treatments would result in measurable changes to water quality throughout the watershed, including outside the park.
Duration	Short-term: Impacts would occur during implementation of treatments or up to one year. Long term: Impacts would be detectable for more than one year.

Alternative 1- No Action

Impact analysis

Under the No Action alternative, no changes to water quality or quantity are expected.

Cumulative Impacts

Recreation, maintenance, and other park projects such as restoration and prescribed fire are generally small-scale activities with limited focus. They can result in increased erosion, which increases turbidity in the water. They can also increase temperature due to decreased shading. These other projects are expected to have negligible, short-term, adverse effects on water quality and no effects on water quantity.

Conclusion

The No Action alternative would have negligible, short-term, adverse effects on water quality based on the cumulative effects and no effects to water quantity.

Alternative 2- Implement full IPM strategy

Impact analysis

The use of manual treatments for invasive plants next to or in water sources could have negligible, adverse, short-term effects to water quality due to the slight increase of fine sediment input into the water source.

Herbicide treatments apply a chemical to a plant to remove the plant. The three main herbicide characteristics are adsorption, or how the herbicide binds to the soil; solubility, how the herbicide dissolves in water; and persistence, the rate of herbicide degradation by environmental factors. Herbicide adsorption is the strongest when clay and organic matter are present. Herbicide

leaching and runoff can be minimized by applying labeled rates at proper times, using the proper method of application. Persistence is dependent on sunlight, temperature, soil pH, microbial activity, and other soil characteristics. Short-lived herbicides can minimize leaching and runoff potential (Brooks 1998). All herbicides applied in the park would follow label directions. Few herbicides would be applied in or near water sources, and those would be limited in distribution and approved by the EPA specifically for that use. Thus herbicide treatments would have negligible, short-term, adverse effects to water quality and no effects to water quantity. Biological treatments generally result in defoliation of the target species. If the target species is next to a water source, this could possibly increase solar radiation reaching the water, thus increasing water temperature. Due to the limited extent of invasive plants next to water sources in the park, biological treatments would be expected to have negligible, short-term, adverse effects on water quality and no effects to water quantity.

Cumulative Impacts

Recreation, maintenance, and other park projects such as restoration and prescribed fire are generally small-scale activities with limited focus. They can result in increased erosion, which increases turbidity in the water. They can also increase temperature due to decreased shading. These other projects are expected to have negligible, short-term, adverse effects on water quality.

Conclusion

Alternative 2, with the implementation of the full IPM strategy, would have negligible, adverse, short-term effects on water quality and no effects on water quantity.

Alternative 3-No Herbicide Use

Impact analysis

No herbicides would be used that have the potential to contaminate water used for human consumption or BCT streams, as well as near trailheads and campgrounds. Without use of herbicides there would be an increased need to remove invasive plants manually, causing increased surface disturbance that would increase turbidity in streams. Regardless of the method used, invasive plants near water sources are few and far between, making the effects on water quality and quantity of this alternative negligible, adverse, and short-term.

Cumulative Impacts

Recreation, maintenance, and other park projects such as restoration and prescribed fire are generally small-scale activities with limited focus. They can result in increased erosion, which increases turbidity in the water. They can also increase temperature due to decreased shading. These other projects are expected to have negligible, adverse, and short-term effects on water quality and quantity.

Conclusion

Alternative 3, without the use of herbicides, would have negligible, adverse, short-term effects to water quality and no effects to water quantity.

4.2.5 Floodplains or Wetlands

How would the use of manual treatments, herbicide treatments, and biological treatments affect floodplains or wetlands?

Impact Intensity	Intensity Description
Negligible	No native vegetation populations would be affected but some individual site-specific native plants could be affected. The effects would be on a small scale.
Minor	The alternative would affect some individual site-specific native plants and a relatively minor portion of that species' population. Mitigation to offset adverse impacts could be required and would be effective.
Moderate	The alternative would affect individual native plants over a relatively large area. Mitigation to offset adverse impacts could be extensive, but would likely be successful.
Major	The action would have considerable effects on native plant populations over a relatively large area. Extensive mitigation measures to offset adverse impacts would be required and success would 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.

Alternative 1- No Action

Impact analysis

The No Action alternative would not allow for the treatment of invasive plants in wetlands or floodplains. Although wetlands make up less than 1% of the park's area, they play a huge role in the biodiversity of the park. Wetlands are landscape sinks, and thus accumulate sediments, nutrients, water, and debris, which can accelerate the growth of opportunistic plant species. This means that wetlands have a higher propensity to become dominated by invasive monotypes (Zedler and Kercher 2004). Any plant species that dominates a community and spreads throughout the habitat can reduce native plant biodiversity (Houlahan and Findlay 2004). The NPS is mandated to manage for native species and maintain wetland environments, therefore a reduction in these species due to no action would alter wetland conditions and result in moderate, adverse, and long-term effects.

Cumulative Impacts

Recreation in and near wetlands, such as campground areas, can result in trampling and other impacts to wetlands. For the most part, these effects are expected to be negligible, adverse, and short-term.

Conclusion

The No Action alternative would not manage invasive plants in floodplains and wetlands, the environments most prone to invasive plants and which contain the park's greatest biodiversity. This would result in moderate, adverse, and long-term effects.

Alternative 2- Implement full IPM strategy

Impact analysis

Alternative 2 would help manage wetlands by removing invasive plants, especially those that have the potential to become a community dominant and thus reduce native plant biodiversity (Houlahan and Findlay 2004). Maintaining the native plant biodiversity is in line with NPS regulations. This alternative would have a moderate, beneficial, and long-term effect to floodplains and wetlands in the park.

Cumulative Impacts

Recreation in and near wetlands, such as campground areas, can result in trampling and other impacts to floodplains and wetlands. For the most part, these effects are expected to be negligible, adverse, and short-term.

Conclusion

Alternative 2 helps to promote native plant biodiversity in floodplains and wetlands. This alternative would have a moderate, beneficial, and long-term effect to floodplains and wetlands in the park.

Alternative 3-No Herbicide Use

Impact analysis

Alternative 3 would have largely the same effects as Alternative 2. No herbicides would be used in the riparian zones or wetlands. This alternative would still promote native plant biodiversity, and thus it is expected to have a minor, beneficial, long-term effect to wetlands in the park.

Cumulative Impacts

Recreation in and near wetlands, such as campground areas, can result in trampling and other impacts to floodplains and wetlands. For the most part, these are expected to be negligible, adverse, and short-term.

Conclusion

Even without use of herbicides Alternative 3 would have minor, beneficial, and long-term effects to floodplains and wetlands.

4.2.6 Species of special concern (plant or animal; state or federal listed or proposed for listing) or their habitat

How would the use of manual treatments, herbicide treatments, and biological treatments affect wildlife and plant species of management concern and their habitats?

Impact Intensity	Intensity Description
Negligible	Negligible impacts on special-status wildlife are those that would cause no measurable or perceptible changes in species populations or their preferred habitat.

Minor	Minor impacts would be measurable or perceptible, but would be localized in area, and the overall viability of wildlife populations would not be affected.
Moderate	Moderate impacts would cause a measurable and perceptible change in wildlife populations; however, the impact would remain localized and could be reversed.
Major	Major impacts would be substantial and highly noticeable and could be permanent in their effects on the size, diversity, or integrity of special-status wildlife populations.
Duration	Short-term refers to a period of less than 5 years. Long-term refers to a period of longer than 5 years.

Alternative 1- No Action

Impact analysis

Invasive weeds would not be manually removed or treated with herbicides. No biological controls would be used and educational programs would not be conducted. Invasive plant populations would not be inventoried and documented.

Restoration actions would not be conducted in sagebrush communities. Failing to treat non – native annual grasses in sagebrush restoration areas would allow the proliferation of cheatgrass and eventual loss of native plant communities, further degrading this habitat type in the park. Non-native annual grasses and forbs have profound impacts on native plant communities, resulting in an increase in fire frequency and eventual loss native plant communities. Lack of invasive plant control in riparian areas and wetlands would allow the unabated invasion of these highly sensitive and productive habitats by non-native forbs. Non-native forbs would reduce the productivity and function of riparian areas and wetlands and degrade their value as habitat for Species Of Management Concern (SOMCs). Effects to SOMCs or their habitat would be direct and indirect, moderate to major, adverse, and long-term.

Alternative 1- No Action

Cumulative Impacts

Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause some impacts to SOMCs or their habitat. These are expected to be negligible to minor, adverse, and short-term.

Alternative 1- No Action

Conclusion

This alternative would have direct and indirect, moderate to major, adverse, and long-term impacts on critical habitats for sensitive wildlife species.

Alternative 2- Implement full IPM strategy

Impact analysis

Invasive plants would be aggressively inventoried and treated using manual, herbicide and biological control methods. Proactive educational programs would be conducted to prevent and limit the expansion of invasive plants. Sagebrush restoration would be conducted and recovery of these areas would benefit from control of non-native annual grasses. Riparian and wetland habitat would see decreases in non-native plants.

Restoration would have the beneficial effect of promoting the re-establishment of early seral states of sagebrush vegetation. An array of seral states and a heterogeneous plant community are most resistant to invasion by invasive species and support diverse communities for SOMCs.

Any biological agent released in the parks would be approved by USDA's Animal Plant Health Inspection Service (APHIS). The NPS Regional IPM Specialist would also review and approve the release of any proposed biological control agents. These are specific to individual invasive species and would not affect desirable native plants that support SOMCs. Removal of targeted invasive plants would reduce competition and allow native plants that support SOMCs to re-establish and thrive.

Impacts to SOMCs on an ecosystem scale would be direct and indirect, moderate to major, beneficial, and long-term.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause some impacts to SOMCs. These are expected to be negligible to minor, adverse, and short-term.

Conclusion
Integrated Pest Management (IPM) would help GRBA achieve the desired condition to have all native plants and native plant communities maintained as part of the natural ecosystem which maintains SOMCs. The overall impacts of this alternative on SOMCs and their habitat would be direct and indirect, moderate to major, beneficial, and long-term.

Alternative 3-No Herbicide Use
Impact analysis
Implementing this alternative would produce impacts to SOMCs similar to those of alternative 2 except that the benefits would be fewer, cover less area, and occur more slowly. Effects would still likely be direct and indirect, minor to moderate, beneficial, and long-term.

Cumulative Impacts
Recreation, maintenance, and other park projects such as restoration and prescribed fire are generally small-scale activities with limited focus. Past, present and future actions within the park would produce negligible to minor, adverse, short and long-term effects to SOMCs.

Conclusion
The overall impacts of this alternative on unique or important wildlife and wildlife habitat would result in fewer benefits than alternative 2. Impacts would be minor to moderate, beneficial, and

short to long-term.

4.2.7 Unique, essential or important fish or fish habitat

What would be the effect of manual treatments, herbicide treatments, and biological treatments on aquatic species of management concern?

Impact Intensity	Intensity Description
Negligible	Negligible impacts are those that would cause the loss of a few individual fish but no measurable or perceptible changes in species populations or their preferred habitat. Mitigations would not be required.
Minor	Minor impacts would cause a slight but measurable reduction in fish population numbers, but the effect would be localized in area. A small percentage of the habitat would be affected. Mitigation to offset adverse impacts would be required and would be effective.
Moderate	Moderate impacts would cause a significant reduction in fish populations and amount of fish habitat Mitigation to offset adverse impacts could be extensive, but would likely be successful.
Major	Major impacts would cause a great reduction in fish populations and amount of fish habitat. Extensive mitigation measures to offset adverse impacts would be required and success would 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.

Alternative 1- No Action

Impact analysis

Untreated populations of invasive weeds in or adjacent to riparian areas would have the potential to indirectly affect aquatic resources. Because many invasive weed species are not as effective at stabilizing soils and preventing erosion as native species, the displacement of native vegetation increases the potential for introduction of fine sediment into the aquatic environment which could affect reproductive success of Bonneville Cutthroat trout (BCT). Invasive weed displacement of native riparian vegetation could also affect the degree of shading and organic material accumulating in the aquatic systems which would affect quality of BCT habitat and availability of preferred invertebrate prey. Effects would be minor to moderate, adverse and long-term.

