Updated 12-01-2012

National Park Service

U.S. Department of the Interior

Midwest Region

Draft for Consultation Purposes
Heartland Invasive Plant Management Plan

And Environmental Assessment

Natural Resource Data Series NPS/MWR/HTLN/NRDS—2012/XXX

ON THE COVER

Prairie and oak forest at Fire Point, Effigy Mounds National Memorial, Iowa.

Photograph by: Ken Block, NPS

Heartland Invasive Plant Management Plan

And Environmental Assessment

Natural Resource Data Series NPS/MWR/HTLN/NRDS—2012/XXX

Sherry A. Middlemis-Brown
National Park Service
The Heartland I&M Network
Wilson's Creek National Battlefield
6424 West Farm Road 182,
Republic, MO 65738

Craig C. Young
National Park Service
The Heartland I&M Network
Wilson's Creek National Battlefield
6424 West Farm Road 182,
Republic, MO 65738

DRAFT

The National Park Service publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Technical Report series is used to disseminate the peer-reviewed results of scientific studies in the physical, biological, and social sciences for both the advancement of science and the achievement of the National Park Service's mission. Examples of such reports include the results of research that addresses natural resource management issues; natural resource inventory and monitoring activities; resource assessment reports; scientific literature reviews; and peer reviewed proceedings of technical workshops, conferences, or symposia. This use of the Natural Resource Technical Report series for the publication is a method of disseminating the findings of an Environmental Assessment of impacts of proposed actions on natural and cultural resources to a broad audience.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. Information and impact analysis in this report were collected and analyzed using methods based on established procedures and reviewed by subject matter experts for accuracy and thoroughness.

Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

Printed copies of reports in these series may be produced in a limited quantity and they are only available as long as the supply lasts. This report is also available from the Heartland I&M Network website (http://www.nature.nps.gov/im/units/HTLN) on the internet, or by sending a request to the address on the back cover.

Please cite this publication as:

Middlemis-Brown, S.A. and C. C. Young. 2012. Heartland Invasive Plant Management Plan and Environmental Assessment. Natural Resource Data Series NPS/MWR/HTLN/NRDS—2012/XXX. National Park Service, Philadelphia, Pennsylvania.

Contents Page

List of Tables

Figures

1

Purpose and Need

This chapter describes the scope of, purpose of, and need for this project. It also discusses the goals and objectives for the program being proposed. A summary of the invasive plant management history of each park and associated invasive plant management issues are also provided. The goal of this project is to establish a plan to manage invasive plants within the 15 Heartland Inventory and Monitoring Network parks of the National Park Service. This Exotic Plant Management Plan and Environmental Assessment develops a cooperative, multi-park program for addressing invasive plant management actions to reduce negative effects on native plant communities and other natural and cultural resources within these parks.

"Exotic species are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as nonnative, alien, or invasive species. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place." (NPS 2006d, page 43, 4.4.1.3)

1.0 Project Background and History

The Network submitted a proposal to establish an EPMT in 2006, but NPS did not fund it. Parks continued invasive plant management individually, when money was available between 2006 and 2010. Some parks included management of these species in a fire management plan (FMP) or other implementation plans, but others had only high-tier planning documents that called for control of invasive species. These high-tier planning documents generally lack implementation details or strategies needed to execute invasive plant control. The National Environmental Policy Act of 1969 (NEPA) compliance may require completion of an Environmental Assessment (EA) for program management plans or resource implementation plans requiring management action. The NPS allows the use of Categorical Exclusions (CE) for invasive plant management actions that are consistent with plans that underwent NEPA process, as stated in its Director's Order 12 Handbook: NEPA Policy Manual Interim Guidance (NPS 2009: 39), for

> "*Restoration of noncontroversial native species into suitable habitats within their historic range and elimination of exotic species*" (Section 3.4.E.2,).

and for

> "*Removal of park resident individuals of non-threatened/endangered species which pose a danger to visitors, threaten park resources or become a nuisance. . .*" (Section 3.4.E.3).

A CE might limit the scope of treatment, thus preventing a long-term solution to invasive species, when a safe and reasonable solution is feasible. It also may hamper early detection and immediate response for eradication of small infestations of invasive plants that pose no immediate, direct threat to park resources, but would threaten resources in the future if not treated immediately. Under a CE, those species could not be treated until they actually pose the threat to resources. This approach is contrary to best management practices for invasive plant control – early detection and action (McCrea and DiSalvo 2001). Additionally, some proposed treatments may require mitigation for their use, excluding them from use under a CE. This EA may broaden the set of tools available in invasive plant management within the parks. It also taps expertise of botanists with experience in this field to augment the knowledge base at the parks.

The current funding for an EPMT began in 2010 with base funding increase to one park that was allocated specifically for the multi-park EPMT. On-ground actions have been implemented since 2010 with EPMT assistance under compliance completed by individual parks. Assistance by the EPMT is not considered part of the status-quo, but rather an interim measure until completion of a final EPMP/EA and development of a program.

This EPMP/EA will assess the use of various treatments to achieve the most effective programmatic invasive plant management possible. The programmatic approach satisfies the recommendation of the DO-12 Handbook (NPS 2001b) Section 3.6 (h) on page 43:

> *"If you will be taking many actions throughout the years that have very little or no potential for environmental impact and would qualify as a CE, it may be a better and more efficient approach to address them programmatically (see sections 3.9 and 7.5 of this handbook). "*

It also combines efforts in a cost effective way, such that one plan and assessment of impacts may be done for the entire program, followed by one strategy implemented across multiple parks.

The EPMT and programmatic plan would provide parks with consistent and continuous management of invasive plants. Actions would be taken throughout the years that probably have little or no potential for environmental impact, but thorough assessment can be made with an EA to ensure that the understanding of environmental impacts is correct and that no cumulative impacts may occur with repeated action over time or with other park actions.

1.1 Project Goals

The overriding goal of this project is to establish an invasive exotic plant management plan to guide actions of a program to control invasive plants within the 15 Heartland Inventory and Monitoring Network (Network) parks of the National Park Service (NPS). The 15 Network member parks (parks) extend across eight states and include a diversity of terrestrial and aquatic ecosystems associated with eastern deciduous forests, the Mississippi floodplain, interior highlands, and tallgrass prairies. Table 1.1.0 provides park names, abbreviated names (park codes), associated state locations, and acreages. A glossary of terms and abbreviations used in this document is included in Appendix A.

Table 1.1.0. Network units with their park codes, location by state, and size

Park	Code	State	Size (acres)
Arkansas Post National Memorial	ARPO	Arkansas	758
Buffalo National River	BUFF	Arkansas	94,293
Cuyahoga Valley National Park	CUVA	Ohio	32,861
Effigy Mounds National Monument	EFMO	Iowa	2,526
George Washington Carver National Monument	GWCA	Missouri	240
Lincoln Boyhood National Memorial	LIBO	Indiana	200
Herbert Hoover National Historic Site	HEHO	Iowa	187
Homestead National Monument of America	HOME	Nebraska	211
Hopewell Culture National Historic Park	HOCU	Ohio	1,170
Hot Springs National Park	HOSP	Arkansas	5,550
Pipestone National Monument	PIPE	Minnesota	301
Ozark National Scenic Riverways	OZAR	Missouri	80,785
Pea Ridge National Military Park	PERI	Arkansas	4,300
Tallgrass Prairie National Preserve	TAPR	Kansas	10,894
Wilson's Creek National Battlefield	WICR	Missouri	1,750

Within this proposed plan, the parks would work cooperatively to address invasive plant management issues in all 15 parks, sharing personnel and equipment. The program would require the allocation of resources for monitoring and treatment of target species to contain, control, or eradicate infestations that threaten critical resources (i.e. threatened species, restoration areas, significant cultural landscapes). The goal of an invasive plant management program is to best use the resources at hand to manage invasive plants in a manner that is:

- Focused on the management of invasive plants.
- Strategically planned with formal and well-justified decision-making pathways.
- Sustainable over the long-term with measurable results achieved that are proportionate and appropriate to the effort going into the actions.

1.2 Project Objectives

Exotic plants are species that occur outside of their native ranges because of direct or indirect human actions. Invasive plants replace native plant communities, degrade wildlife habitats, and reduce the biological diversity of ecosystems. A list of exotic plants designated by the parks and Network as high priority invasive plants is presented in Appendix B. These plants will be referred to as invasive plants throughout this document. Invasive plants may include native plants that are disrupting resources on site or fit some other criteria of "pest" species as discussed in the NPS Management Policies 2006 (NPS 2006d).

This Exotic Plant Management Plan and Environmental Assessment (EPMP/EA) develops a cooperative, multi-park program for addressing invasive plant management actions to reduce their negative effects on native plant communities and other natural and cultural resources within the parks. Currently, the parks complete individual projects addressing invasive plant management with project funding or base funding. Often invasive plant management has been part of large vegetation management plans that are unique to each park.

This proposed programmatic approach to invasive plant management uses an Exotic Plant Management Team (EPMT) type of action-plan to provide invasive plant management, effective monitoring, and centralized data management. The program would target species and locations where success is most feasible and critical resources are most threatened.

The program objectives are to:

- Attain / maintain desired conditions.
- Restore sustainable communities with a sustainable program.
- Prevent unacceptable threat to resources and support early detection and treatment.
- Ensure planning and compliance.
- Use best management practices.

1.3 Scope of EPMP/EA

During the vital signs selection process in 2003, parks recognized the need for invasive plant monitoring. Nine parks (CUVA, EFMO, GWCA, HEHO, HOCU, HOME, LIBO, OZAR, PERI) identified invasive plants as their most important management issue, two parks (TAPR, WICR) identified invasive plants as their second most important management issue, and PIPE identified invasive plants as its third most important management issue. During this process, invasive plant monitoring was recognized across all parks as the most important shared need.