Cumulative Impacts

Recreation, maintenance, and other park projects such as restoration and prescribed fire are generally small-scale activities with limited focus. They can result in increased erosion. They can also increase temperature due to decreased shading. These other projects are expected to have negligible, short-term, adverse effects on BCT and their habitat.

Conclusion

Uncontrolled infestations of invasive species may cause habitat conditions to decline and may result in a negative trend in the aquatic community and dependent BCT populations. Taken

together, implementation of Alternative 1 and cumulative impacts from other past, present, and future projects would produce indirect, minor to moderate, adverse, long-term impacts to unique, essential, or important fish or fish habitat.

Alternative 2- Implement full IPM strategy

Impact analysis

This alternative would implement a full IPM strategy that would include manual treatments, herbicide treatments; biological treatments; education and outreach, and restoration. Only those herbicides registered for aquatic use and approved by the EPA would be used in aquatic ecosystems. These control measures would have a very low potential to adversely affect fish and aquatic invertebrate species if applied in accordance with the herbicide labels. Herbicide treatment, when used as a tool as part of stream and wetland restoration activities, could improve aquatic habitat and may result in a positive trend in the aquatic species community and BCT populations. Impacts to BCT and their habitat would likely be indirect, minor, beneficial, and short to long-term.

There would be no impacts to aquatic species with the use of biological control agents. Impacts to fish and aquatic species from manual treatments would primarily result from runoff events on disturbed soils. These impacts would be direct, negligible, adverse, and short term.

Cumulative Impacts

Recreation, maintenance, and other park projects such as restoration and prescribed fire are generally small-scale activities with limited focus. They can result in increased erosion. They can also increase temperature due to decreased shading. These other projects and actions are expected to have negligible, adverse, short-term effects on BCT and their habitat.

Conclusion

Taken together, implementation of this alternative and cumulative impacts from other past, present, and future projects would produce direct, negligible, adverse, short-term and indirect, minor, beneficial, short and long-term impacts to unique, essential, or important fish or fish habitat.

Alternative 3-No Herbicide Use

Impact analysis

Impacts to BCT populations from Alternative 3 would be similar to those in Alternative 2, but this alternative would require a greater dependence on manual treatments in wetland and riparian areas. Manual treatments can include substantial digging and surface disturbance. Runoff events crossing these disturbed riparian areas would increase the relative quantity of sediment input into BCT streams compared to Alternative 2. This could slightly reduce BCT reproductive success relative to that expected under Alternative 2. All of the potential impacts would be direct, negligible, adverse, short-term to indirect, minor, beneficial, and long- term.

Cumulative Impacts

Recreation, maintenance, and other park projects such as restoration and prescribed fire are

generally small-scale activities with limited focus. They can result in increased erosion. They can also increase temperature due to decreased shading. These other projects are expected to have negligible, short-term, adverse effects on BCT and their habitat.

Conclusion
Implementation of Alternative 3 would have similar impacts to BCT as alternative 2 except that increased sedimentation from runoff has potential to reduce reproductive success. Overall, impacts to unique, essential, or important fish or fish habitat would be direct, negligible, adverse, and short-term to indirect, minor, beneficial, and long- term.

4.2.8 Cultural Resources

What would be the effect of manual treatments, herbicide treatments, and biological treatments on cultural resource sites, including archaeological sites and artifacts, historic structures and a designated historic district?

Analyses of the impacts to cultural resources are correlated with Section 106 of the National Historic Preservation Act (NHPA) and guidance of the Advisory Council on Historic Preservation (ACHP) for the implementing regulations (36 CFR Part 800). Steps required by Section 106 are: 1. Determine the Area of Potential Effect (APE), 2. Identify historic properties in the APE that are listed or eligible to be listed on the National Register of Historic Places (NRHP), 3. Apply the criteria of adverse effect to affected historic properties, 4. Consider ways to avoid, minimize or mitigate potential adverse effect.

An adverse effect occurs whenever an impact alters, directly, or indirectly, any characteristics that qualify it for inclusion on the NRHP in such a way that it is no longer considered eligible for that listing. Adverse effects might include, diminishing the integrity of location, setting, design, materials, workmanship, feeling or association. Adverse effects may be mitigated but by definition they are irreversible and long term.

Beneficial impacts would be considered in the 'negligible' to 'minor' impact intensity because they improve rather than diminish the National Register eligibility. An example would be removing non-native vegetation that is not part of a historic landscape plan, where that vegetation might damage historic foundations or pose fire hazard to historic properties. This would be considered beneficial effect, and therefore it would have no adverse effect.

The following table is provided to correlate NHPA criteria with the Impact Intensity determinations of this document.

Impact Intensity	Intensity Description
Negligible	Impact is barely perceptible and not measurable. Significant character-defining attributes of historic properties (including the informational potential of archaeological resources) are not appreciably diminished by the undertaking. The determination of effect for Section 106 would be ***no historic properties affected or no adverse effect.***

Minor	Impact is perceptible and measurable. The effects remain localized and confined to a single element contributing to the significance of a larger national register property/district, or archaeological site(s) with low to moderate data potential. Alteration of a feature(s) would **not** diminish the overall integrity of the resource and the property may still be eligible for the National Register of Historic Places. The determination of effect for Section 106 would be ***no adverse effect***.
Moderate	Impact is sufficient to alter character-defining features of historic properties, generally involving a single or small group of contributing elements, or archaeological site(s) with moderate to high data potential. The overall integrity of the resource would be diminished, the property may not retain its National Register eligibility. The determination of effect for Section 106 would be ***potential adverse effect.***
Major	Impact results in a substantial and highly noticeable change in character-defining features of historic properties, generally involving a large group of contributing elements and/or individually significant property, or archaeological site(s) with high to exceptional data potential seriously diminishing the overall integrity of the resource to the point where it is not eligible for the National Register. The determination of effect for Section 106 would be ***adverse effect.***

Alternative 1- No Action

Impact analysis

Alternative 1 would allow invasive plant infestation to continue unchecked. This poses potential direct and indirect, site specific, minor to moderate, adverse, long term, impacts to cultural resources.

Archaeological resources - Invasive plants introduce ecological conditions that alter the natural processes that are part of the historic fabric of cultural resources. For archaeological sites non-native plants alter the setting, which may be a character defining feature, and pose potential direct impacts through root penetration in cultural features. Indirect impacts include increasing fire risk and erosion potential that damage surface and sub-surface deposits. Impacts would be indirect and direct, minor to moderate, adverse, and long-term.

Historic structures and features - Invasive species have potential for short and long term adverse impacts for historic structures. Non-native species often grow in disturbed soils and areas where humans introduce seed intentionally and unintentionally. Structure foundations suffer direct adverse impact from root penetration. Whether native or non-native, unrestrained vegetation growth adjacent to historic structures poses indirect and direct, minor to moderate, long-term impacts, with increased potential for fire damage.

Cumulative Impacts

The potential for cumulative effect under Alternative I would be considered on a site specific basis. While allowing invasive species to continue unchecked may individually have negligible or minor effects, when combined with dissimilar park actions and visitor use, have potential to become major when they alter character defining features of an archeological site or historic structures of features. A series of minor, long term impacts, to an archeological or historic site would reach the threshold of major impact when there is alteration to character defining features, and adverse effect under Section 106.

Conclusion

Adopting a no action policy and allowing invasive plant growth to continue unchecked could have adverse, direct, site specific, long term, minor to moderate impacts to cultural resources, through root growth in historic structures and features in archaeological sites. In addition, invasive plant growth around archaeological sites and historic structures and features increases potential fuel load, increasing potential for fire and erosion. Cumulative effects from continued invasive growth, development, and visitor use, could cause adverse effects that would damage National Register eligibility.

Alternative 2- Implement full IPM strategy

Impact analysis

This alternative would implement a full IPM approach that would include manual treatments, herbicide treatments; biological treatments; education and outreach; and restoration. This alternative poses potential for both beneficial and adverse effects. These would be direct, site specific, short term and long term, negligible, minor, to moderate impacts to cultural resources. Mitigations identified in Table 3 are designed to avoid adverse impacts.

Archaeological sites

Use of manual treatments poses potential for adverse, direct, site specific, long term, minor to moderate impacts to cultural resources. Potentially 8000 acres are targeted for treatment. There are 213 known sites within the park. Of those 213 sites 75 are historic sites and structures. 122 are prehistoric sites and 16 are multi-component sites with both prehistoric and historic components. Most historic sites are found in areas of roads, trails or developed areas. Prehistoric sites are found primarily in riparian areas and spring locations throughout the great basin. Soil disturbance from digging invasive plants and restoration activities has potential to damage integrity of site integrity of archaeological deposits. Severe damage to context would render the site not eligible for NRHP under the Criterion D, for information potential. This would be a moderate to major impact.

Use of herbicide treatments to control invasive plant growth would have negligible to minor beneficial impacts for archaeological sites, controlling root penetration and preserving subsurface context. There are also negligible to minor beneficial indirect impacts derived from reducing fuel load and fire potential.

Historic structures and features

Use of manual treatments to control invasive plant growth around historic structures and features would have minor to major, direct and indirect, beneficial impacts for historic structures and features. Removing vegetative material would prevent root penetration that could damage structures and potential for tree fall that might damage standing structures. Indirect beneficial impacts also include reducing fuel load and fire /erosion potential.

Use of herbicide treatments would have the same beneficial impacts as manual treatment.

Cumulative Impacts

The potential for cumulative effect under Alternative I would be considered on a site specific basis. Continuous use of manual treatments that involve digging and ground disturbance when

coupled with general park operations and visitor use have the potential for adverse effect to render archaeological sites not eligible for NRHP. Less soil disturbance protects subsurface context and preserves information potential.

Use of herbicide and manual treatments would have cumulative beneficial impacts to historic structures and features. Cumulative benefit from treatments would reduce damage due to root penetration, reduce potential for overgrowth and physical damage, and reduce overgrowth of fuel and fire potential.

Conclusion
Adopting Alternative 2, the proposed action, would have both beneficial and adverse impacts to cultural resources. Archaeological sites could be adversely affected by manual treatments that disturbed subsurface deposits and altered context for information potential. This could be moderate to major effect, rendering the sites not eligible for NRHP. Monitoring and/or mitigations would be required to avoid adverse or potentially adverse effects. Conversely, manual and herbicide treatments would have minor to moderate beneficial effect for historic structures, reducing root growth and penetration, and reducing fuel load and fire/erosion potential.

Alternative 3- No Herbicide Use
Impact analysis
This alternative would be the same as Alternative 2 but would eliminate the use of herbicides. The plan would still include manual treatments, biological treatments, education and outreach, and restoration. The effects for Alternative 3 are similar to those of Alternative 2 (Full IPM) but there is increased potential for adverse effects due to the increase in area and intensity of manual treatments in lieu of herbicide. Effects would be direct, site specific, short term, and long term, negligible, minor, to moderate impacts to cultural resources. Mitigations identified in Table 3 are designed to avoid adverse impacts.

Archaeological sites
Use of manual treatments poses potential for adverse, direct, site specific, long term, minor to moderate impacts to archaeological sites. Potentially 8000 acres are targeted for treatment. There are 213 known sites within the park. Of those 213 sites 75 are historic sites and structures. 122 are prehistoric sites and 16 are multi-component sites with both prehistoric and historic components. Most historic sites are found in areas of roads, trails or developed areas. Prehistoric sites are found primarily in riparian areas and spring locations throughout the great basin. Soil disturbance from digging invasive plants and restoration activities has potential to damage context and site integrity of archaeological deposits. Severe damage to context would render the site not eligible for NRHP under the Criterion D, for information potential. This would be a moderate to major, adverse, long-term impact impact.

Historic structures and features
Use of manual treatments to control invasive plant growth around historic structures and features would have minor to major, direct and indirect, beneficial impacts for historic structures and features. Removing vegetative material would prevent root penetration that could damage

structures and potential for tree fall that might damage standing structures. Indirect beneficial impacts also include reducing fuel load and fire /erosion potential.

Cumulative Impacts

Archaeological sites

The potential for cumulative effect under Alternative 3 would be considered on a site specific basis. Soil disturbance damages subsurface context and information potential of archaeological sites. Repeated and increased use of manual treatments that involve digging and ground disturbance when coupled with general park operations and visitor use have the potential for adverse effect to render archaeological sites not eligible for NRHP.

Historic structures and features

Use of manual treatments would have cumulative beneficial impacts to historic structures and features. Cumulative benefit from treatments would reduce damage due to root penetration, reduce potential for overgrowth and physical damage, and reduce overgrowth of fuel and fire potential.

Conclusion

Adopting Alternative 3 would have both beneficial and adverse impacts to cultural resources. Archaeological sites could be adversely affected by manual treatments that disturb subsurface deposits and alter context, reducing information potential. This could be moderate to major effect, rendering the sites not eligible for NRHP. Monitoring and/or mitigations would be required to avoid adverse or potentially adverse effects. Conversely, manual treatments would have minor to moderate beneficial effect for historic structures, reducing root growth and penetration, and reducing fuel load and fire/erosion potential.

4.2.9 Long-term management of resources or land/resource productivity

What would be the effect of manual treatments, herbicide treatments, and biological treatments on long-term management of resources or land/resource productivity?

Impact Intensity	Intensity Description
Negligible	The action would not have any measurable or perceptible impacts to the long-term management of resources.
Minor	There would be measurable changes in some resources, resource conditions, or areas of land productivity. Mitigation to offset adverse impacts would be required and would be effective.
Moderate	There would be distinctive changes in a number of resources, resource conditions, or larger areas of land productivity. Mitigation to offset adverse impacts could be extensive, but would likely be successful.

Major	There would be significant changes in a majority of resources, resource conditions, or obvious degradation of land productivity over a substantially large area. Extensive mitigation measures to offset adverse impacts would be required and success would 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.

Alternative 1- No Action

Impact analysis

Invasive weeds would not be manually removed or treated with herbicides. No biological controls would be used and educational programs would not be conducted. Invasive plant populations would not be inventoried and documented. Restoration actions would not be conducted in sagebrush communities. Failing to treat non–native annual grasses in sagebrush restoration areas would allow the proliferation of cheatgrass and eventual loss of native plant communities, further degrading this habitat type in the park. Non-native annual grasses and forbs have profound impacts on native plant communities, resulting in an increase in fire frequency and eventual loss of native plant communities. Lack of invasive plant control in riparian areas and wetlands would allow the unabated invasion of these highly sensitive and productive habitats by non-native forbs. Non-native forbs would reduce the productivity and functioning of riparian areas and wetlands and degrade their value for wildlife habitat. All of these factors and their responses would adversely affect the original character of the park, its resources, and land and resource productivity. This alternative would result in major, adverse, long-term effects.

Cumulative Impacts

Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause some impacts to resources or land productivity. These are expected to be negligible to minor, adverse, and short-term.

Conclusion

The No Action alternative would not take any management actions to prevent the proliferation of invasive plants in any habitat in the park, thus allowing eventual naturalization of non-natives and permanently altering native habitat which could lead to a reorganization of the park's biodiversity and natural character. This would result in major, adverse, and long-term effects to long term management of resources or land/resource productivity.

Alternative 2- Implement full IPM strategy

Impact analysis

Invasive plants would be aggressively inventoried and treated using manual, herbicide and biological control methods. Proactive educational programs would be conducted to prevent and limit the expansion of invasive plants. Sagebrush restoration would be conducted and recovery of these areas would benefit from control of non-native annual grasses. Riparian and wetland habitat would experience decreases in non-native plants. Restoration would have the beneficial effect of promoting the re-establishment of early seral states of sagebrush vegetation. An array of

seral states and a heterogeneous plant community are most resistant to invasion by invasive species and support diverse wildlife communities. The native plant communities and the wildlife that depend on those habitats all contribute to long-term land and resource productivity. The effects would be minor, beneficial, and short-term to major, beneficial, and long-term.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause some impacts to resources or land productivity. These are expected to be negligible to minor, adverse, and short-term.

Conclusion
Integrated Pest Management (IPM) would help the park to achieve the desired conditions to have all native plants and native plant communities maintained as part of the natural ecosystem, thereby maintaining a diversity of wildlife and wildlife habitat. The overall impact of this alternative on long term management of resources or land/resource productivity would be minor, beneficial, and short-term and moderate to major, beneficial, and long-term.

Alternative 3- No Herbicide Use
Impact analysis
Impacts to long term management of resources or land/resource productivity would be similar to those of Alternative 2, but limited treatment options would increase the amount of time required to control invasives and native plant re-establishment would be delayed. There would be but moderate to major, beneficial, and long-term effects.

Cumulative Impacts
Impacts from campground rehabilitation, road grading, digging, fire suppression, and fuel reduction treatments and other ground disturbing activities are likely to cause some impacts to resources or land productivity. These are expected to be negligible to minor, adverse, and short-term.

Conclusion
The overall impact of this alternative on long term management of resources or land/resource productivity would be minor to moderate, beneficial, and long-term.

4.3 CUMULATIVE IMPACTS ANALYSIS

The Council on Environmental Quality (CEQ) regulations for implementing NEPA requires the assessment of cumulative impacts in the decision-making process for federal actions. A cumulative impact is described in the Council on Environmental Quality, Regulation 1508.7, as follows:

> *A "cumulative impact" is the impact on the environment which results from the*

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

Cumulative impacts are considered for the No Action and all Action alternatives. Cumulative impacts were determined by combining the effects of the alternative with other past, present, and reasonably foreseeable future actions with the effects of the alternatives. The following table lists of actions that could result in cumulative impacts.

Table 6, Cumulative Impacts Analysis

Action Past Projects	Description	Resources Potentially Affected
Manual, herbicide and biological control of invasives	Manual, herbicide and biological control methods have been used in GRBA to control invasive plant species.	Native plants and species of management concern. Archaeological resources. Recreation and visitor services. Water sources.
Grazing	Since the 1800's domestic livestock (cattle, sheep and horses have grazed the Snake Valley which includes GRBA. In 1999, cattle grazing was discontinued. Sheep grazing was discontinued in 2009. Although cattle and sheep grazing was discontinued, grazing by domestic cattle and sheep continues in areas of trespass. Grazing also occurs by deer and elk.	Native plants and animals.
Manual Fuel Reduction Projects	Numerous manual fuels reduction projects have been implemented in the park below 8,000 feet, within Fire Regime Condition Class 3.	Native plants and species of management concern
Wildland Fire	Numerous wildland fires have occurred throughout GRBA. The., the largest being the Phillips Ranch fire in 2000. Building fireline	Native plants and species of management concern.

	around fires has caused ground disturbance and opportunity for colonization by invasive plants.	Archaeological resources. Recreation and visitor services. Water sources.
Prescribed Fire	Several prescribed fire projects, mostly pile burning of thinning slash from manual fuels reduction projects have been implemented below 8,000 ft. A broadcast burn was initiated in the area across from the Baker Creek Campground in 1999-2001.	Native plants and species of management concern
Recreational Camping/hiking	Five developed campgrounds are located in the park. In addition the park has dispersed camping in Snake and Strawberry Creeks.	Native plants and species of management concern, Water sources. Archaeological resources. Recreation and visitor services.
Maintenance projects	Repair, rehabilitation and new development have been implemented by park staff mostly in the areas of the campgrounds, gravel and paved roads, residences and offices. Ground disturbance activities such as digging, grading, ripping and scraping by hand or heavy equipment have been used in the repair, rehabilitation or new development. Soil used in many projects has either been transported from a local ranch to the project site or from one project site to another. Hazard trees have been removed from high visitation areas such as campgrounds, roadways, and trailheads.	Native plants and species of management concern. Soils. Archaeological resources.
Hydro-geologic Drilling	Drilling of a well as part of the Hydro-geologic testing occurred in June 2012 at a small (<1 ac.) adjacent to Baker Creek Road.	Native plants. Soil disturbance. Archeological resources.
Present Projects		

Manual, herbicide and biological control of invasives	Manual, herbicide and biological control methods to control invasive plants are limited to areas of known infestations. Pheromones are placed on ponderosa pine trees to prevent bark beetle infestations.	Native plants and species of management concern. Soil disturbance. Archaeological resources
Manual Fuel Reduction Projects	At present the Kious Basin Manual Fuel Reduction project is being implemented.	Native plants and species of management concern. Soil disturbance. Archaeological resources.
Recreational Camping/hiking	Recreational camping and hiking will likely increase as new development occurs in the campgrounds, and new hiking trails are expanded or developed.	Native plants and species of management concern, Water sources. Archaeological resources.
Maintenance projects	Repair, rehabilitation and new development of campgrounds, gravel roads are presently taking place in Strawberry Creek, Greycliffs Campground, Baker Creek Campground, Wheeler Peak Campground, Pole Canyon road, Baker Creek Road, Snake Creek road and Wheeler Peak Scenic Drive. Hazard trees are removed from high visitation areas as warranted.	Native plants and species of management concern, Water sources. Archaeological resources.
Future Projects		
Manual, herbicide and Biological control of invasives	Manual, herbicide and biological control methods to control invasive plants are limited to areas of known infestations. Pheromones are placed on ponderosa pine trees to prevent bark beetle infestations.	Native plants and species of management concern. Soil disturbance. Archaeological resources.
Manual Fuel Reduction Projects	Manual fuel reduction projects will continue to be implemented at	Native plants and species of

	various locations to reach desired condition.	management concern. Soil disturbance. Archaeological resources.
Prescribed Fire	A strategy to improve fire regime condition class and improve desired conditons throughout the park, future implementation of prescribed fire projects will increase,	Native plants and species of management concern. Soil disturbance. Archaeological resources.
Recreational Camping/hiking	Promotion of improvements made in the park's campgrounds will increase visitation and recreational camping and hiking.	Native plants and species of management concern. Soil disturbance. Archaeological resources.
Maintenance projects	Continued maintenance, rehabilitation, improvements and new developments will occur primarily in high visitation areas and on the park's hiking trails.	Native plants and species of management concern. Soil disturbance. Archaeological resources.
Hazard tree removal	Hazard tree removal will continue to occur in areas of high visitation as a safety precaution for the parks visitors and employees.	Native plants and species of management concern. Soil disturbance. Archaeological resources.
Snake Creek Fish Barrier	A fish barrier will be installed in the near future in an area near the park boundary on Snake Creek. The fish barrier will be installed to eliminate additional non-native fish to enter the park.	Native plants and species of management concern. Soil disturbance. Archaeological resources.

Johnson Lake Historic District	A multiple-year stabilization at the Johnson Lake Historic District is to begin in 2013.	Native plants. Soil disturbance. Archaeological resources.

5.0 CONSULTATION AND COORDINATION

5.1 SCOPING

Internal Scoping

Internal scoping was conducted between March 15, 2012 and Jan. 15, 2013, through several ID Team Meeting of Great Basin National Park staff. Preliminary issues were identified using the PEPC Environmental Screening Form.

Public Involvement

Public scoping was conducted by mailing out letters (Appendix C) to individuals and groups on the Park's NEPA mailing list on February 13th, 2012. Scoping letters were sent to all consulting Tribes (see section on conformance for a list of Consulting Tribes), and a press release was sent to a number of local state newspapers, television and radio stations, tourism groups, and government agencies. The press release was posted at several local businesses, post offices, and a local citizen website. Information was also available on the National Park Service Planning, Environment & Public Comment (PEPC) website at: http://parkplanning.nps.gov/ . The public was informed that the park was preparing an EA for a proposed Invasive Plant Management Plan utilizing IPM strategy. At the end of 45 days, the park had received 3 comments from individuals and no written comments from groups or Tribes.

5.2 REGULATORY COMPLIANCE

Compliance with major federal laws and associated state regulations is summarized below.

Nevada State Historic Preservation Office

Because the Invasive Plant Management Plan identifies a large area of potential treatment and treatment alternatives, consultation with the Nevada State Historic Preservation Officer will be initiated when specific project areas and treatment methods are identified.

Tribes

The National Park Service has consulted with Native American tribes and copies of the Invasive

Plant Management EA will be forwarded to each respondent for review or comment. If subsequent issues or concerns are identified, appropriate consultations would be undertaken for specific identified locations.

U.S. Fish and Wildlife Service
There are no threatened or endangered animal species found in the park, therefore no consultation is necessary with the U.S. Fish and Wildlife Service.

Army Corps of Engineers
No construction was planned in any wetlands or floodplains, thus no consultation was needed with the Army Corps of Engineers.