A long-term, strategic approach is paramount to effective execution of invasive plant management across 15 parks comprising over 235,000 acres in eight states. Because of the diversity within the project area, a general programmatic plan would provide resource managers with multiple treatment options that fit specific needs. More importantly, it would establish a procedure for treatment selection. In consultation with the EPMT, resource managers could select the most appropriate treatment option or combination of treatments using the selection procedure to minimize potential impacts and maximize overall management success.

Several characteristics of a successful invasive plant management program include:

- **Cooperative efforts.** The program would provide information to park managers on inter-park and inter-organizational cooperative approaches to invasive plant management. It would provide a strategic collaboration in planning and implementing field actions that are in accord with this EPMP/EA. Despite this collaboration, any planning compliance for actions that extend beyond the scope of this EPMP/EA would be the responsibility of the park.
- **Training.** The program would provide training to park staff in order to increase the capacity of parks to manage invasive plants.
- **Staging**. The customary EPMT consists of a group of trained technicians that undertake treatment at all member parks. This is not a feasible approach for 15 parks in eight states. This Network program would assist parks in gaining access to human resources and equipment for invasive plant management activities, including providing field assistance and monitoring. Actions in the field may consist of those initiated and led by the parks, those led by the EPMT staff, and those that are combined efforts.
- **Prevention, Early Detection, and Rapid Response.** While difficult to implement, prevention is intended to reduce the need to control invasive plants. The Network monitors each park at least once every five years. Park staff remains vigilant, looking for new infestations. Following detection, the EPMT could develop strategies and commit resources to eradicate an invasion with little additional compliance, if the situation fits the programmatic EPMP/EA conditions.
- **Management of Established Invasions.** While prevention and early detection are preferred strategies, invasive plants have become established in all Network parks. The EPMT coordinator would work with park managers to focus efforts on the most critical resource threats and on invasions that can be realistically addressed.
- **Adaptive Management.** The program would oversee collection of information needed to evaluate program effectiveness. A good database that supports short-term and long-term assessment of treatment effectiveness ensures sustainability of management and long-range planning.

This plan covers types of treatments allowed to manage invasive plants within the Park boundaries on both NPS fee-simple and in some cases non-NPS owned lands. Park boundaries are boundaries that have been legislated by Congress, but may include land not owned or not managed by NPS. No invasive plant management activities will be led by the NPS in areas located outside of park boundaries under this EPMP/EA, but cooperation with partners and neighboring land managers will be encouraged. This EPMP/EA includes consideration of lands outside of NPS management control or ownership, but within park boundaries. Any invasive plant management activities that occur within park boundaries on lands not owned by NPS and that involve NPS resources (funding or staff) will be conducted in full cooperation and agreement with landowners. Invasive plant management activities within park boundaries on lands not owned by NPS and that do not use NPS resources, or are conducted by other entities (such as park commissions or counties) are not covered under the EPMP/EA. In summary, management activities must occur within park boundaries and must involve NPS resources to be within the scope of the EPMP/EA.

Proposed alternatives were developed using an Integrated Pest Management (IPM) conceptual approach. Integrated Pest Management is a decision-making process that coordinates knowledge

of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage, using cost-effective means, while posing the least possible risk to people, resources, and the environment. Natural history for each invasive plant is evaluated before developing management strategies. The alternatives call for differences in strategic approach to treatment and tool selection, and differences in treatments allowed.

This plan considers all treatment method-types that are currently being implemented by the parks, or that may be used in the future. Proposed treatments include:

- **Cultural Methods.** These practices promote growth of desirable plants and reduce opportunities for invasive plant growth. Examples include seeding of native plant species to enhance interspecies competition, and using visitor education to reduce transfer of invasive species' seeds. Cultural methods may be coupled with other treatments, such as seeding of native plant species, which may require a mechanical seeder to complete.
- **Manual/Mechanical Treatments.** These practices cause physical damage to or removal of part or all of the target plant. Examples include hand pulling, cutting, grubbing, haying, and mowing. It may also include strategic timing of the removal of reproductive potential for the plant. Various tools are included in this treatment, such as cutters, chainsaws, weed-whips, and shovels. Heavy equipment may be included in this treatment, such as disk harrows or hydro-axes. Manual or mechanical treatments may be used for restoration purposes as well, such as seeding of native plant species, using a seed drill or by manually broadcasting.
- **Biological Treatments.** Biological control or biocontrol employs natural enemies, such as insects and microorganisms, to reduce invasive species abundance or prevent reproduction. Natural enemies are imported purposefully and are released into areas where the plant is invasive. Biocontrols are not currently used in parks.
- **Chemical Treatments.** This practice uses pesticides as prescribed by their labels. Examples of application methods include, but are not limited to, portable sprayers, utility vehicles (UTVs) or tractors equipped with sprayers, and wicking or hand painting herbicide.
- **Prescribed Fire Treatments.** This practice applies fire to reduce the growth of invasive plants and to increase the growth of desirable, fire-dependent species.

During internal scoping, it was determined that the EPMP/EA should not be so specific or complicated that it could not adapt with the need to change management techniques. The EPMP/EA will require annual review to ensure that conditions and issues are the same as those assessed. The document also should not be so restrictive that it prevents site-specific invasive plant management actions from being implemented on a case-by-case basis. In general, it was agreed during scoping that the plan should:

- Include common treatment methods recently or currently used at each park, as well as any methods that could be used during the life of this plan (5 years).
- Account for any activities, such as variable application methods within legal guidelines, associated with each treatment type.
- Be flexible to allow for treatment of additional invasive plant species in the future, including invasive plant species that currently are not currently managed.
- Mitigate potential impacts to resources.

- Be both integrated and adaptive.
- Be definitive enough to address site-specific issues at each park.
- Be general enough to avoid unnecessary restrictions.
- Be flexible enough to allow for future needs not currently recognized by resource managers.

Each park would have the option to develop more detailed and park-specific implementation plans for treatments. Park-specific plans that include treatments and associated potential impacts considered in this EPMP/EA could minimize further compliance documentation if their actions would not pose cumulative impacts. Park-specific plans taking actions or having associated impacts not covered in this EPMP/EA would require additional NEPA compliance in the form of a new EA or Environmental Impact Statement (EIS), or possibly a Memo to File that tiers off this EA.

Only plants defined as invasive "exotic plants" or "native pests" in accordance with NPS policies (NPS 2006d) will be targeted under the EPMP/EA. For this project, exotic plants are defined as:

> *"Exotic species are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as nonnative, alien, or invasive species. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place."* (NPS 2006d, Section 4.4.1.3: page 43).

Under NPS policies (NPS 2006d, page 48, Section 4.4.4.2), an exotic plant must also meet several criteria to warrant control measures:

> *"All exotic plant and animal species that are not maintained to meet an identified park purpose will be managed - up to and including eradication - if (1) control is prudent and feasible and (2) the exotic species:*

- interferes with natural processes and the perpetuation of natural features, native species or natural habitats; or
- disrupts the genetic integrity of native species; or
- disrupts the accurate presentation of a cultural landscape; or
- damages cultural resources; or
- significantly hampers the management of a park or adjacent lands; or
- poses a public health threat as advised by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Program); or
- creates a hazard to public safety."

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

Native plants are defined as those species that "*have occurred or now occur as a result of natural processes on lands designated as units of the national park system*" (NPS 2006d, Section 4.4.1.3: page 43). On occasion, species that are native to a region may not be naturally occurring on a particular site, but are the result of human disturbance and have not evolved in concert with the species native to that site. These species will be treated as invasive native plant species, a

type of pest species that is not a natural component of the ecosystem at that place or in current numbers or density. A native pest species may also be a species that interferes with management objectives of a specific site or that jeopardizes human health or safety. Authority for treatment of these species comes from NPS policy (NPS 2006d, Section 4.4.4.2, page 48).

> *"The Service may control native pests to*
> - *conserve threatened, rare, or endangered species, or unique specimens or communities;*
> - *preserve, maintain, or restore the historical integrity of cultural resources;*
> - *conserve and protect plants, animals, and facilities in developed areas;*
> - *prevent outbreaks of a pest from invading uninfested areas outside the park;*
> - *manage a human health hazard when advised to do so by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS public health program); or*
> - *to otherwise protect against a significant threat to human safety."*

Native pest plants and invasive exotic plants fitting these criteria will be referred to as **invasive species** or **invasive plants** within this document. Park-specific management priorities will be assigned to each invasive species. In accordance with NPS policy (NPS 2006d, page 48, Section 4.4.4.2), relative management priorities will be determined as follows:

> *"Higher priority will be given to managing exotic species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled. Lower priority will be given to exotic species that have almost no impact on park resources or that probably cannot be successfully controlled. Where an exotic species cannot be successfully eliminated, managers will seek to contain the exotic species to prevent further spread or resource damage."*

1.4 Purpose for Taking Action

Under Director's Order 12 (DO-12), "purpose" is defined as a statement of goals and objectives that the NPS intends to fulfill by taking action (NPS 2001a). Under this definition, the purposes of this project are to

- Focus on the management of invasive plants.
- Plan strategic management with formal and well-justified decision-making paths.
- Create a program that is sustainable over the long-term with measurable results achieved that are proportionate and appropriate to the effort going into the actions.