Any other agencies that the park is consulting with
The park has entered into an MOU that established the Snake Valley Cooperative Weed Management Area in cooperation with White Pine County, White Pine Conservation District, Eastern Nevada Landscape Coalition, BLM Ely Field Office, Ely District of Humboldt-Toiyabe National Forest (USFS), U.S. Fish & Wildlife Service, Nevada Division of Wildlife, Nevada Department of Transportation, Natural Resources Conservation Service, University of Nevada Cooperative Extension, and Tri-County Weed Project. This MOU defines the terms and conditions under which the participants will cooperate, coordinate activities, and share resources necessary for the prevention and control of noxious weeds within the Snake Valley CWMA.

5.3 LIST OF PREPARERS AND CONTRIBUTORS

Preparers
Beth Cristobal, Environmental Protection Specialist
Ben Roberts, Natural Resources Program Manager
Gorden Bell, Environmental Protection Specialist

Contributors
Patrick Mingus, Vegetation Coordinator
Gretchen Baker, Ecologist
Betsy Duncan-Clark, Chief of Interpretation
Andy Ferguson, Superintendent (Retired)
Bryan Hamilton, Wildlife Biologist
Tammie Henderson, Chief Ranger
Karla Jageman, Archeologist
Eva Jensen, Cultural Resources Program Manager
Mark Pepper, Fisheries Biologist
Tod Williams, Chief of Science and Resources Management

5.4 List of Recipients and Review of EA

The following is a list of agencies and organizations that will receive a notice of availability or a copy of the environmental assessment. In addition, 20 individuals and organizations will have received a notice of availability and the press release announcing availability will have been sent to 14 area newspapers and radio stations for release as a public service announcement. A complete list of names on the NPS mailing list and press release list for this project is in the project file and is available from the issuing office.

Tribes
-Ely Shoshone Tribe
-Goshute Business Council
-Southern Paiute Consortium, Kaibab Paiute Tribe
-Southern Paiute Tribe, Indian Peaks Band
-Southern Paiute Tribe of Utah

Federal Agencies
-Bureau of Land Management, Ely District Office
-BLM, Utah State Office
-Natural Resources Conservation Service, Ely Service Center
-U.S. Fish and Wildlife Service, Reno Office
-U.S. Forest Service, Ely District
-Fish Springs National Wildlife Refuge

State Agencies
-Desert Research Institute
-Nevada Department of Wildlife, Reno
-Nevada Department of Wildlife, Ely
-Nevada State Department of Conservation
-State Historic Preservation Officer

Regional, County, and Municipal Agencies
-Baker Citizens Advisory Board
-White Pine County Chamber of Commerce
-White Pine County Economic Diversification Council
-White Pine County Sheriff's Office

Elected Officials
-U.S. Senator Harry Reid
-U.S. Senator Dean Heller
-U.S. Representative Shelley Berkley
-U.S. Representative Mark Amodei
-Nevada State Representative Pete Goicoechea
-Nevada State Senator Dean Rhoads
-County Commissioners for White Pine County and Millard County
-Mayors of Ely, Delta
-Ely City Council

Organizations
-Eastern Nevada Landscape Coalition
-Great Basin Chapter of Trout Unlimited
-Sagebrush Chapter of Trout Unlimited
-Southern Nevada Chapter of Trout Unlimited
-Great Basin National Heritage Area
-Great Basin National Park Foundation
-Great Basin Water Network
-National Parks Conservation Association, Ft. Collins
-National Parks Conservation Association, Las Vegas
-Nevada Land Conservancy
-White Pine County Public Lands Users Advisory Committee
-The Conservation Fund
-Toiyabe Chapter of the Sierra Club

General Postings
U.S. Post Office, Baker
U.S. Post Office, Garrison

Libraries
The following is a list of libraries and public venues where the public can access this EA and review the document onsite.

EskDale Center
Great Basin Visitor Center, Great Basin National Park
Lehman Caves Visitor Center, Great Basin National Park
White Pine County Library

There will be a 30-day comment period on the EA. Comments may be submitted online at: http://parkplanning.nps.gov/, or in writing to the following address:

Great Basin National Park, Planning
100 Great Basin National Park
Baker, Nevada 89311

6.0 REFERENCES

6.1 REFERENCES

Bradley, B., R.A. Houghton, J. Mustard, S.P. Hamburg. 2006. Invasive grass reduces above ground carbon stocks in shrublands of the Western US. Global Change Biology, 12:1815-1822.

Brooks, Randy. 1998. Herbicides and water quality protection. University of Idaho Extension Forestry Information Series. Water Quality No. 4. http://www.uidaho.edu/~/media/Files/Extension/Forestry/Water/Water%20Quality/Herbicides%20and%20Water%20Quality%20Protection.ashx

Center for Science, Economics and Environment. 2002. The state of the nation's ecosystems: measuring the lands, waters and living resources of the United States. Cambridge, United Kingdom: Cambridge University Press. 288 p. with 2005 updates [2007, July 17].

Chambers, Jeanne C., Devoe N., and Evenden A., eds. 2008. Collaborative Management and Research in the Great Basin: Examining the Issues and Developing a Framework for Action, USDA Forest Service Gen. Tech. Rep. RMRS-GTR-204.

Frissel, C. A.; Liss, W. J. 1993. Valley segment classification for the streams of Great Basin National Park, Nevada. Final Report, Oregon State Univ. Coop. Park Studies Res. Unit. 53 pp.

Houlahan, J. E., & Findlay, C. S. 2004. Effect of invasive plant species on temperate wetland plant diversity. *Conservation Biology*, *18*(4), 1132-1138.

Knopf, F. L.; Johnson, R. R.; Rich, T.; Samson, F. B.; Szaro, R. C. 1988. Conservation of riparian plant communities. Wilson Bulletin 100:272-284.

Krzyzanowski, J. and P. Lara Almuedo. 2010. Cumulative impacts of natural resource development on ecosystems and wildlife: An annotated bibliography for British Columbia. Forrex Forum for Research and Extension in Natural Resources, Kamloops, BC. Forrex Series 26. www.forrex.org/publications/forrexseries/fs26.pdf

Pellant, M.; Statement before the Senate Subcommittee on Public Lands and Forests RE: The Great Basin Restoration Initiative, B LM, U.S. Dept. of the Interior October 11, 2007

Rowland, M. M.; Suring, L. H.; Wisdom, M. J.; Meinke, C. W.; Schueck, L. 2005. Habitats for vertebrate species of concern. In: Wisdom, M. J.; Rowland, M. M.; Suring, L. H., eds. 2005. Habitat threats in the sagebrush ecosystem: methods of regional assessment and applications in the Great Basin. Lawrence, KS: Alliance Communications Group, Allen Press: 163-204.

Sada, D. W.; Vinyard, G. L. 2002. Anthropogenic changes in biogeography of Great Basin aquatic biota. In: Hershler, R., Madsen, D. B., and Currey, D. Great Basin aquatic systems history. Smithsonian Contributions to the Earth Sciences No. 33: 277-293

Sada, D.W.; Williams, J.E.; Silvey, J.C.; Halford, A.; Ramakka, J.; Summers, P.; Lewis, L. 2001. Riparian area management. A guide to managing, restoring, and conserving springs in the western United States. Technical Reference 1737-17. Denver, CO: Bureau of Land Management. BLM/ST/ST-01/001+1737.

Skudlarek, E., ed. 2006 [Draft]. Nevada Wetlands Priority Conservation Plan. Nevada Department of Conservation and Natural Resources, Nevada Heritage Program, Carson City, Nevada.

Smith, S. D.; Murray, K. J.; Landau, F. H.; and Sala, A. M. 1995. Structure of woody riparian vegetation in Great Basin National Park. *Faculty Publications (SLS).* Paper 70.

Szaro, R. C. 1989. Riparian forest and scrubland types of Arizona and New Mexico. *Desert Plants* 9:70-138.

Zedler, J. B., & Kercher, S. 2004. Causes and consequences of invasive plants in wetlands: opportunities, opportunists, and outcomes. *Critical Reviews in Plant sciences*, *23*(5), 431-452.

7.0 APPENDICES

APPENDIX A: GRBA Target Plant Species

According to GRBA's DRAFT Invasive Plant Report FY2011, the following five plant species were listed as Target Species in the park.

- Spotted Knapweed (*Centaurea maculosa*)
- Bull thistle (*Cirsium vulgare*)
- Musk Thistle (*Carduus nutans*)
- Houndstongue (*Cynoglossum officinale*)
- Hoary Cress or Whitetop (*Cardaria draba*)

In addition these plants are noted as prone to invasion

- Loosestrife
- Salt cedar (tamarisk)
- Russian olive
- Crested wheatgrass

APPENDIX B: Herbicide and Biological Control List

Active Ingredient	Invasive Plants Targeted	Group	Mode Of Action
1,4-D	Bull thistle Musk thistle Knapweed Russian thistle	Phenoxyaliphatic Acid Herbicides	Auxin growth regulators
Triclopyr	Russian Olive Siberian elm	Picolinic Acids	Auxin growth regulators
Chlorsulfuron	Whitetop	Sulfonylureas	Amino acid inhibitors
Imazapic	Cheatgrass	Imidazolinone	Enzyme inhibitors
Glyphosate	Bindweed Canadian thistle	Aromatic	Amino acid inhibitors

Biological		
Biological Species	**Invasive Plant Targeted**	**Mode of Action**
Tamarisk leaf beetle (*Diorhabda elongata deserticola*)	Tamarisk	Defoliation
Indigenous fungal pathogens	Cheatgrass Knapweed Puncture vine	Infection and defoliation

APPENDIX C: IPM Examples Excerpted from the NPS IPM Handbook

Introduction

The National Park Service is proud to be a leader among federal agencies in the implementation of Integrated Pest Management (IPM). With over 80 million acres of land, 45,000 buildings and cultural landscapes ranging from croplands to historic rose gardens, we face every conceivable pest problem. Since implementing an IPM program in the early 1980's, the Park Service has reduced pesticide use by over 60 percent while improving the effectiveness of our pest management efforts. Key elements in this success were formal training and the provision of printed and audiovisual materials.

One of our products is an IPM Manual which is now available in a second edition. It provides descriptions of the biology and management of 21 species or categories of pests. The Park Service is pleased to offer this information to the IPM community.

The National Park Service wishes to thank the Entomology Department at Colorado State University. They designed the original NPS IPM Manual website and made it available on the Internet before the Park Service's natural resource website was fully operational.

Terry Cacek
IPM Coordinator

Thistles

This module is intended to serve as a source of basic information needed to implement an integrated pest management program for thistles. Any pest management plan or activity must be formulated within the framework of the management zones where it will be implemented. Full consideration must be given to threatened and endangered species, natural and cultural resources, human health and safety, and the legal mandates of the individual parks. Recommendations in this module must be evaluated and applied in relation to these broader considerations.

Thistles include many species of composite plants in the subfamily Cynareae. Although most species in this subfamily are native and are beneficial for wildlife, a number of introduced species are well known as serious weeds of crops and rangelands. The pest status of introduced species results from the lack of population suppression exerted by natural enemies (e.g., insect herbivores and diseases). Thus, long-term goals in thistle management emphasize biological and cultural controls, although emergency intervention with chemical or mechanical controls may be necessary.

IDENTIFICATION AND BIOLOGY OF THISTLES

Five species of thistle are currently considered major pest weed species by the National Park Service and are under chemical, biological, or cultural control programs in North America. Other species, such as *Carduus acanthiodes* (plumeless thistle), *C. crispus* (welted thistle), and *C. macrocephalus* (nodding thistle), may be pest weeds in local areas. The five species listed below were introduced from Europe and North Africa into North America.

Musk thistle (*Carduus thoermeri* Weinmann). Originally thought to be *C. nutans* (L), *C. thoermeri* is only found in small isolated pockets. The musk thistles are a complex of several species or subspecies, the taxonomy of which is unclear. See McCarty and Lamp (1982) for details. Musk thistles are found throughout the United States, and are especially common in Southern California and Midwestern and Appalachian regions. Musk thistles are biennial thistles that flower in May-June.

Italian thistle. (*Carduus pycnocephalus* [L]). Italian thistle is found in California (mainly in coastal counties) and are rare in other areas of the United States. Italian thistles are summer annuals or may be biennials in dry habitats.

Canada thistle. (*Cirsium arvense* [L]). Canada thistle is found throughout North America except in Alaska, and is most common in northern tier of states and southern Canada. Canada thistles are perennial thistles which flower in June-October.

Bull thistle. (*Cirsium vulgare* (Savi) Tenore). Bull thistle is found in southern Canada and

throughout the United States. Bull thistles are biennial thistles which flower in July-September.

Milk thistle. (*Silybum marianum* [L]). Milk thistle is found in California, mainly in the coastal counties and drier areas. Milk thistles are winter annuals or may be biennials in dry habitats.

See Fernald (1950), pages 1538-1542, and Peterson and McKenny (1968), pages 302-306, for descriptive keys and illustrations of thistle species. See also Moore and Frankton (1974) for detailed keys to species.

Thistles are pioneer species and are most often found in sites where the ground cover has been disturbed by grazing, erosion, traffic, or other means. Thistles reduce the use of an area for grazing or recreational purposes because of the prominent spines on leaves, stalks, and blooms. Livestock do not eat thistles and will not graze between thistle plants on more desirable forage (Batra 1982).

Each thistle produces many seeds, often in excess of 10,000 seeds per plant. The fine filaments or pappus (thistle down) of the seed coat permit windborne dispersal over long distances to suitable habitats. Reinfestation occurs from roadsides or other areas where control is not practiced or by long-lived seeds stored in the soil from previous years. Newly germinated thistle seeds require considerable light and usually become established on disturbed areas of pastures or croplands where competition is limited during the seedling stage (Hodgson 1968). Foliar growth occurs during the spring, summer, and fall. The amount of growth and rate of new establishment varies from region to region according to the geographic, ecologic, and climatic characteristics of each region.

Losses in cultivated crops are as high as 60% at usual levels of infestation (25 shoots of Canada thistle per square yard). Losses in productivity of forage grasses from Canada thistle at a density of less than two shoots per square meter are as high as 15% (Hodgson 1968).

The introduced thistles represent a range of life histories, and the life history of each species may vary depending on habitat conditions:

> **Summer annuals** grow each spring or summer from seed. They grow, mature, produce seeds, and die in one growing season. Seeds generally overwinter before germinating the following spring.
>
> **Winter annuals** germinate in late summer or fall from seed, then mature and produce seed the following spring or summer. Seeds are dormant during the spring.
>
> **Biennials** germinate any time during the growing season. They usually produce a rosette of leaves close to the soil during the first season, then flower (using energy and nutrients stored during the first season's growth), mature, and die during the next year.

Perennials become established by seed or vegetative parts (e.g., roots, tubers, or rhizomes). Once established, they live for more than 2 years, and often for many years.

MONITORING AND THRESHOLDS FOR THISTLES

Thistles are relatively conspicuous weeds and in most cases periodic visual inspections should be sufficient to monitor thistle populations. The permanent plot technique is a good way to monitor thistle populations after they have become established and while they are being controlled. A representative section of the field is marked off and thistles are counted and mapped and notes made on their condition (height, flowering, etc.). Monitor on a regular basis (weekly, biweekly, monthly). Keep careful records, note when treatments take place, or when biological controls are introduced (naturally or artificially). Study of records, over time, will show population trends and indicate whether or not control strategies are successful.

A variation on the above is the use of photo plots. Take a series of photographs of the sample plot showing the density of thistles and condition. Include in the photo an object of known size (person or measuring stick) to indicate thistle size. Also include in the frame a sheet of paper with the date in bold letters. All photos should be taken from the same location with the camera pointed in the same direction and with lenses of equal coverage. This method is especially useful in monitoring the effects of control measures over the course of several seasons.

Many states have laws requiring the control or removal of pest thistle species before they flower, whenever and wherever they occur. In these states, and in most other instances, the threshold action level is one or more weed thistles.

NON-CHEMICAL CONTROL OF THISTLES

The primary control strategy for annuals and biennials is seed management while the control strategy for perennials must include depletion of plant reserves. Long-term strategies for thistle control depend on biological and cultural controls. Generally, no one technique will provide adequate control. Currently available biological controls using insects require several years for establishment of the insect, and even longer for control. Most successful programs combine biological control with cultural controls such as timely mowing or reseeding with competitive desirable plants. Suppression of thistles may require altering land use.

Biological Control

Pest species of thistles have been introduced into North America without their compliment of natural enemies. In Europe, *Carduus* thistles are attacked by approximately 340 species of insects and 7 fungal pathogens. Current research in biological control is an attempt to reunite natural enemy species with their hosts. Biological control agents seldom eliminate pest thistles from an area, but can reduce populations below set economic thresholds.

Imported thistles have been the subject of biological control programs for several years. The following is a brief description of several biological control agents.

Rhinocyllus conicus, a European weevil that feeds on developing seed heads has been introduced into the United States and Canada for control of *Carduus* thistles, particularly the musk thistle. It has also been introduced for control of Italian and milk thistles in the western United States. In the absence of *Carduus* thistles, *R. conicus* will feed on Canada and bull thistles, but control is not as complete as on its primary host. *R. conicus* deposits eggs on bracts and flower stems. Larvae feed beneath developing seeds, destroying them. Pupation occurs in the flowers, and adults emerge in mid-summer. Adults hibernate in overwintering floral rosettes. There is one generation per year. Release of *R. conicus* on National Park Service lands is not being allowed at this time due to possible impacts on native plants.

Trichosirocalus horridus, another European weevil, has also been introduced for control of *Carduus* thistles. This insect feeds primarily on the root crowns of musk and Italian thistles. *T. horridus* has been released in Canada and most of the United States. It has not been introduced on the west coast of the United States because it has been shown experimentally to feed on artichoke. However, it is not considered to be a pest in artichoke-producing areas of Europe, and further studies are being carried out. *T. horridus* deposits eggs on leaf ribs and larvae migrate to the root crown where they feed. Pupation occurs in the soil. Adults feed after emergence and overwinter in the rosettes. Weevils from populations in southern Europe and from central Europe have been introduced into the United States. Southern European weevils mate in autumn, oviposit from mid-December to March, and adults emerge in April and June. Central European weevils mate in spring and oviposit in May to June. Adults emerge in September and hibernate until the spring thaw. These two populations are currently undergoing further study to develop more effective control for thistles. Stoyer and Kok (1987) suggest that a combination of *T. horridus* and sublethal dosages of 2,4-D herbicide could aid in *Carduus* thistle control.

For control of Canada thistle, *Altica carduorum*, a European weevil has been imported into North America. Adults feed throughout the summer on leaves, defoliating the plant and weakening it. Although Canada thistle is seldom killed outright by this weevil, the continued stress upon it reduces the number and vigor of vegetative shoots and reduces seed production. Although repeatedly released in North America, this species is not yet well established (Batra et al. 1981).

A second weevil, *Ceuthorhynchus litura*, that feeds on leaves and root crowns of Canada thistle is established and providing some control in Canada, Idaho, Montana, and California (Rees 1990).

A tephritid fly, *Erophora cardui*, that feeds on Canada and bull thistles was released in 1973 and is established in British Columbia.

Cassida rubiginosa, a chrysomelid beetle that feeds on leaves of *Carduus* and *Cirsium* thistles, has been established in North America since 1927 (Batra et al. 1981).

Several other species of insects, mostly seed-head weevils, are currently being studied for possible importation and release for biological control of thistles in the United States.

Two fungal pathogens that are spread by thistle feeding insects are also being considered for release in the United States. Rust fungi in the genus *Puccinia*, which attack the leaves of the basal rosette and underground basal parts, have been introduced into Canada. Further studies are required to determine their effectiveness.

Ustilago cardui, a smut fungus, has been observed to attack late maturing seed heads of *Carduus* thistles in Europe. Seed production is stopped in infected plants, giving full control. This fungus compliments control by *R. conicus* , which feeds on early flower heads (Bolt 1978).

Consult your National Park Service regional Integrated Pest Management coordinator for further information on biological control for thistles in your area.

Cultural Control

In areas that are grazed, eroded, or subject to heavy traffic, the grass cover may not be dense enough to prevent establishment of thistles. Rotational or deferred grazing, water conservation, erosion control, redirection of traffic, and sound pasture and turf management practices can reestablish heavy grass cover and prevent thistle establishment (Bendall 1973, Trumble and Kok 1982, Kok et al. 1986).

Mechanical Control

Cutting or removing thistles (where feasible) can be effective in reducing thistle populations. Annual and biennial thistles, if mowed within two days of flowering of the terminal blooms, will not produce seed or regenerate significantly. Timing in mowing is important; if mowing occurs four days after terminal bloom anthesis (full flowering), significant amounts of seed are produced. Since thistle stands mature at different times, careful monitoring and proper timing are necessary for mowing to be a viable option in an Integrated Pest Management program. However, even if mowing is done late and seed is produced, mowing the stalks will reduce seed dispersal and seed production, keeping infestations from spreading widely (McCarty and Hattling 1975).

Canada thistle, a perennial, is difficult to control by mechanical methods. Occasional cultivation may increase sprouting from broken roots due to its ability to propagate vegetatively. However, repeated cultivation can significantly reduce infestations if begun when plant reserves are at their lowest stage in early spring (early bud stage), before the shoot leaves can furnish energy to the roots in amounts greater than the roots require for production of new growth. Cultivation should start in early spring by plowing and disking. When new shoots appear, the area should be cultivated 3"to 4" inches deep every 20-21 days to destroy new shoots. Up to 90% or more of a Canada thistle infestation can be eliminated in a single season of cultivation when properly performed. Remaining plants can be eliminated by continuing cultivation in the following spring (Hodgson 1968). Hodgson (1968) reports excellent control of Canada Thistle in alfalfa fields mowed for hay twice a year.

Mechanical controls are compatible with biological controls if the mechanical controls are used

early in the season to stress the plants, and natural enemies are allowed to enter the system to further weaken and eliminate thistles. Mechanical controls combined with chemicals may be successful in some cases. In most cases, however, combining a chemical and biological control is a more viable approach to thistle management.

Controlled burning may only damage the above ground portion of the thistle allowing rapid regrowth from the root section or from seed. Fire should be used only in combination with other control measures.

CHEMICAL CONTROL OF THISTLES

Several herbicides are useful for thistle control and your regional Integrated Pest Management coordinator should be consulted for more information on these. Spot treatments, rather than broadcast treatments, are preferred. Chemical control for annuals, biennials, and perennials must be initiated before the plants blossom and produce seeds. Young plants are most susceptible to control with chemicals. Best results are obtained when plants are in their initial and heaviest growth stage. The use of herbicides provides a quick and easy (albeit expensive under largescale operations) method of control, but without a long-term strategy herbicides often lead to greater problems because of their effect on other plant species, the development of resistance, and the lack of susceptibility of certain life stages of thistles.

Trials combining herbicides (usually 2,4-D), and biological control agents (*R. conicus* and *T. horridus*) have shown the two to be compatible if precautions are taken (Trumble and Kok 1980). Field and laboratory tests have shown that spring application of 2,4-D (when blooms are beginning) provides the most effective thistle control, and causes the fewest adverse effects on thistle weevils; *R. conicus* adults and *T. horridus* pupae, the only life stages likely to be exposed to such spraying, are relatively unaffected by the herbicides. Adults of both species will move to unsprayed plants, thus increasing biological control in nearby areas where herbicide treatment is not feasible or economical. Tests to determine compatibility of biological control agents with herbicides other than 2,4-D are still in the planning stage.

SUMMARY

To summarize, the following steps are recommended to manage thistles:

1. Monitor infestations over time with the use of maps, plots, or photographs.

2. The primary control strategy for annuals and biennials is seed management, while the strategy for perennials must include depletion of plant reserves.

3. Use biological controls in your area if possible. Check with your National Park Service regional Integrated Pest Management coordinator for details.

4. Use cultural controls to reestablish dense grass or ground cover in order to prevent or reduce

thistle establishment.

5. Cut, mow, or otherwise remove thistles, if feasible. Thistles should be cut before the flowering of terminal blooms to prevent seed production.

6. Use appropriate herbicides on a spot treatment basis. Time applications to control thistles at prebloom stage and for compatibility with natural enemies.

REFERENCES

1. Balsbaugh, E.U., R.D. Frye, C.G. Scholl, and A.W. Anderson. 1981. Insects for weed control: status in North Dakota. N. Dak. Farm Res. 39(3):3-7.