This would be done through achieving the objectives of the program:

- Attain or maintain desired conditions for landscapes; support approved park treatment plans.
- Restore sustainable native plant communities, where appropriate, to reduce the need for ongoing invasive plant treatment, contributing to a sustainable program.
- Prevent unacceptable levels of invasive plant cover and threat, using environmentally sound, cost-effective management strategies that pose the least possible risk to people, park resources, and the environment, and support early detection and treatment.

- Develop a sustainable invasive plant management plan and compliance documentation that provides the necessary environmental assessment for invasive plant management strategies at the parks.
- Use best management practices.

A program level approach to invasive plant management should strengthen efforts of the parks by combining forces to achieve an economy of scale and a cooperative approach. The program would encourage efforts to leverage available funds and work with local partners, neighboring landowners, and volunteers under this EPMP/EA or other vegetation management plans that supersede or complement this plan.

1.5 Need for Taking Action

Under DO-12, "need" is an existing condition that should be changed, problems that should be remedied, decisions that should be made, and policies or mandates that should be executed.

1.5.1 Existing Conditions that Should be Changed

Invasive plants currently threaten natural and cultural resources, including cultural landscapes, within the parks. Invasive plants threaten the following park resources:

Federally threatened plants: Plants designated by U.S. Fish and Wildlife Service (USFWS) as threatened in the United States.

- Pipestone National Monument (western prairie fringed orchid [*Platanthera praeclara*])
- Wilson's Creek National Battlefield (Missouri bladderpod [*Lesquerella filiformis*])

State endangered, threatened, or otherwise protected plants: Over 70 species are listed as rare in their respective states.

Globally rare plant communities: Natureserve designated these as globally rare.

- Homestead National Monument of America (mesic bur oak [*Quercus macrocarpa*] forest, G4[1])
- Pipestone National Monument (Sioux quartzite outcrop prairie, G1)
- Wilson's Creek National Battlefield (limestone glade, G2)

Cultural landscapes: Cultural landscapes provide context for historical and cultural interpretation in parks. Invasive species threaten the integrity of cultural landscape in the following parks (acreage threatened by invasive plant species appears in parentheses).

- Arkansas Post National Memorial (360 acres)
- Effigy Mounds National Monument (100 acres)
- George Washington Carver National Monument (100 acres)

[1] status is taken from NatureServe Conservation Status Ranks, http://www.natureserve.org/explorer/ ranking.htm#interpret (9-13-2010): The status number (1 = critically imperiled; 2 = imperiled; 3 = vulnerable; 4 = apparently secure; 5 = secure) is preceded by a letter for geographic scale assessment (G = Global, N = National, and S = Subnational).

- Herbert Hoover National Historic Site (84 acres)
- Hopewell Culture National Historic Site (400 acres)
- Homestead National Monument of America (162 acres)
- Hot Springs National Park (7 acres)
- Lincoln Boyhood Home National Memorial (160 acres)
- Ozark National Scenic Riverways (200 acres)
- Pea Ridge National Military Park (3000 acres)
- Pipestone National Monument (100 acres)
- Wilson's Creek National Battlefield (250 acres)

Rare habitat / restored habitat / natural areas: Many of these are uncommon or declining within their range, usually due to human activities. For example, tallgrass prairie parks represent some of the few remaining remnants or restorations of a once large ecosystem. Natural areas are located at

- Arkansas Post National Memorial (deciduous bottomland)
- Buffalo National River (glades, canebrakes, oak-hickory forests)
- Effigy Mounds National Monument (oak-hickory forest, tallgrass prairie, goat prairie, talus slopes)
- George Washington Carver National Monument (tallgrass prairie, woodlands, riparian)
- Herbert Hoover National Historic Site (tallgrass prairie, woodlands, stream riparian area)
- Hopewell Culture National Historic Site (mixed mesophytic forest)
- Homestead National Monument of America (tallgrass prairie)
- Hot Springs National Park (old growth shortleaf pine, oak-hickory forests, tufa cliff, novaculite outcrops)
- Lincoln Boyhood Home National Memorial (old-growth oaks)
- Ozark National Scenic Riverways (glades, canebrakes, oak-hickory forests)
- Pea Ridge National Military Park (oak-hickory forests)
- Pipestone National Monument (tallgrass prairie, Sioux quartzite wetlands, riparian forests)
- Wilson's Creek National Battlefield (tallgrass prairie, oak-hickory forests).

1.5.2 Problems to be Remedied and Decisions to be Made

An EPMP/EA is needed to achieve compliance with NEPA for future invasive plant management projects. Resource managers need access to scientifically based techniques and strategies that have been vetted through an environmental assessment process. Managers focus on restoring plant communities that support cultural landscapes, achieve desired resource conditions, and preserve resources mandated by NPS policy. By standardizing invasive plant management, these goals can be effectively achieved, using best management practices. A standardized decision-making process enhances public engagement in and communication of management decisions.

1.5.3 Policies and Mandates that Should be Implemented

Executive Order 13112 requires that federal agencies prevent the introduction of invasive species and provide for their control. NPS Management Policies 2006 states in section 4.4.1.1, page 43 that NPS will,

> *" . . . prevent the introduction of exotic species into units of the national park system, and remove, when possible, or otherwise contain individuals or populations of these species that have already become established in parks."*

Invasive plants control is integral to achieving NPS policies, when invasive plants threaten native plant and animal restoration, threatened or endangered plants and animals, and natural landscapes (NPS 2006d, Section 4.4.2.2 through 4.4.2.4).

1.6 Invasive Plant Management at Each Park

The following sections provide a brief history and description of purpose for each park, followed by a summary of invasive plant management at the parks. Figure 1.6.0 shows the location of each park within the Network area. Table 1.6.0 provides a listing of functional ecoregions, as recognized by the Network, and the parks associated with those ecological groupings. A summary of common and scientific names of invasive species, as taken from U.S. Department of Agricultural, Natural Resources Conservation Service, Plants Database, http://plants.usda.gov/[2], including a summary of current invasive plant management actions at each park appears in Appendix B. Additional species may become management priorities in the future.

Figure 1.6.0 Heartland Network exotic plant management parks

Table 1.6.0. Ecological grouping of parks.

Ecological Group	Park
Eastern Deciduous Forest Parks	Cuyahoga Valley National Park
	Effigy Mounds National Monument
	Hopewell Culture National Historic Park
	Lincoln Boyhood National Memorial
Mississippi Embayment Park	Arkansas Post National Memorial
Ouachita Mountain Park	Hot Springs National Park
Ozark Highland Parks	Buffalo National River
	Ozark National Scenic Riverways
Ozark Plateau Parks	George Washington Carver National Monument
	Pea Ridge National Military Park
	Wilson's Creek National Battlefield
Tallgrass Prairie Parks	Herbert Hoover National Historic Site
	Homestead National Monument of America
	Pipestone National Monument
	Tallgrass Prairie National Preserve

1.6.1 Eastern Deciduous Forest Parks

Cuyahoga Valley National Park

More than 1,200 plant species have been documented at CUVA with nearly 20 percent of those species being non-native to the area; approximately 50 of those non-native species are considered to be locally invasive and are able to over-run native habitats, displace native species, and form large monocultures that provide limited habitat value to native wildlife (Djuren and Young 2007). The eleven most common exotic, invasive plants at CUVA (in descending order) are multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolata*), reed canarygrass (*Phalaris arundinacea*), black locust (*Robinia pseudoacacia*), Japanese knotweed (*Polygonum cuspidatum*), privet (*Ligustrum* spp.), Japanese barberry (*Berberis thunbergii*), common reed (*Phragmites australis*), glossy buckthorn (*Frangula alnus*), Kentucky bluegrass (*Poa proatensis*), and autumn olive (*Elaeagnus umbellat*a) (Djuren and Young 2007). All of these species are distributed throughout the park and frequently exhibit broad environmental tolerances that enable them to inhabit upland and bottomland forests, as well as old fields and scrub. Some exotic plants dominate wetland and riparian areas (e.g., reed canarygrass, Japanese knotweed, and common reed), while others occupy drier uplands (e.g., black locust and autumn olive).

Effigy Mounds National Monument

A relatively small number of plants pose wide-scale resource management challenges. Active invasive plant management began in 1993; however, significant personnel resources have been allocated only since 2008. Park biological technicians work to control invasive plant species such as garlic mustard, Chinese bushclover (*Lespedeza cuneata*), common buckthorn (*Rhamnus cathartica)*, Japanese barberry, and bush honeysuckles (*Lonicera* spp.) using spot herbicide, spot burning, cut stump herbicide treatments, or hand pulling, depending on season and need. Low-priority invasive plants may be opportunistically treated when encountered.

Hopewell Cultural National Historical Park

In recent years, the park has controlled invasive species, particularly in the restored successional fields and along forested public trails. Major species targeted include Canada thistle (*Cirsium arvense*), Johnsongrass (*Sorghum halepense*), garlic mustard, bush honeysuckles, and exotic olives (*Elaeagnus* spp.*).*

Lincoln Boyhood National Memorial

A comprehensive invasive plant treatment program has not been established for the park.

1.6.2 Mississippi Embayment Park

Arkansas Post National Memorial

The locations of 20 invasive plant taxa were found during 2006 surveys. Six invasive species have been managed in the Memorial Unit. Seasonal workers have used a cut stump herbicide application to treat Trifoliate orange (*Poncirus trifoliata*), Chinese privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*). Mimosa (*Albizia julibrissin*), black locust, and common water hyacinth (*Eichhornia crassipes*) have been mechanically treated by cutting or pulling. All treatments since 2006 have been mapped in ArcGIS. No treatment has occurred in the Osotouy Unit.

1.6.3 Ouachita Mountain Park

Hot Springs National Park

The park began a limited control program of mechanical removal of invasive species with some chemical treatment in 2005. Work was accomplished with summer seasonal labor. The target areas were all old home sites that had become overrun with Mimosa, tree of heaven (*Ailanthus altissima*), and several varieties of privet, ivy (*Hedera* sp.), bush honeysuckles, and wisteria (*Wisteria* sp.). The park has controlled kudzu (*Pueraria montana* var. lobata) in disturbed areas with cut-stump herbicide application, but follow-up treatments are required because of kudzu's ability to establish quickly in disturbed areas. During that same period, prescribed fire was introduced for the first time.

1.6.4 Ozark Highland Parks

Buffalo National River

The current invasive plant program is largely limited to open fields, which are managed for hay or as grazing areas for elk (*Cervus elaphus*).

Ozark National Scenic Riverways

To date an invasive plant management program has not been established for the park and all treatments have been conducted on a case-by-case basis. Current control of invasive plants is largely limited to the park's cultural field openings, which are managed for hay. In 2004, the park received funding and coordinated with the Missouri Department of Conservation in converting approximately 100 acres of early succession fields to native warm season grass community. In

2009, a small volunteer group of students helped pull garlic mustard along a 1/2 mile walking trail. Surveys by the EPMT in 2009 documented seven invasive plant species in the Big Spring Pines Natural Area, Chubb Hollow, Long Bay Field, and Long Bay, where treatments have not been initiated.

1.6.5 Ozark Plateau Parks

George Washington Carver National Monument

The locations of 26 invasive plant taxa were found in restored prairies and in forests at the monument. Seasonal workers have treated invasive plants with herbicide, particularly Chinese bushclover, winged sumac (*Rhus copallina*), Johnsongrass, crown vetch (*Coronilla varia*), and wintercreeper (*Euonymus fortunei*) in the prairies, hand pulled musk thistle (*Carduus nutans*) and sweetclover (*Melilotus officinalis*) in the prairie, and hand-pulled Japanese honeysuckle in the forests. Annual mowing helps to control Johnsongrass and invasive woody plants, such as winged sumac.

Pea Ridge National Military Park

Some control of invasive plants has been accomplished through application of pesticide and brush hogging. Monitoring has been done by collecting GPS data associated with all removal projects and transferring data to a geodatabase.

Wilson's Creek National Battlefield

Most invasive species control has fallen under the authority of the fire management plan and EA (see Appendix I of WICR's FMP 2004; NPS 2004d). Prescriptions cover distinct areas of the park and call for specific treatments. The areas have differing invasive plant issues with heavy invasions of native woody plants and of exotic species, including eastern red cedar (*Juniperus virginiana*), honey locust (*Gleditsia tricanthos*), smooth brome (*Bromus inermis*), and Chinese bushclover. Spot treatment with pesticides is used in areas of recent exotic invasion where success is probable. Mechanical treatment is used in areas of wide exotic dispersal. Trees are removed with a hydro-ax or brush hog followed by burning and pesticide spot treatment of re-sprouts. Control actions occur each year.

1.6.6 Tallgrass Prairie Parks

Herbert Hoover National Historic Site

Prescribed fire served as the primary control for invasive species during much of the 40 years since prairie reconstruction. A major effort was made in the late 1980s to eradicate Canada thistle. Little targeted invasive plant control was undertaken again until 2005, when park finances and project money permitted undertaking of projects intended to rehabilitate areas of the prairie inundated with invasive plants, using manual, mechanical, and chemical treatment followed by restoration in accordance with a prairie management plan. The park mapped treatments completed after 2005 as geospatial data.

Homestead National Monument of America

Various methods of control, including chemical (pesticide), mechanical, and prescribed fire, have been used to treat invasive and native woody plant species. Monitoring, using geospatial data associated with all removal projects, has led to a geospatial database on plant treatment.

Pipestone National Monument

The park has had a robust program in place for invasive species treatment that incorporates an IPM program. Monitoring has included the collection of spatial data associated with all removal projects and the transfer of data into a geodatabase.

Tallgrass National Preserve

Some control of invasive plants has been accomplished through prescribed fire, pesticide application, and mechanical methods. Monitoring and treatment has targeted Chinese bushclover, Johnsongrass, and the Old World bluestems (*Andropogon bladhii* and *A. ischaemum*). Large-scale prairie restoration efforts have taken place in smooth brome hayfields. Patch burn grazing has been applied to manage tallgrass prairie rangeland.

1.7 Impact Issues and Topics

In all planning and strategy development, the NPS seeks input from its stakeholders. The EA process allows opportunities for public dialogue about NPS management issues and strengthens ties with stakeholders. By engaging people with traditional, cultural, or ethnic ties to NPS lands, and other partners and stakeholders, the NPS broadens its perspective on stewardship of public trust resources. Public involvement exemplifies the NPS desire to conduct the management of public resources in an open and inclusive manner. Each park determined the best civic engagement activities to accomplish external scoping and advertise the public comment period.

The Planning, Environment and Public Comment[3] software (PEPC) provides the location for internal and external documents related to civic engagement. Parks and the EPMT published documents for public communication and meetings, using the tools available in PEPC, for this project, PEPC # 31771. The completed NEPA compliance forms, originally produced in PEPC, are available in Appendix C.

A list of the individuals and organizations contacted in conjunction with preparation and review of this EA and a summary of external scoping activities accomplished in each park appear in Appendix E. Records of civic engagement and consultation have been kept by the EPMT and originals of park specific communications are located at each park. Results of public comment were analyzed by the EPMT and included in the final EA with a summary in Chapter 5 and more detailed results in Appendix E.

[3] External access: http://parkplanning.nps.gov/ ; NPS internal access: https://pepc.nps.gov/userHome.cfm

1.7.1 Scoping Issues

Impact issues were solicited from the Interdisciplinary Team developing this EPMP/EA, experts in invasive species management, park staff, cultural resource experts, agencies, stakeholders, and the public. These issues are concerns about threats to resources and the human environment that could result from invasive plant treatment. Internal and external records are provided in Appendix E. In summary, the following impact issues were identified:

- Damage to cultural resources such as artifacts, structures, and historic fabrics.
- Degradation of water quality.
- Unknown effects on soil properties.
- Impacts on visitor health and quality of experience.
- Impacts on wilderness.
- Unintentional damage due to "footprint" of workers in field.
- Degradation of air quality.
- Secondary infestations of invasive plants after initial control.
- Negative impacts on threatened or endangered species.
- Degradation of cultural landscapes (aesthetics, historicity).
- Degradation of wetlands (as defined in Clean Water Act).
- Movement of pesticides in karst landscapes.
- Fate of pesticide, esp. in areas with ground water near soil surface.
- Fate of pesticide within soil column.
- Degradation of traditional cultural property.
- Degradation of cave habitats and cave biota.
- Risks to workers exposed to pesticide.
- Potential for drift on to private lands.
- Degradation of wildlife habitat and impacts to wildlife.
- Direct exposure of wildlife to toxic substances.
- Impacts with other agencies and their land use plans.
- Is there an extensive enough knowledge base?
- Potential for impact to water resources.

Elimination of impact issues is acceptable (1) if the issue does not appear relevant to the proposed alternatives, (2) if the issue has no or relatively small impacts in comparison with other impact topics, or (3) if best practices and mitigations will make impacts minor or negligible. The issues and reasons for elimination are summarized below:

- Aggressive action is needed to accomplish invasive management.

  In accordance with the NPS Management Policies 2006, IPM will determine the initiation of and type of treatment appropriate for invasive plant management. Aggressive action is a level of response and not a characteristic of an alternative. Therefore, setting an objective of "aggressive" action will not be considered in the analysis.

- "Action Thresholds" do not adequately address ecologically invasive plant species.

  One of the principles of an IPM program is the setting of action thresholds. As stated by the U.S. Environmental Protection Agency (EPA), "*Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or*

environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. The level at which pests will either become an economic threat is critical to guide future pest control decisions."[4] The NPS Management Policies 2006 outline a course of action that will use IPM in the management of invasive plants. The EPMT and parks recognize that they must set various thresholds that relate to each strategy, eradication, control, and containment. Therefore, the EPMP will employ action thresholds as a trigger for action and will not single out this aspect of IPM in the impact analysis.

- The NPS should work in cooperation with Cooperative Weed Management Areas.

  This recommendation is supported by NPS policies. It is not an impact topic for analysis, but remains as a recommendation within each alternative.

- Use the Mid-Atlantic Exotic Pest Plant Council database for early detection list.

  This recommendation has been forwarded to the monitoring program involved in early detection of invasive plants. It is a resource and not impact topic.

- Inadequate knowledge base.

  This affects all options equally, and the analysis will not address this as an impact topic. The alternatives allow for incorporating new findings into planning.

- Application of pesticides may be harmful to applicators or other workers entering area; applications may affect health of park visitors and local residents.

  The EPA has authority to regulate the sale and usage of pesticides from two main laws: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act, the latter relating to pesticide residue on foods and not directly applicable to this EPMP/EA. The FIFRA law and other statutes that affect the EPA's pesticide programs ensure that pesticides are safe to applicators and workers, when applied in accordance with label instructions. Pesticide labels provide all health and safety directives relative to the safe use of the pesticide. Application of pesticides will be done in accordance with all laws, regulations, and NPS policies by trained and, when appropriate, certified pesticide applicators. The safety plan calls for the use of personal protective equipment (PPE) by applicators and may require posting or closing of treatment areas. Application will be done under strictly enforced weather conditions that eliminate threats from drift and runoff. All Occupational Health and Safety Agency (OSHA) regulations would be followed under each alternative. Therefore, this concern is addressed similarly in all the alternatives and is not considered outside of general discussions of health and safety considerations in the environmental impact analysis.