2. Batra, S.W.T. 1978. *Carduus* thistle distribution and biological control in the Northeastern states. *In* Frick, K.E. (ed.), Biological control of the genus *Carduus* in the United States--a progress report. pp. 1-6. Science and Education Administration, U.S. Department of Agriculture, Washington, D.C.

3. Batra, S.W.T. 1980. First establishment of *Rhinocyllus conicus* (Froelich) in Maryland and Pennsylvania for thistle control (Coleoptera: Curculionidae). Proc. Entomol. Soc. Wash. 82(3):511.

4. Batra, S.W.T. 1982. Biological control in agroecosystems. Science 215:134-139.

5. Batra, S.W.T., J.R. Coulson, P.H. Dunn, and P.E. Boldt. 1981. Insects and fungi associated with *Carduus* thistles (Compositae). Tech. Bull. 1616. U.S. Department of Agriculture, Washington, D.C.

6. Bendall, G.M. 1973. The control of slender thistle, *Carduus pycnocephalus* L. and *C. tenuiflorus* Curt. (Compositae) in pasture by grazing management. Aust. J. Agric. Res. 24:831-837.

7. Bolt, P.E. 1978. Foreign exploration for the biological control of *Carduus* sp. *In* Frick, K.E. (ed.), Biological control of the genus *Carduus* in the United States--a progress report. pp. 11-17. Science and Education Administration, U.S. Department of Agriculture, Washington, D.C.

8. Brosten, B.S., and D.C. Sands. 1986. Field trials of *Sclerotinia sclerotiorum* to control Canada thistle (*Cirsium arvense*). Wed Sci. 34:377-380.

9. Dunn, P.H. 1976. Distribution of *Carduus nutans*, *C. acanthoides*, *C. pycnocephalus*, and *C. crispus* in the United States. Weed Sci. 24(5):518-524.

10. Dunn, P.H. 1978. History of the biological control of musk thistle in North America and studies with the flea beetle *Psylliodes chalcomera*. *In* Frick, K.E. (ed.), Biological control of the genus *Carduus* in the United States--a progress report. pp. 1- 6. Science and Education

Administration, U.S. Department of Agriculture, Washington, D.C.

11. Fernald, M.L. (ed.). 1950. Gray's manual of botany, eighth edition. American Book Co., New York.

12. Goeden, R.D. 1978. Initial analysis of *Rhinocyllus conicus* (Froelich) as an introduced natural enemy of milk thistle (*Silybum marianum* (L) Gaertner) and Italian thistle (*Carduus pycnocephalus* L.) in southern California. *In* Frick, K.E. (ed.), Biological control of the genus *Carduus* in the United States--a progress report. pp. 39-50. Science and Education Administration, U.S. Department of Agriculture, Washington, D.C.

13. Goeden, R.D., and D.W. Ricker. 1974. Imported seed weevils attack Italian and milk thistles in Southern California. Calif. Agric. 28:8-9.

14. Hawkes, R.B., L.A. Andres, and P.H. Dunn. 1972. Seed weevil released to control milk thistle. Calif. Agric. 26:14.

15. Hodgson, J.M. 1968. The nature, ecology, and control of Canada thistle. Tech. Bull. 1386. U.S. Department of Agriculture, Agricultural Research Service, Washington, D.C.

16. Hodgson, J.M., and N.E. Rees. 1976. Dispersal of *Rhinocyllus conicus* for biocontrol of musk thistle. Weed Sci. 24(1):59-62.

17. Kok, L.T. 1978. Status of biological control of musk thistle in Virginia. *In* Frick, K.E. (ed.), Biological control of the genus *Carduus* in the United States--a progress report. pp. 23-30. Science and Education Administration, U.S. Department of Agriculture, Washington, D.C.

18. Kok, L.T. 1980. Compatibility of *Rhinocyllus conicus*, *Trichosirocalus horridus*, and 2,4-D for *Carduus* thistle control. Proc. V Symp. Biol. Contr. Weeds, Brisbane, Australia.

19. Kok, L.T., and W.W. Surles. 1975. Successful biocontrol of musk thistle by an introduced weevil, *Rhinocyllus conicus*. Env. Entomol. 4(6):1025-1027.

20. Kok, L.T., T.J. McAvoy, and W.T. Mays. 1986. Impact of tall fescue grass and *Carduus* thistle weevils on the growth and development of musk thistle (*Carduus nutans*). Weed Sci. 34:966-971.

21. McCarty, M.K. 1978. The genus *Carduus* in the United States. *In* Frick, K.E. (ed.), Biological control of the genus *Carduus* in the United States--a progress report. pp. 7- 10. Science and Education Administration, U.S. Department of Agriculture, Washington, D.C.

22. McCarty, M.K., and J.L. Hatting. 1975. Effects of herbicides or mowing on musk thistle seed production. Weed Res. 15:363-367.

23. McCarty, M.K., and W.O. Lamp. 1982. Effect of a weevil, *Rhinocyllus conicus*, on musk thistle seed production. Weed Sci. 30:136-140.

24. Moore, R.J., and C. Frankton. 1974. The thistles of Canada. Canadian Dept. Agriculture. Monograph #10.

25. Moscow, D., and S.W. Lindow. 1989. Infection of milk thistle (*Silybum marianum*) leaves by *Septoria silybi*. Phytopathol. 79:1085-1090.

26. Mulligan, G.A., and C. Frankton. 1954. The plumeless thistle (*Carduus* sp.) in Canada. Can. Field-Natur. 68:31-36.

27. Peschken, D.P. 1979. Host specificity and suitability of *Tephritis dilacerata* (Diptera: Tephritidae): a candidate for the biological control of perennial sow thistle, (*Sonchus arvensis*) [Compositae] in Canada. Entomophaga 24(4):455-461.

28. Peschken, D.P., and A.T.S. Wilkinson. 1981. Biocontrol of Canada thistle (*Cirsium arvense*): releases and effectiveness of *Ceutorhynchus litura* (Coleoptera: Curculionidae) in Canada. Can. Entomol. 113(9):777-785.

29. Peterson, R.T., and H. McKenny. 1968. A field guide to wildflowers of Eastern North America. Houghton Mifflin Co., Boston, Mass.

30. Puttler, B., S.H. Long, and E.J. Peters. 1978. Establishment in Missouri of *Rhynocyllus conicus* for the biological control of musk thistles (*Carduus nutans*). Weed Sci. 26(2):188-192.

31. Rees, N.E. 1978. Interactions of *Rhinocyllus conicus* and thistles in the Gallatin Valley. *In* Frick, K.E. (ed.), Biological control of the genus *Carduus* in the United States--a progress report. pp. 7-10. Science and Education Administration, U.S. Department of Agriculture, Washington, D.C.

32. Rees, N.E. 1986. Two species of musk thistle (*Carduus* spp.) as hosts of *Rhinocyllus conicus*. Weed Sci. 34:241-242.

33. Rees, N.E. 1990. Establishment, dispersal, and influence of *Ceutorhynchus litura* on Canada thistle (*Cirsium arvense*) in the Gallatin Valley of Montana. Weed Sci. 38:198-200.

34. Rizza, A., G. Campobasso, P.H. Dunn, and M. Stazi. 1988. *Cheilosia corydon* (Diptera: Syrphidae), a candidate for the biological control of musk thistle in North America. Ann. Entomol. Soc. Am. 81:225-232.

35. Shorthouse, J.D., and R.G. Lalonde. 1988. Role of *Urophora cardui* (L) (Diptera, Tephritidae) in growth and development of its gall on stems of Canada thistle. Can. Entomol. 120:639-646.

36. Stoyer, T.L., and L.T. Kok. 1987. Insect/plant interactions in integrating *Trichosirocalus horridus* (Coleoptera: Curculionidae) and 2,4-dichlorophenoxyacetic acid for *Carduus* thistle control. Environ. Entomol. 16:864-868.

37. Stoyer, T.L., and L.T. Kok. 1989. Oviposition by *Trichosirocalus horridus* (Coleoptera: Curculionidae), a biological control agent for *Carduus* thistles, on plants treated with low dosages of 2,4-dichlorophenoxyacetic acid. Environ. Entomol. 18:715-718.

38. Trumble, J.T., and L.T. Kok. 1980. Impact of 2,4-D on *Ceuthorhynchiduis horridus* (Coleoptera: Curculionidae) and their compatibility for integrated control of *Carduus* thistles. Weed Res. 20:73-75.

39. Trumble, J.T., and L.T. Kok. 1980. Integration of a thistle-head weevil and herbicide for *Carduus* thistle control. Protection Ecol. 2:57-64.

40. Trumble, J.T., and L.T. Kok. 1982. Integrated pest management techniques in thistle suppression in pastures of North America. Weed Res. 22:345-359.

41. Trumble, J.T., B. Cartwright, and L.T. Kok. 1981. Efficiency of suction sampling for *Rhinocyllus conicus* and a comparison of suction and visual sampling techniques. Env. Entomol. 10:787-792.

42. Young, J.A., R.A. Evans, and R.B. Hawkes. 1978. Milk thistle (*Silybum marianum*) seed germination. Weed Sci. 26(4):395-398.

Weeds of Developed and Historic Sites

This module is intended to serve as a source of basic information needed to implement an integrated pest management program for weeds in historic and developed sites. Any pest management plan or activity must be formulated within the framework of the management zones in which it will be implemented. Full consideration must be given to threatened and endangered species, natural and cultural resources, human health and safety, and the legal mandates of the individual parks. Recommendations in this module must be evaluated and applied in relation to these broader considerations.

Weeds are usually described as any plants growing where they are not wanted. Any undesirable grass or broad leafed plant species, from a small herbaceous plant to a woody shrub, vine, or tree, may be considered a weed if it is growing in a landscape bed or in a structure.

Dicotyledonous (broad-leaved) plants are those that have two cotyledons in each seed. They are characterized by broad leaves and often have woody stems. Some species (e.g., sunflower) only become woody in old parts of stems and roots; these are referred to as semi-herbaceous dicots. Most weeds have little or no woody tissue (e.g., plantain, dandelion) and are herbaceous.

Grasses are members of the plant family Gramineae. All grasses are monocotyledonous and have long, narrow leaves with parallel veins and fibrous root systems. Some grasses produce underground stems called rhizomes (e.g., Kentucky bluegrass, quackgrass) or aboveground runners called stolons (e.g., creeping bentgrass), while others produce both (e.g., bermudagrass).

It is important to understand the distinction between monocots and dicots since the selectivity of many herbicides is based on which type of plant they kill. Thus many herbicides which would kill a dicotyledonous weed in turfgrass, which is a monocot, could not be used in a landscaped area since woody landscape plants are also dicots.

The description of each potential weed species is beyond the scope of this report. Contact the Cooperative Extension Service of the agricultural university in your state or your regional Integrated Pest Management coordinator for specific information on the most important weeds in your region. A list of useful pictorial weed guides is included in the reference section.

IDENTIFICATION AND BIOLOGY OF WEEDS OF DEVELOPED AND HISTORIC SITES

Undesirable plants (weeds) invade man-made environments such as landscape beds wherever they are established. Weeds are often found where soil has been exposed or disturbed by compaction, planting activities, or maintenance activities. They also occur where the turfgrass or groundcover is weakened by adverse environmental conditions, diseases, or pests to the extent that it cannot compete for nutrients, water, or light with weed species. Weeds are very common

where the grass or groundcover species being grown is not well-adapted to its environment.

Life cycles

The life cycles of weeds can be grouped into the following major types.

Summer annual weeds. These weeds grow each spring or summer from seed. Examples include prostrate spurge, ragweed, large crabgrass, and goosegrass. They mature, produce seeds, and die in one growing season. Seeds generally overwinter before germinating the following spring. The majority of annual weeds are of this type. Some annuals, such as crabgrass, can root from leaf-stem junctions, forming dense colonies.

Winter annual weeds. These weeds (e.g., henbit, shepherdspurse, annual bluegrass) germinate in the fall or late winter from seed, mature and produce seed during the following spring, and die in early summer. Seeds of most of these species are dormant during the spring.

Indeterminate annual weeds. These weeds, such as chickweed and annual bluegrass, can germinate and grow during most seasons in certain regions.