- Potential for pesticide drift on to private lands; landowner concern that invasive plant management may affect private property adjacent to and within park boundaries.

  Highly selective application methods would be used in accordance with the pesticide label. No aerial spraying will be used. The preferred method of pesticide delivery is by handheld sprayers affixed to small tank or backpack units. Handheld sprayers allow

[4] Integrated Pest Management (IPM) Principles. U.S. Environmental Protection Agency. http://www.epa.gov/pesticides/factsheets/ipm.htm#setaction. Accessed 6 April 2011.

extremely precise delivery of pesticide on selected target plants. Small boom sprayers are occasionally used, but label restrictions and BPs would be rigorously applied in the Preferred Alternative. Therefore, this concern has been fully addressed in mitigations that occur on the pesticide label with additional mitigations and BPs under the Preferred Alternative.

- Degradation of air quality or visibility.

  All 15 parks are designated Class II air quality areas (NPS 2011). The Class II designation allows moderate air quality deterioration. The amounts of exhaust or particulates contributed to the air from these proposals would be similar to normal background levels and would not exceed levels of current management and maintenance activities. The principal air pollutant in the parks is ground-level ozone. Only CUVA is in a proposed 8-hour ozone non-attainment area. The ozone injury-risk-assessment indicates risk of ozone injury is moderate to high in six of the parks (NPS 2011). This plan mitigates any contributory ground-level ozone and particulate emissions by not using power equipment during air quality advisories based on the Air Quality Index[5]. Therefore, mitigations eliminate this topic from further consideration.

- Prescribed fire may damage air quality, cultural resources, wildlife, and soils; and, prescribed fire is not appropriate for the control of invasive plants in Buffalo National River.

  This concern from external scoping addressed only BUFF, but the determination to use prescribed fire has been addressed by each park individually in another decision document. Parks evaluated prescribed fire use in fire management planning through a NEPA decision process. The interaction of fire and other treatments will be considered in the cumulative impacts section of this EA. Use of fire will not be addressed as a topic.

- Consider the effects of emerald ash borer (*Agrilus planipennis*) on invasive plant distribution; consider effects of climate change.

  The effects of various parasites, pathogens, and climate stressors will be considered in implementation. This type of threat to ecosystem integrity will be assessed as a general disturbance to the affected environment. It will receive consideration as a cumulative impact and it will be treated as a stressor in determining treatment effects on the environment during the tool selection process.

1.7.2 Identifying Topics

Impact topics are derived from two sources:

- Mandatory impact topics derived from laws, regulations, and policies.
- Impact topics distilled from impact issues identified through scoping. Issues acquired during scoping were evaluated for application to the EPMP/EA and for similarity to other issues that may be combined into an impact topic. An example would be the stated concern,

[5] http://airnow.gov/index.cfm?action=airnow.actiondays. Accessed 1 August 2012.

"Some species contribute to the cultural or historical landscapes, but are exotic to the site. Species may be traditionally used, but considered invasive."

This issue is considered within the two impact topics, cultural landscapes and ethnographic resources, where impacts to cultural or historical significance and to traditional use are analyzed. Presence of these species is also considered as an indicator of potential archeological sites and will be considered in that impact topic also. Thus, the stated concerns from scoping are applied to corresponding topics.

Mandatory Impact Topics

Several impact topics must be considered in an EA written for the NPS. Some of these topics are appropriate to the proposed alternatives and some are not. Many of these topics are consistent with the impact topics derived from scoping and have been incorporated into impact topics accordingly. Impact topics considered relevant to this EA include:

- Wetlands.

  These resources are included in discussions of water resources and of vegetation, but will not be a separate impact topic. No actions will result in a loss of wetlands, the primary concern in the mandate. Wetland processes could potentially be indirectly benefitted by invasive plant management, discussed in the water and vegetation impact analysis.

- Endangered or threatened plants and animals and their habitats.

  This resource is covered as a discreet impact topic. Mitigations are applied for the protection of listed species documented as occurring in the parks. State-listed conservation species and federally endangered, threatened, and candidate species are included in the analysis. Consideration is also given species listed by conservation organizations as rare or in need of conservation protection.

- Important archeological or historic resources.

  This impact topic is discussed in analyses of impacts on cultural resources, relative to undocumented resources (principally archeological). Cultural landscape and ethnological resources are included in the analysis as discreet topics as well. Documented historic buildings are protected by BPs and mitigations and are not included in the analysis.

- Sacred sites.

  This topic is handled in the ethnographic resources impact topic.

Elimination of mandatory topics is acceptable if the topic meets one or more of the criteria, (1) if the issue does not appear relevant to the proposed alternatives, (2) if the issue has no or relatively small impacts in comparison with other topics, or (3) if best practices and mitigations will make impacts minor or negligible. Mandatory topics eliminated, based on this criteria, include:

- Floodplains.

  The alternatives do not involve construction within, alteration of, or loss of function for floodplains, the primary concerns of this mandate.

- Ecologically critical areas, Wild and Scenic Rivers, or other unique natural resources.

Wilderness

At this time, the EPMT coordinator and BUFF, the only park with designated wilderness, do not expect to treat any areas within or immediately adjacent to the wilderness. Currently, BUFF uses the Minimum Requirements Analysis and Minimum Tool in considering actions in their designated wilderness (NPS 2006e). Should future treatment be considered, a Minimum Requirement Analysis would be completed to confirm that the Minimum Tool prior to any treatments, ensuring that the treatment or combination of treatments posing the least possible risk to wilderness values, while accomplishing objectives, is selected. This would be the same across all alternatives, and would become part of the Optimum Tool selection process in Alternatives 2 and 3.

Rivers Listed on the Nationwide Rivers Inventory (NRI)

Within the Heartland Network, the Cuyahoga River at CUVA, the East Fork Little Buffalo River and the Little Buffalo River at BUFF, the Yellow River at EFMO, and Current and Jacks Fork Rivers at OZAR are listed on the NRI for their water quality, free-flowing condition, and at least one river value – scenic, recreational, geologic, fisheries, wildlife, historic, cultural, or other. Plans that have the potential to affect these stated river values must not propose actions that could adversely affect the values that qualify these rivers for addition to the National Wild and Scenic Rivers System. Complete details regarding the NRI status of these rivers and their associated values can be found at http://www.nps.gov/ncrc/programs/rtca/nri/.

No adverse impacts to water quality or free-flowing condition are proposed. Visitor experience may be temporarily affected and is covered in the impact analysis under the visitor experience impact topic. Other river values will be analyzed within natural and cultural resource topic areas, but the analysis will not address NRI as a stand-alone topic.

Congressionally Designated Rivers

Buffalo National River and Ozark National Scenic Riverways were designated by Congress as National Rivers under legislation independent of the Wild and Scenic Rivers Act, but are similar in purpose and administration to Wild and Scenic Rivers (WSR). Each was enacted to protect water quality, free-flowing condition, and specific river values. Buffalo National River was designated for its scenic and scientific features, free-flowing condition, recreational, fish, and wildlife values. Ozark National Scenic Riverways was designated for its scenic and other natural values, objects of historic interest, the free-flowing condition of the Current and Jacks Fork Rivers, and for the preservation of springs and caves.

No adverse impacts to the values for which these rivers were designated are expected from proposed actions that would not be considered under specific natural and cultural resource impact topics. Visitor experience may be temporarily affected and this is specifically analyzed under that topic. Although this EA will not anayze designated rivers as a separate topic, the impacts to values will be analyzed within other topics.

- Possible conflicts between the proposal and land use plans, policies, or controls for the area concerned (including local, state, or tribal).

  Coordination and cooperation with surrounding land use plans and actions will be accomplished similarly in all alternatives. Actions will be taken on NPS fee-simple land, unless accomplished in cooperation and collaboration with other landowners within the park boundary. No land-use change is proposed in this plan. All local, state, and federal laws and regulations, and all NPS and park policies will be followed in implementing these proposed actions. Consultation with local, state, and tribal governments is ongoing. Therefore, this has been dropped as a topic for analysis.

- Natural or depletable resource requirements and conservation potential; energy requirements and conservation potential.

  The alternatives will not increase energy use or conservation in the long-term. Successful treatment of invasive plants may require some energy resources, but increases would be negligible, relative to current park operations.

- Urban quality, historic and cultural resources, and design of the built environment.

  Impacts to historic and cultural resources are discussed in impact topics. Invasive plant management actions will occur outside of urban settings and the built environment and so no adverse impacts to urban quality would be expected from the alternatives.

- Public health and safety.

  Policies of the NPS advocate a safe work environment for employees and a safe experience for park visitors. The equipment proposed for use, such as hand tools, chainsaws, portable sprayers, and UTVs, are standard devices commonly used in the parks. Training on the proper use of equipment is included as part of policy. Safety protocols for storing, mixing, transporting, handling spills, and disposing of unused pesticides and containers are included in Appendix G and apply to Alternative 2. The pesticides currently considered for use have very low acute toxicity to humans. Label restrictions, and mitigations and BPs in this document are applied to pesticide use. The mitigations and BPs in Alternatives 2 and 3 further protect the public from accident and injury. The alternatives would likely not affect human health or safety for park employees, park neighbors, or visitors. Therefore, this impact topic was eliminated as a stand-alone topic for analysis, and was considered implicitly throughout the EA and explicitly incorporated into the analysis on visitor use and experience.

- Hazardous materials.

  Numerous federal laws exist for the management of hazardous materials. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, commonly known as Superfund provided broad federal authority to respond to releases of hazardous substances that may endanger public health or the environment. Waste management and contamination issues are covered on page 129-130 of the NPS Management Policies 2006, section 9.1.6. This section states that the NPS recognizes the far-reaching impacts that waste products, contaminants, and wasteful practices have, not only on park resources, but also on biotic and abiotic resources elsewhere in the nation and around the world. The NPS will therefore demonstrate environmental leadership and serve as a model in managing wastes and contaminants.

If a park implements pesticide treatments, small amounts of pesticide may be stored on site for a short time in accordance with NPS policies, and would be transported to treatment locations. The types and quantities of hazardous materials considered for invasive plant management are similar to the types and quantities of hazardous materials that parks currently use for turf management and other IPM uses. Pesticide use, safety, transportation, treatment, storage, cleanup, and disposal are addressed in this EPMP/EA. All regulations and safety protocols for storing, mixing, transporting, handling spills, and disposing of pesticides and containers would be implemented. This EPMP/EA documents the mitigation measures and BPs under the Preferred Alternative that ensure the health and safety of people when dealing with hazardous materials (See Appendix G).

Parks will use small quantities of hazardous materials during nearly all implementation of invasive plant management activities. Gasoline and diesel fuel will be used to power engine-driven devices, such as chainsaws and UTVs. Small quantities of oil and antifreeze would also be used and stored on site. These materials are a part of normal park operations and would be handled in accordance with NPS policies. Because the potential for releases of hazardous substances that may endanger public health or the environment, other than pesticides specific to the treatments described in this EPMP/EA, is unlikely and would be successfully and similarly mitigated and remediated under all alternatives, this general impact topic was eliminated from further analysis.

- Prime and unique agricultural lands.

  The proposal does not suggest the conversion of prime and unique agricultural lands.

- Socially or economically disadvantaged populations (see EO 12898, Environmental Justice).

  Executive Order 12898 required that federal actions address environmental justice in minority and low-income populations with particular note of impacts to children. No differences exist among the alternatives in this context and the alternatives do not affect disadvantaged populations.

- Indian Trust resources.

  No Indian Trust resources are affected by this proposal and so this topic has been dropped from further consideration.

Impact Topics Retained for Analysis

Issues retained for inclusion were clustered into impact topics that covered similar resources (e.g., wildlife, vegetation, water) or similar categories of concern (e.g., health and safety, visitor use) in Table 1.7.2.

Table 1.7.2. Issues arranged by impact topic area

	Topic	Issue examples
Natural Resources	Water, wetland, karst hydrology	Degradation of water quality, particularly in karst geology. Pesticides in riparian and aquatic systems (surface and ground water, water in karst). Fate of pesticide, especially in areas with ground water near soil surface. Degradation of wetlands (as defined in CWA). Movement of pesticides in karst landscapes.
	Geology, soils and karst features	Fate of pesticide within soil column. Understanding the effects on soil properties, top soil, and microorganisms, including scarring and erosion.
	Vegetation communities	Impacts to non-target species. Unintentional damage due to "footprint" of workers in field. Secondary infestations of invasive plants after initial control. Need for restoration of disturbed area. Effects in wetland and riparian vegetation.
	Wildlife and Fish	Degradation of cave habitats and cave biota. Degradation of wildlife habitat and impacts to wildlife. Direct exposure of wildlife to toxic substances or to disturbance from equipment.
	Threatened / Endangered Species	Negative impacts on threatened or endangered species. Impacts to species of continental importance or management concern.
Cultural Resources	Archeology and Historic Structures	Damage to cultural resources such as archeology, artifacts, and historic properties. Pesticides impacts to organic materials within cultural sites. Removal of plants associated with archeological sites or that may constitute elements of archeological sites.
	Cultural Landscapes	Degradation of cultural landscapes (historic integrity, historicity, and aesthetics). Degradation to interpretive values.
	Ethnographic Resources	Degradation of traditional landscapes, cultural property, sacred sites, or traditionally used plants, and to access to those resources.
Visitor Resouces	Use and Experience	Visitor access, views, enjoyment, and soundscapes. Health and well-being, including Wilderness and Wild and Scenic Rivers. Sensitivity to meet park needs and interpretive opportunities.

1.7.2 Regulatory Measures and Policies

A number of regulatory measures for management of invasive species, noxious weeds, and invasive plants are applicable to any actions taken by the EPMT or parks. Regulatory measures include laws, executive orders, presidential proclamations, regulations, and policies. Regulatory measures fall into federal, state, or local jurisdictions. The NPS abides by these regulations. Additionally, every park unit and program within the NPS is guided and regulated by agency and bureau policies, as well as individual park policies. A brief summary of the regulatory measures and the legal authorities appears in the main text of this document, but the regulatory measures are explained in detail in Appendix F with Internet links for further information.

Federal

The **National Environmental Policy Act of 1969** (NEPA) is an umbrella legislation that requires the federal government to use all practicable means to create and maintain conditions in the human environment.

The **Federal Insecticide, Fungicide, and Rodenticide Act 0f 2008** (FIFRA) is the primary guidance for pesticide registration and use, training and certification of pesticide applicators, and penalties associated with misuse of pesticides.

The **Occupational Health and Safety Hazard Communication Standard** requires employers to provide workers with training, protective equipment, and information about hazardous substances, including maintaining and making available Material Safety Data Sheets (MSDSs).

Executive Order 13112 of 1999, Section 2 directs federal agencies to identify actions affecting invasive species and to take action to prevent, detect, monitor, and control invasive species.

Plant Protection Act of 2000 consolidates and modernizes all major statutes pertaining to plant protection and quarantine. It provides the USDA Animal and Plant Health Inspection Service (APHIS) with the authority to regulate biocontrol agents.

The **National Pollutant Discharge Elimination System** (NPDES), as a permit program authorized by the Clean Water Act, controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Other Federal Laws and Regulations Related to Invasive Plant Actions

Many laws and regulations guide actions related to invasive species actions. The following list is not exhaustive and the invasive plant management program will conform to changes or additions to laws and regulations as they occur.

- **Executive Order 13514,** Federal Leadership in Environmental, Energy, and Economic Performance.
- **Noxious Weed Control and Eradication Act of 2004**
- **Safe Accountable, Flexible, Efficient Transportation Equity Act of 2005**
- **The Antiquities Act of 1906** and **Archeological Resources Protection Act of 1979**
- **Clean Air Act,** as amended in 1990
- **Clean Water Act of 1972** (as amended in 1977)
- **Comprehensive Environmental Response, Compensation, and Liability of 1980**, as amended
- **Endangered Species Act of 1973**
- **Environmental Quality Improvement Act of 1970**
- **Executive Order 11593,** Protection and Enhancement of the Cultural Environment
- **Executive Orders 11644 and 11989**, Off-Road Vehicle Use
- **Executive Orders 11988 and 11990**, Floodplain Management and Wetland Protection.
- **Executive Order 12898,** Environmental Justice
- **Executive Order 13007**, Indian Sacred Sites

- **Federal Cave Resources Protections Act of 1988**, as amended 1990; and implementing regulations 43 CFR Part 37
- **Government Performance and Results Act of 1993**
- **National Historic Preservation Act of 1966**, as amended and **Archeological and Historic Preservation Act of 1974**
- **National Parks Omnibus Management Act of 1998**
- **Native American Graves Protection and Repatriation Act of 1990**
- **Resource Conservation and Recovery Act of 1976**
- **Wild and Scenic Rivers Act of 1968**, as amended
- **Wilderness Act of 1964**
- **NPS Management Policies 2006**
- **Adaptive Management** (516 Departmental Manual 4.16, 2004)
- **DO-77 (in development)** and **NPS 77 Reference Manual**
- **DO-41, Wilderness Preservation and Management**
- **DO-46, Wild and Scenic Rivers**
- **DO-50C, Public Risk Management Program**
- **NPS-75, Natural Resources Inventory and Monitoring**
- Individual park's resource management program policies and plans

1.8 Relationship to Other Park Plans

This section describes the relationship of the EPMP/EA to other park plans and policies. Table 1.8.0 summarizes those plans and policies that may affect the EPMP, analysis of impacts from proposed Alternatives, or the status of resources or invasive species in the parks.