Biennial weeds. These weeds may germinate at any time during the growing season. Examples include wild carrot, bull thistle, and mullein. They usually produce a radial cluster (rosette) of leaves lying close to the soil during the first season. In the second year they produce flower stalks (using food stored from the first season's growth), produce seeds, and die.

Perennial weeds. These plants live for three or more years. Some species may not flower the first year, while others may produce mostly nonviable seeds. Many perennials (e.g., curly dock, dandelion, and common milkweed) spread primarily by producing seeds, while others (e.g., field bindweed, white clover, silverleaf nightshade, bentgrass, and quackgrass) spread both by seed and vegetatively. The latter can occur by rhizomes, stolons, tubers, or rooting of stem nodes that touch the soil.

The seasonal abundance of weeds is related to their specific life cycles. Summer annuals grow from spring until fall, then are killed by low fall or winter temperatures. Winter annuals grow from fall to late spring, so they are usually not found during the summer. Biennials grow during the spring, summer, and fall of their first year, survive over the following winter, and flower during the next growing season. Therefore, some biennial stages are likely to be present at any time of the year. Perennials grow during each growing season. Their aboveground structures may die over the winter (e.g., yellow nutsedge) or may remain viable but dormant.

Knowledge of the life cycle of a particular weed species is an important part of its management. For example, mowing a patch of annual weeds to remove the flowers can prevent seed set. Refrain from cultivating areas where there are high populations of weeds that reproduce by rhizomes; this cuts the rhizomes into pieces and each piece can generate a new weed plant.

Impact of Weeds

The most obvious impact of weeds on turf areas is the competition and replacement of desired plants by weed species. In the case of weeds that overgrow an area and then die, such as crabgrass and knotweed, unsightly dead areas can be created. This often leads to the necessity for increased expenditures for turf maintenance. In landscape beds, weeds can grow among desirable plantings or among groundcovers and create an unsightly nuisance. This can lead to the need for hand weeding, which entails a high labor cost.

Toxicity to humans and animals is also a consideration. Some common weeds are poisonous if consumed (e.g., black nightshade, pokeweed, poison hemlock, and Johnsongrass); cause inflammation when touched (e.g., stinging nettle, poison ivy, oak, and sumac); or cause allergic reactions (e.g., common ragweed, goldenrod). Visitor injury or annoyance can result from bees or wasps seeking nectar from some weeds. Furthermore, many weed plants or their seeds have spines, thorns, or burs which can have similar allergic effects.

Weedy areas provide habitat for beneficial insects but may also attract rodents and arthropods such as rats, ticks, and fleas that might attack humans and domestic animals or carry diseases which will affect humans and domestic animals. Weeds can also serve as hosts for some fungal pathogens and insects which might attack desirable plants.

Weeds can also grow large enough to cover signs, block trails, or obstruct historic landscapes or vistas, interfering with visitor use of the park. Weeds that grow on buildings can cause structural damage if they grow into cracks in mortar or bricks; sometimes they will stain buildings as well.

Weed Habitats

Two habitats will be considered in this report; landscaped areas (where natural vegetation has been replaced or augmented with other plants, usually for aesthetic purposes) and buildings. Weeds growing in landscaped areas are found where soil has been exposed or disturbed by traffic or weakened by adverse environmental conditions, diseases, or pests to the extent that they cannot compete for nutrients, water, or light with weed species; where the desired plantings are not as well-adapted to their environment as are native or exotic weed species; and where the growth of the desired plants modifies their local environment so that natural ecologic succession to weed species occurs (in the absence of control).

Buildings, ruins, and other artificial sites can be considered disturbed environments, which will become populated by pioneer plant species if there is no intervention. Weeds can become established anywhere that a suitable substrate and water are found. Gutters, cracks in roofs, walls or foundations, and chinks in masonry all can provide suitable locations for germination of weed seeds. Woody plants can take root in soil pockets or deep cracks and crevices.

MONITORING AND THRESHOLDS FOR WEEDS AT DEVELOPED AND HISTORIC SITES

Regular monitoring for weeds is an essential part of a weed integrated pest management program. Weeds are most easily removed when they are small or present in low numbers; in the

case of weeds which grow into structures or walkways it is important to remove them before serious structural damage occurs. In addition to monitoring for population density, identification of the species is important. The biology of the weed will often determine when it is to be removed or the most appropriate herbicide if chemical control is necessary.

Conduct weekly inspections around buildings and in landscape beds, recording weed species observed. Some estimate of density, such as number per square foot or number along a transect, should be recorded as well. If structural damage is already occurring, this should be noted as well. This type of information will help to correctly time weed removal. It will also help to prioritize areas for weed management if resources are limited and to evaluate the success of weed removal strategies used.

Certain areas are more likely than others to have high weed populations, and these should be the emphasis of your monitoring program. For example, recent cultivation will expose previously buried weed seeds to light. Heavy pedestrian traffic can lead to bare, compacted soil, which may be likely to support weed growth.

NON-CHEMICAL WEED CONTROL IN DEVELOPED AND HISTORIC SITES

The types of intervention strategies employed for management of weeds in the areas mentioned above will depend on where the weeds are located (landscape or structural), the size of the area in which the weeds are to be managed, the biology of the weed species present, the resources available for weed management, and the weed density that can be tolerated. Minimizing the spread of existing weeds and preventing the growth of new weeds should be the focus of a weed management program. One weed plant can produce hundreds of seeds which could potentially disperse over a wide area.

The objective of the site must be considered before selecting a weed control strategy and technique, especially in the case of historic sites. Filling and sealing the chinks in a stone wall might prevent weed growth, but that option is not available if it is not historically correct. Careless use of electric weed trimmers could damage fragile historic structures. Certain herbicides are corrosive and should not be sprayed near susceptible surfaces. The cultural resources staff should be consulted before implementing weed control in historic sites.

Weeds in the Landscape

Weeds in the landscape are generally considered to be unsightly and thus have a very low aesthetic threshold. In the case of new plantings, take time before establishment to remove existing weeds. In the case of existing plantings, emphasize the use of monitoring to detect weeds while they are still small or present at low population densities.

Weeds Around Buildings and Structures

Early detection and removal of weeds around buildings and structures such as benches and fences is especially critical. Once weeds grow into foundation cracks they become unsightly,

difficult to manage and can do serious structural damage. This leads to high maintenance and repair costs. Weed growth into structures and on patios and walks can be partly prevented by proper maintenance of these structures. Filling of cracks in mortar and sidewalks so that organic debris cannot accumulate inside them will help to eliminate the entry and subsequent germination of weed seeds.

Weed Biology

Weed management must be based on a knowledge of the biology of the weed species. This is in turn dependant on correct identification of the weeds at a site. For instance, there is no point in applying a pre-emergent herbicide for crabgrass control if there is no crabgrass. It would also be fruitless to apply a pre-emergent herbicide that acts by preventing weed seed germination for control of established perennial weeds. Likewise, it could do more harm than good to cultivate a landscape bed for yellow nutsedge control in July after nutlets have formed; the cultivation will break the nutlets into small pieces and produce more weed plants. However, cultivation early in the season could remove the young plants before nutlet formation and might be an effective form of nutsedge management.

Physical Methods of Weed Management

Barriers and mulches are often used to eliminate a substrate in which weed seeds can germinate. While this is often a good, long-term solution to a weed problem, it is usually expensive to install. The elimination of the need for weed management may pay for the installation of the barrier over the long term, however.

One type of barrier would be the installation of paved walkways rather than soil, or the use of pavement or bricks under benches and around fences. This may not represent a permanent solution if cracks (and subsequent weed growth) are allowed to develop in the pavement. Depending on the site, it may be objectionable for aesthetic reasons as well.

Bare drainage ditches or pond banks can be lined with stones or desirable vegetation to help eliminate bare soil areas which are favorable for weed growth. This may not work in high-use areas where children could play with the stones, but might be a good solution to a weed problem in low-use areas of a park.

Weed mats are frequently used in landscape beds as a barrier to weed seedlings. These are made of materials which permit passage of air and water to plant roots but serve as a physical barrier so that weed seedlings cannot develop. While they are often effective, initially they are expensive to purchase and install. Also, weeds which grow through them cannot be pulled because the barrier will tear. For a complete discussion of the pros and cons of these materials, as well as a list of suppliers, see Billeaud and Zajicek (1989) and Lytton (1990).

Use of mulch in a landscaped areas is another common practice to reduce weed populations. This will not eliminate a problem, since weeds can grow through a mulch or germinate in it as it starts to decompose. A wide variety of material is available for use as mulch; the most appropriate mulch for a given situation depends on expense, effectiveness, aesthetics, availability, and types

of plants growing in the mulched area. For example, plastic sheeting can be an effective mulch but it is unsightly and may pose disposal problems. Some stones or cinders may drastically alter soil Ph, while decomposition of sawdust or non-composted bark mulches can rapidly deplete soil nitrogen. For more information on the advantages and disadvantages of different mulch materials, as well as information on specialty materials which may be locally available, contact the Cooperative Extension Service at your land grant university.

Another type of mulch to consider is a living mulch. This involves the use of a groundcover to cover the soil around larger landscape plants. Sometimes this is supplemented with the use of a fast-growing annual to fill in bare areas between groundcover plants before they become large enough to cover the soil. Care must be taken not to use an invasive groundcover which may itself become a weed.

Mechanical Weed Management

Cultivation and hand-removal of weeds will be most cost-effective in small areas, eliminating small, newly established weed plants during seasons (usually the spring and fall) when the soil is moist and weeds are most easily removed. Keep in mind that there are certain times when cultivation will do more harm than good. Cultivation of annual weeds when mature seeds are on the plants is probably not a good idea, nor is hoeing of perennial weeds that regenerate by rhizomes or tubers after these structures have formed. Regular mowing is often sufficient to control weeds over large areas. In small areas, electric weed trimmers or propane burners are often used for weed control.

Biological Control of Weeds

Biological control of weeds in rangelands and waterways has been extensively investigated and seems to have a great deal of potential. This is not so for weeds in landscape settings, however. The only weed that would be found in a landscape that is currently under investigation as a biological control candidate is Canada thistle, *Cirsium arvense.* It is doubtful whether weed densities required for a biological control agent to be effective would be tolerated in a landscape. For more information on biological control of weeds, see Grossman (1989a) and Grossman (1989b).

CHEMICAL CONTROL OF WEEDS IN DEVELOPED AND HISTORIC SITES

When selecting a herbicide for use against a weed it is essential to identify the weed species, since many herbicides are specific in the types of weeds they kill (e.g., only grasses prior to germination, only broadleaf plants, most effective against poison ivy). Some herbicides are non-selective and will kill all vegetation whose leaves they contact; others are selective but are absorbed by roots of non-target plants and may injure or kill them as well. Mulgrew (1990) is a good resource for information concerning the use of herbicides in landscape beds. You should also contact your regional Integrated Pest Management coordinator or state Cooperative Extension Service for herbicide recommendations for your area, as well as for information on new herbicide formulations, since these change frequently.

Also consider that use of a non-selective herbicide for weed control may lead to an increase in weed problems in the future. The bare ground created in this situation could serve as a site for invasion by new weed species.

REFERENCES

Literature cited

1. Billeaud, L.A. and J.M. Zajicek. 1989. Mulching for weed control. Grounds Maintenance (February), pp. 16-18+.

2. Grossman, J. 1989a. Update: biological control of weeds -- what's happening, what's needed. IPM Practitioner 11(6/7):1-11.

3. Grossman, J. 1989b. Update: biological control of weeds -- what's happening, what's needed (part 2). IPM Practitioner 11(8):1-8.

4. Lytton, P. 1990. Miraculous textile mulch: a fabric-ation?
American Horticulturist (March), pp. 8-9.

5. Mulgrew, S.M. 1990. 1990 Herbicide Guide for Controlling Weeds in Nurseries and Landscape. University of Massachusetts Cooperative Extension Service, Amherst, MA.

Weed Identification

1. Barkley, T.M. 1983. Field Guide to the Common Weeds of Kansas. University of Kansas Press, Lawrence.

2. Baldwin, F.L. and E.B. Smith. Weeds of Arkansas Lawns, Turf, Roadsides, and Recreation Areas: A guide to Identification. MP 169 of the Cooperative Extension Service of Arkansas, Little Rock, AR 72203.

3. Dennis, L.J. 1980. Gilkey's Weeds of the Northwest. Oregon State University Press, Corvallis.

4. Muenscher, W.C. 1980. Weeds. Cornell Univ. Press, Ithaca, NY.

5. Nelson, E.W. 1979. Nebraska Weeds. Nebraska Dept. of Agriculture, Lincoln.

6. Regional Technical Committee of Project NC-10. 1960. Weeds of the North Central States. University of Illinois Agric. Exp. Sta., Urbana.

7. Stucky, J.M., T.J. Monaco, and A.D. Worsham. 1983. Identifying Seedling and Mature Weeds Common in the Southeastern United States. Agriculture Res. Service. North Carolina State University, Raleigh, NC.

8. Weed Identification Guide. Southern Weed Science Soc. 309 W. Clark St., Champaign, IL, 61820.

Weed Management

1. Anderson, W.P. 1983. Weed Science: Principles. 2nd ed. West Publishing Co., St. Paul, MN.

2. Aldrich, R.J. 1984. Weed-Crop Ecology Principles in Weed Management. Breton Publishers, North Scituate, MA.

3. Bohmont, B.L. 1990. The Standard Pesticide User's Guide. Prentice-Hall, Inc., Englewood Cliffs, NJ.

4. Herbicide Handbook. 1989. Weed Science Soc. of America, 309 West Clark St., Champaign, IL, 61820.

5. Shurtleff, M.C., T.W. Fermanian, and R. Randell. 1987. Controlling Turfgrass Pests. Prentice-Hall, Inc., Englewood Cliffs, NJ.

6. Weed Control Manual and Herbicide Guide. 1991. Meister Publishing Co., Willoughby, OH. (Updated each year. Lists currently available herbicides by common and trade names.)

7. Weed Control and Plant Growth Regulation. 1989. Air Force Manual, 91-19. Headquarters of the Air Force, Environmental Directorate, Bolling AFB, Washington, D.C., 20332-5000.

APPENDIX D: Planning Environment and Public Comment website

Comments Requested for Proposed Weed Management Plan

Great Basin National Park is currently seeking issues and comments for a proposed Weed Management Plan. Your issues and comments will assist in developing alternatives to the proposed action presented below and help in conducting an environmental analysis consistent with the National Environmental Policy Act (NEPA).

The proposed action is to develop a plan that incorporates an integrated pest management approach. "The term 'integrated pest management' means a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks." *The Food, Conservation, and Energy Act of 2008.* The proposed plan intends to increase monitoring in high risk areas, promptly eliminate new invasions before they become established, prevent the spread of established invasive plants, and increase the use of education and restoration. Specific control techniques would include:

- Mechanical methods- hand-pulling, cutting, and shoveling.
- Biological methods- the use of insect predators, parasites, and pathogens.
- Chemical methods- herbicide control using backpack sprayer and cut-stump application methods.
- Cultural methods- education and preventative management practices, including restoration to increase native vegetation.

Preliminary issues developed by park staff include the effects to and impacts on: soils, water quality, wetlands, and wildlife habitat.

Information is also available on the National Park Service Planning, Environment & Public Comment (PEPC) website at: http://parkplanning.nps.gov/. This website provides access to current National Park Service plans, environmental impact analyses, and related documents on public review. Comments may be submitted through the PEPC website.

Mailed comments will also be accepted. Please submit comments no later than March 2nd, 2012, to Attn: Ben Roberts, Planning, 100 Great Basin National Park, Baker, NV, 89311. If you would like to be added to the park's NEPA mailing list, please contact Beth_Cristobal@nps.gov or call 775-234-7331 x264.

APPENDIX E: Scoping Brochure

Public Comments During Scoping

We welcome your comments about the Proposed Weed Management Plan. Your comments will help identify issues and other alternatives to evaluate in the NEPA process.

Please post your comments online at:

www.parkplanning.nps.gov/GRBA_Weeds

or
Send comments to:

Attention: Planning
Great Basin National Park
100 Great Basin National Park
Baker, NV 89311

Please provide comments by

March 15, 2012

Great Basin National Park

National Park Service
Great Basin National Park
100 Great Basin National Park
Baker, NV 89311

National Park Service
U.S. Department of the Interior

Great Basin National Park
Nevada

PUBLIC SCOPING

Proposed Weed Management Plan

Winter 2012

Background

Great Basin National Park (GRBA) proposes to update the Weed Management Plan to address non-native plants growing in the park.

The proposed Weed Management Plan would incorporate integrated pest management (IPM) techniques. This approach combines mechanical, biological, chemical, and cultural control methods. IPM is an environmentally sensitive approach to invasive plant management that relies on a combination of common-sense practices. IPM programs use comprehensive information on the life cycles of invasive plants and their interaction with the environment. Combining all available control methods to manage invasive plants by the most effective means can provide the least possible hazard to people, property, and the environment.

'Invasive plants' are defined as nonnative species whose introduction is likely to cause economic, environmental, or human harm (Federal Executive Order 13112). A shift from native vegetation to an invasive plant infestation can alter wildlife habitat, reduce species diversity, and promote undesirable monocultures over large areas. Continuing an effective invasive plant management strategy involves considering all available resources and tools. IPM options focus on determining the least harmful and most effective control of invasive plants. Techniques include removing invasive plants, preventing their spread and seed production, and promoting native plant competition.

The proposed Weed Management Plan would expand the current manual and chemical treatments (which include pulling, cutting, and using herbicides) to also include biological controls such as the use of insect predators, parasites, and pathogens. Additional cultural treatment methods would also be included, such as education, preventative management practices, and restoration.

The park currently sprays for weeds in a variety of habitats.

GRBA is currently treating invasive plants under the draft Integrated Nonnative Plant Management Plan of 2000. This updated Weed Management Plan is needed to address changing invasive plant populations, increase the use of cultural treatment techniques, and consider newly developed methods of treatment.

The park's weed program can remove nonnative thistles when they are still in the rosette stage, before they spread any seeds.

Objectives

* Remove invasive plants
* Prevent spread of invasive plants and seeds
* Promote native plant competition

Issues to Consider

* Impacts to other vegetation, including native plant communities
* Impacts to water quality and wetlands
* Visitor experience
* Impacts to soil resources
* Impacts to wildlife and their habitat

APPENDIX F: Press Release

National Park Service
U.S. Department of the Interior

100 Great Basin National Park
Baker, Nevada 89311

775-234-7331 phone
775-234-7269 fax

Great Basin National Park News Release

Release Date: Immediate

Contact: Ben Roberts

Phone Number: (775) 234-7331 extension 228

Date: February 13, 2012

Comments Requested for Proposed Weed Management Plan

Great Basin National Park is currently seeking issues and comments for a proposed Weed Management Plan. Your issues and comments will assist in developing alternatives to the proposed action presented below and help in conducting an environmental analysis consistent with the National Environmental Policy Act (NEPA).

The proposed action is to develop a plan that incorporates an integrated pest management approach. "The term 'integrated pest management' means a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks" (*The Food, Conservation, and Energy Act of 2008*). The proposed plan intends to increase monitoring in high risk areas, promptly eliminate new invasions before they become established, prevent the spread of established invasive plants, and increase the use of education and restoration. Specific control techniques would include:

- Mechanical methods- hand-pulling, cutting, and shoveling.
- Biological methods- the use of insect predators, parasites, and pathogens.
- Chemical methods- herbicide control using backpack sprayer and cut-stump application methods.
- Cultural methods- education and preventative management practices, including restoration to increase native vegetation.

Preliminary issues developed by park staff include the effects to and impacts on: soils, water quality, wetlands, and wildlife habitat.

Information is also available on the National Park Service Planning, Environment & Public Comment (PEPC) website at: http://parkplanning.nps.gov/. This website provides access to current National Park Service plans, environmental impact analyses, and related documents on public review. Comments may be submitted through the PEPC website.

Mailed comments will also be accepted. Please submit comments no later than March 15, 2012, to Attn: Ben Roberts, Planning, 100 Great Basin National Park, Baker, NV, 89311. If you would like to be added to the park's NEPA mailing list, please contact Beth_Cristobal@nps.gov or call 775-234-7331 x264.

EXPERIENCE YOUR AMERICA
The National Park Service cares for special places saved by the American people so that all may experience our heritage.

APPENDIX G: Text of MOU for the SNAKE VALLEY COOPERATIVE WEED MANAGEMENT AREA

Memorandum of Understanding

1. **Authority.** This Memorandum of Understanding is made and entered into by:
   White Pine County
   White Pine Conservation District
   Eastern Nevada Landscape Coalition
   Bureau of Land Management, Ely Field Office
   Forest Service, Humboldt-Toiyabe National Forest, Ely District
   U.S. Fish & Wildlife Service
   Nevada Division of Wildlife
   Nevada Department of Transportation
   Natural Resources Conservation Service
   University of Nevada Cooperative Extension
   Great Basin National Park
   Tri County Weed Project

   Hereinafter referred to as the principal parties or participants. Contacts are listed in **Attachment A.**

2. **Introduction.** Public, private, and tribal landowners are concerned with noxious weed infestations that presently exist, and may be introduced, in the Snake Valley CWMA. These infestations reduce the biological, agricultural, recreational, and economic value of the land, reduce native plant populations, and degrade important ecosystems. For weed management efforts to be successful, a coordinated, integrated approach to managing noxious weeds is necessary.

3. **Purpose**. The purpose of this Memorandum of Understanding (MOU) is to establish the Snake Valley CWMA and define the terms and conditions under which the participants will cooperate, coordinate activities, and share resources necessary for the prevention and control of noxious weeds within the Snake Valley CWMA.

4. **Geographic Area**. The area comprising the Snake Valley CWMA is 32,920.15 acres. **Attachment B** is an area map.

5. **Scope of Cooperative Action**. The CWMA Working Group will consist of a participant from each party named in the MOU and any private citizen or landowner, and any representative from a public, private, or non-profit agency with an interest in the Snake Valley CWMA. The group will coordinate activities within the CWMA as well as with other adjacent and overlapping CWMAs. Organizational structure will include a chairperson, a vice-chairperson, a secretary, and a financial manager.

   The working group will meet to:
   a. Develop, document, and implement a strategic plan to coordinate the integrated management of noxious weed control in the Snake Valley CWMA.

b. Create an annual work plan. The plan may include, but is not limited to: combining resources to map and inventory existing noxious weed populations; plan and implement noxious weed prevention, eradication, control and monitoring programs; determine site restoration actions; and promote public awareness and education.
c. Perform activities necessary for the implementation of CWMA projects.
d. Review financial records.
e. Preparing an annual evaluation report.

6. **Independent Responsibilities.** It is recognized that each participant has a primary responsibility to its own governing body and lands under its jurisdiction. They agree to provide resources to each other as legal authorities may permit. All signing parties are responsible and accountable for their own funds, equipment, and personnel. The MOU also in no way restricts participants from participating in similar activities with other public or private agencies, organizations, and individuals.

7. **Modification.** This MOU may be revised as necessary by mutual consent of the parties by execution of a written amendment signed and dated by all parties. Additional participants, including interested property owners, property managers, special districts, non-profit entities and members of the public may become part of the Snake Valley CWMA by execution of a Signature Page, subject to ratification by a majority of the existing participants.

8. **Termination.** Any participant may terminate their involvement in this MOU by providing written notice to all other parties.

9. **Indemnification.** Each respective party agrees to indemnify and hold harmless the other party to the extent provided by law, including but not limited to, NRS chapter 41, from and against any arbitration arising out of the performance of the MOU proximately caused by an act or omission of its officers, agents, and employees.

10. **Non-Fund Obligating Document.** This MOU is neither a fiscal nor a funds obligation document. Any endeavor involving reimbursement or contribution of funds among the parties to this instrument will be handled in accordance with applicable laws, regulations, and procedures including those for government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority.

11. **Access to Records.** Any participant or their authorized representative has access to and the right to examine all documents and records related to the Snake Valley CWMA.

12. **Effective Date.** This MOU shall be effective upon execution of a Signature Page by a minimum of two (2) PARTIES. This MOU shall remain in effect as long as a minimum of two (2) parties is participating. This MOU may be executed in one or more counterparts, each of which shall be deemed an original.

IN WITNESS WHEREOF, the parties hereto have executed this MOU on the attached Signature Page as of the date when the second party has signed the Signature page.