Table 1.8.0. Park plans and relationship to EPMP

Park	Policy/Plan	Responsible Agency	Requirements/ Goals/ Objectives	Relationship to EPMP
All Parks	General Management Plan (GMP)	NPS	Contains Desired Conditions or other description of conditions that park should attain in preserving resources	Desired conditions are implicitly or explicitly established for natural areas, sometimes including references to exotic plant conditions
	Resource Management Plan (RMP) or Resource Stewardship Strategy (RSS)	NPS	Resource program level plan that tiers from the GMP and guides implementation planning for resource preservation	Program level guidance that may address exotic plant management and guides implementation plans for vegetation management
	Fire Management Plan (FMP)	NPS; Interagency Cooperative Fire Management	Provides guidance for health and safety of fire fighters and public, protecting people and property during wildland fire; for use of prescribed fire to attain management goals, including exotic plant management; and for wildland fire education and prevention	When permitted, provides guidance for the use of wildland and/or prescribed fire for exotic plant management or to benefit natural, fire-dependent vegetation communities
	Federal Noxious Weed Act, 1974	All federal land management agencies	Secretary of Agriculture has authority to prohibit importation, interstate transportation, and sale of species the Secretary deemed noxious through inspection and quarantine	This Act does not invalidate any state or local laws regulating noxious weeds, but allows federal agencies to cooperate with state agencies to control the spread of noxious weeds.
	Invasive Species Executive Order 13112	Federal agencies	Establishes the National Invasive Species Council to prevent introduction of invasive species and to provide for control to minimize economic, ecological, and human health impacts	Provides authority for invasive species treatment
	NPS Management Policies 2006	NPS	Manage parks in a way consistent with NPS mission and all laws and regulations relating to NPS parks administration and resources	Policies guide park management, including definition and management of exotic species
	NPS-77 and draft Directors Order-77	NPS	Details NPS policies relating to resource management	Includes management of vegetation communities and exotic vegetation
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
CUVA	GMP, 1977	NPS	As per All Parks	As per All Parks
	RMP, 1999	NPS	As per All Parks	No longer an official planning document; provides oversight for resource management
	Wildland Fire Management Plan, 2005	NPS	As per All Parks	Allows use of fire on park owned land for vegetation management/restoration.
	RSS, in progress	NPS	As per All Parks	As per All Parks
	Cultural Landscape Report, 2000	NPS	Evaluates history and integrity of landscape, including changes to context, features, materials, and use; provides information needed to make management decisions	Establishes certain exotic species as appropriate to the location and as serving a cultural resource purpose
	Hazard Tree Plan, 2008	NPS	Guides the management and removal of diseased and dead trees, hazard fuels, or trees that pose a hazard to visitors and staff	Discusses removal of exotic species of trees that pose a hazard.
	Trail Management Plan	NPS, Cleveland and Summit County Metroparks	Guides the future course of trail management and development in national park in cooperation with partner parks	Trails can be a source of invasive species; trail placement may affect plant distribution
	Invasive Exotic Plant Management Recommendations for CUVA, 2007	NPS	Recommendations for consideration in planning vegetation management	Specific recommendations that would be incorporated into annual invasive plant management work plans
	Degraded Wetland Restoration Plan, 2005	NPS	Restoration of disturbed wetlands	Wetland restoration must be considered as a cumulative impact to terrestrial vegetation management
	Wetland Protection Plan for Proposed Agricultural Lands, 2002	NPS	Restoration of agricultural lands and wetlands on those lands	Agricultural lands may be a source of invasive species affecting distribution; must be considered as a cumulative impact to terrestrial vegetation management
	Riparian Buffer Plan for Proposed Agricultural Lands, 2002	NPS	Sets the management for floodplain and river bank landscape and vegetation	Uses vegetation to achieve effective stream buffer
	Linking the Corridor: A plan for the towpath trail in the North Cuyahoga Valley Corridor, 1999	NPS	Plan to develop towpath trail	Trails can be a source of invasive species; trail placement may affect plant distribution
	Strategic Plan, 1999	NPS	Program operations plan	General guidance for achieving mid-term goals
	Long-term Ecological Monitoring Plan (Vegetation and Tree),1998	NPS	Monitor vegetation communities and tree regeneration	Monitoring will contribute to discovery of new or changing invasive plant infestations
	Disturbed Site Restoration Management Plan, 1994	NPS	Restoration of lands disturbed by development	Restoration influences distribution of invasive plants
	Mowing Plan, 1994	NPS	Plan for maintained landscapes	Mowing can influence distribution of invasive plants and is a treatment for control of some invasive species

	Final Rural Landscape Management Program EIS, 1993	NPS, partners	Record of Decision is not yet published, but set the objectives for preservation of rural landscape within the park	Determines landscape types and appearance at specific locations as well as providing a general goal relative to landscape
	Control Plan Alien Plant Species, 1990	NPS	Control of exotic plant species	Park implementation plan for control of exotic plant species
	Transportation Plan, 1983	NPS, Federal Highways	Guides the placement of roadways and travel corridors	Disturbance from roadways affects invasive plant distribution
	Ohio Noxious Weed Laws, Chapter 971.33, 5579.04-5579.08; R.C. 731.51, 901.5-37-01	State, counties	Based on Federal Noxious Weed Act, state lists those species that are noxious and appropriate actions to control spread	Provides target species and requirement for treatment
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
EFMO	GMP, in process	NPS	As per All Parks	A new GMP is underway, but has not been completed
	RSS, in process	NPS	As per All Parks	An RSS is proceeding in lock-step with the new GMP
	FMP, in review 2011	NPS, joint agreement	As per All Parks	Allows and guides use of prescribed fire for both small areas and landscapes
	Iowa Noxious Weeds and the Iowa Weed Law, Chapter 317, Code of Iowa, 1997	Counties	County weed commissioner shall supervise the control and destruction of all noxious weeds in the county.	Guides park in which species to target to reduce or eradicate noxious weeds
	Natural Resource Condition Assessment, draft	NPS	Assess watershed resource conditions in national parks.	Evaluates the current conditions of resources in the park and suggests one or more options for potential targets representing desired conditions.
	Figures on the Landscape: Historic Resource Study	NPS	Study evaluates the history and integrity of the archeologically significant landscape.	This includes the character of the mounds, which lie outside of the treatment area.
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
HOCU	GMP 1997	NPS	As per All Parks	As per All Parks
	RMP 1999	NPS	The primary consideration for vegetation management is protection of archeological resources, control of alien vegetation, and restoration of native vegetation. Until a Cultural Landscape Report is completed, the park will continue mowing and limit alien plant control and fertilizer use.	Mound City unit focused on alien plant control in 45-acre wooded area around earthworks. Haying permitted in two units and exotic forbs and grasses used for hay dominate vegetation cover. Within Hopewell unit, 40 acres are mowed for noxious weed control. The vegetation around earthworks was 90% non-native or weed species.
	FMP 2004	NPS, joint agreement	**FMP Goal 6:** Use prescribed fire as a method of restoring and maintaining the cultural and natural landscape to meet resource objectives of the park.	Archeological resources must be protected. Dozing, fire lines, ditching, or other earthwork activities will not take place over known sites; will be evaluated by an archeologist on a case-by-case basis, and must be monitored at all times. Prescribed fire used infrequently. The purpose of prescribed fire is to protect and preserve cultural resources of the park, manage vegetation, and reduce fuel loading.
	Integrated Pest Management 2005	NPS	Control of pests in park facilities and natural areas.	Natural areas section will inform priorities for EPMP implementation. Park policies established in this document will take precedent over EPMP.
	Ohio Noxious Weed Laws, Chapter 971.33, 5579.04-5579.08; R.C. 731.51, 901.5-37-01	State, counties	Based on Federal Noxious Weed Act, state lists those species that are noxious and appropriate actions to control spread	Provides target species and requirement for treatment
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
LIBO	GMP	NPS	As per All Parks	As per All Parks
	RMP	NPS	As per All Parks	As per All Parks
	FMP	NPS, joint agreement	As per All Parks	Allows use of fire on park owned land for vegetation management/restoration.
	Indiana Noxious Weeds, Code 15-15-1; and Indiana Seed Law, Code 15-4-1	State, counties	Designates noxious weeds and acts to prevent the spread of plants or seed	Establishes target noxious weed species
	Report: Trends in Tree and Shrub Vegetation & Development of a Vegetation Monitoring Database, 2004	NPS	Reports on vegetation monitoring and makes suggests on future development. Analyzed the tree and shrub data to examine vegetation changes from 1985 to 1997.	Developed a vegetation-monitoring plan for the memorial that utilizes the permanent vegetation plots.
	Inventory of Invasive/exotic Flora, August 2004	NPS	A survey of invasive plants conducted at Lincoln Boyhood National Memorial in the summer of 2003 to document targeted invasive species distributions.	The inventory describes the distribution and composition of invasive flora: 1) pinpoints some areas that should be monitored closely, and 2) establishes baseline data for understanding the distributional patterns of the targeted invasive species.

	Forest Restoration: Presettlement, Existing Vegetation, and Restoration Management Recommendations, April 1989	NPS	A study was initiated in 1984 to recommend how to approximate the presettlement forest at Lincoln Boyhood National Memorial.	Recommendations were made by vegetation type
	Invasive Exotic Plant Monitoring: Year 1 (2006), March 2007	NPS	In 2006, a total of 31 invasive plant taxa were found during the survey at Lincoln Boyhood National Memorial	Of 27 invasive plant species, each covered one acre or less. Several invasive plants are a moderate problem, but successful control appears possible for a large group of species.
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
ARPO	GMP, 2003	NPS	As per All Parks	Conservation areas managed as natural-appearing environment, while preventing processes from damaging or destroying cultural resources. Techniques would promote natural systems. Lands considered as additions to park would have a manageable presence of exotic species. *"The NPS would manage a significant portion of the Memorial Unit using the conservation prescription to provide maximum protection of natural and cultural resources."*
	RMP, 1998	NPS	As per All Parks	*"Eradication and control of these additional exotics are awaiting the completion of a Cultural Landscape Management Plan"* and *"A cultural landscape plan will direct proper management of the park as a historic scene. Completion of the project could have major consequences on the parks aggressive fire management program, mowing operation, and control of exotic plants."* It mentions concerns about surface and bluff bank erosion. In addition, CLR needs to be completed before any additional eradication.
	FMP	NPS, joint agreement	As per All Parks	Allows and guides use of fire in Memorial Unit to meet goals for hazard fuel treatment and vegetation management goals, but does not allow prescribed fire in Osotouy Unit
	Cultural Landscape Report 2006	NPS	A CLR evaluates the history and integrity of the landscape including any changes to its geographical context, features, materials, and use. A CLR can provide managers, curators and others with information needed to make management decisions.	Treatment recommendations for invasive and noninvasive exotic plant species are: (1) conserve vegetation with cultural associations warranting preservation in the context of resource value, projected threat to native vegetation, and relative maintenance burden; (2) control light infestations of Japanese privet (*Ligustrum japonicum*), Japanese honeysuckle, and trifoliate orange, clearing with a shovel or grubbing hoe, removing entire root system; and (3) large-scale infestations may be treated with glyphosate pesticide immediately following cutting in order to kill rootstock.
	Integrated Pest Management Plan	NPS	Assists park management in making sound and informed pest management decisions in accordance with NPS policies and regulations.	A basic resource for ARPO managers, employees, IPM Coordinators, and residents. It is reviewed at least every 3 years to reflect changes in pest management technologies, locally available expertise, input from park Divisions, and Federal, State, and NPS policies. It guides EPMT in implementation of actions at the park that relate to IPM.
	Arkansas State Plant Board, Noxious Weed Program	State; counties	Declares seven species as noxious weeds	Establishes state recognized noxious weeds for targeting
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
HOSP	GMP, 1985	NPS	As for All Parks	Enabling legislation states that geothermal water resources are to be preserved in an unaltered state and that those resources are to be provided to the public in an unending supply. The desired condition includes restoration of native timber devoid of exotic species.
	RMP, 1996	NPS	Protection and control of the geothermal recharge zone is an essential component of enabling legislation's directive.	Several hundred acres of residential lands have been cleared of fabricated structures to protect the geothermal recharge area. Cleared areas have been rapidly colonized by aggressive invasive plant species that now threaten upland forest communities.
	FMP, 2005 (updated 2010)	NPS, joint agreement	Prescription fire is now being used as an ecological tool in HOSP for the first time in its history.	Controlled burns will be used in conjunction with mechanical and chemical treatments in order to achieve the desired conditions.
	Cultural Landscape Report, 2010	NPS	Prescription of landscape objectives based on scholarly report of historic landscape and features that best support the park purpose	Specific to the historic district with little application to natural areas
	Arkansas State Plant Board, Noxious Weed Program	State; counties	Declares seven species as noxious weeds	Establishes state recognized noxious weeds for targeting

Park	Policy/Plan	Responsible Agency	Requirements/ Goals/ Objectives	Relationship to EPMP
BUFF	GMP	NPS	As per All Parks	As per All Parks
	RMP	NPS	As per All Parks	As per All Parks
	FMP	NPS, joint agreement	As per All Parks	As per All Parks
	Terrestrial Habitat Management Plan and Environmental Assessment, 2006	NPS	The desired future condition to be achieved through this plan is the development of sustainable and enduring vegetation that can be managed with less maintenance effort, promote the conservation of natural and cultural resources, and increase use of natural processes, while preserving the riparian corridor.	A variety of native habitats will be enhanced and overall acreage of native plant communities enlarged, habitats for rare or endangered plant species improved, and rare plants re-introduced, protected, and monitored. Additionally, it calls for low tolerance for invasive species, but does permit non-invasive exotic plants to be used to satisfy the cultural landscape and historic uses. Analysis of impacts to cultural resources from this plan has applicability to the EPMP.
	Arkansas State Plant Board, Noxious Weed Program	State; counties	Declares seven species as noxious weeds	Establishes state recognized noxious weeds for targeting
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
OZAR	GMP, in development	NPS	As per All Parks	Allows for the continued limited use of pesticides within regulations and guidelines per NPS policy and other applicable laws/guidelines. To achieve the objectives of the park's open fields program, a variety of operations can be involved (i.e. chain sawing, brush hogging, seeding, etc.); use of pesticides must be approved and is generally restricted.
	RMP, 1995	NPS	As per All Parks	No longer an official planning document
	FMP	NPS, joint agreement	As per All Parks	Allows use of fire on park owned land for vegetation management. It also provides guidance in restoration, treatment, and maintenance of fire-dependent ecosystems, with the primary focus on maintaining and expanding glade/savanna complexes and improving woodland structure and species assemblages, and cultural landscapes. It defines use of wildland and prescribed fire to attain management goals, including hazard fuel reduction and exotic plant management.
	Missouri Revised Statutes, Chapter 263	State; counties	Declares certain noxious weeds and methods of control, including penalty for lack of control	Establishes noxious weeds for targeting
	Natural Resource Condition Assessment	NPS	Expands the knowledge base for decision-making relative to desired and achievable goals in resource management and determines current conditions of those resources.	Provides information on potential vegetation types and potential threats to resources; provides current conditions.
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
GWCA	GMP, 1997	NPS	As per All Parks	As per All Parks
	RMP, 1998	NPS	As per All Parks	Not an official document
	FMP, 2004	NPS, joint agreement	As per All Parks	Attain management goals in plant community conditions and hazard fuel management
	Invasive Exotic Plant Monitoring (Cribs, et al. 2007)	NPS	Survey of invasive plants	Source of information for decision making
	An Evaluation of Biological Inventory Data Collected at George Washington Carver National Monument -- Vertebrate and Vascular Plant Inventories, 2009		Inventory of 114 non-native vascular plants and rank scores.	Source of information for decision making
	Prairie Restoration Management Review, 2009	NPS	A compilation and review of past adaptive resource management actions.	Source of information for decision-making
	Plant Community Monitoring Baseline Report, 2009	NPS	Park baseline data of native and non-native species diversity in the park's prairie.	Source of information for decision-making
	Cultural Landscape Inventory, 2010	NPS	A comprehensive inventory of all historically significant landscapes within the national park system	Defines the historically significant landscapes and evaluates the integrity of that landscape relative to National Register of Historic Places (NRHP). The CLI contributes to determine areas to restore to historical appearance and importance of landscape features to the integrity of the site.
	Prairie Management Recommendations, 2010	NPS	Assessment of prairie condition based on indicator species	An assessment suitability of cover-type based on four indicator species -- characterizes plant community restoration within spatial context
	Prescription Burn History (1982 - 2010)	NPS	Information on past management actions relative to prescribed fire	Provides a historic record of fire use
	Missouri Revised Statues, Chapter 263	State; counties	Declares certain noxious weeds and methods of control, including penalty for lack of control	Establishes noxious weeds for targeting

Park	Policy/Plan	Responsible Agency	Requirements/ Goals/ Objectives	Relationship to EPMP
PERI	GMP, 1998/2005	NPS	As per All Parks	As per All Parks
	RMP, 1998	NPS	As per All Parks	As per All Parks
	FMP, 2005	NPS, joint agreement	As per All Parks	Fire can be used to promote historically accurate ecological and cultural characteristics of the park landscape. Prescribed fire can be used to maintain the open fields, and assist in the restoration of the woodlands and native prairies.
	Arkansas State Plant Board, Noxious Weed Program	State; counties	Declares seven species as noxious weeds	Establishes state recognized noxious weeds for targeting
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
WICR	GMP, 2003	NPS	As per All Parks	Establishes that rehabilitation of native vegetation and elimination or control of exotic plant species is a goal of resource management. Declares that exotic plant species proliferation would be contained and exotic plants would gradually be replaced by native vegetation.
	Interim RMP, 1999	NPS	Targets 5% of exotic plant species to contain.	Establishes a list of exotic species to target.
	FMP, 2004	NPS, joint agreement	As per All Parks	Declares that prescribed fire and fuel management projects will be used to reduce exotic species distribution and abundance, and mitigate significant increases in exotic species due to fires and suppression activities. Provides the list of exotic species to target and a schedule for prescribed fire through 2012.
	Cultural Landscape Report, 2004	NPS	Establishes treatment recommendations for managing vegetation.	Recommends that: adventive plants be identified, controlled, and removed; establish a monitoring program for invasive and adventive plants; identifies the most critical species to be controlled.
	Missouri Revised Statues, Chapter 263	State; counties	Declares certain noxious weeds and methods of control, including penalty for lack of control	Establishes noxious weeds for targeting
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
HEHO	GMP, 2006	NPS	As per All Parks	As per All Parks
	RSS, draft	NPS	As per All Parks	As per All Parks
	FMP, 2008	NPS, joint agreement	As per All Parks	As per All Parks
	Prairie Management Plan, 2003	NPS	Manages prairie in a sustainable manner, reducing exotic species and increasing diversity	Implementation plan that recommends discreet actions for vegetation community restoration and maintenance
	Cultural Landscape Report, 1996	NPS	Recommends the goals and zonal objectives to achieve of a cultural landscape that best fulfills the park purpose.	Recommends vegetation types should use in particular areas of the park. The GMP supersedes these recommendations.
	Iowa Noxious Weeds and Iowa Weed Law, Chapter 317, Code of Iowa, 1997	Counties	County weed commissioner supervises the control and destruction of all noxious weeds in the county.	Guides park in which species to target
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/ Goals/ Objectives**	**Relationship to EPMP**
HOME	GMP, 1999	NPS	As per All Parks	Does not define Desired Conditions
	RMP, 2000	NPS	As per All Parks	RMP is mainly a list of projects, but provides good historical background.
	FMP, 2006 (updated 2009)	NPS, joint agreement	As per All Parks	FMP goals list controlling exotic and invasive plant species.
	Vegetation Management Action Plan, 2004-2014	NPS	Guides managers to maintain vegetation in a suitable and enduring manner so that it reflects hardships and triumphs of those people who sought free land under the Homestead Act of 1862.	Vegetation management guidance that includes exotic plant species
	Cultural Landscape Report, 2000	NPS	Calls on monument to interpret the prairie and manage the prairie and woodland using the best available scientific information by linking the vegetation to the Homestead Act of 1862	Provides several treatment recommendations to restore the cultural landscape.
	Noxious Weed Control Act, 2009, Title 25, Chapter 10	State, counties	Establishes a workable framework, delineates responsibilities, encourages education of the public, and provides the necessary authority to control noxious weeds	Establishes duty of landowners to control noxious weeds

Park	Policy/Plan	Responsible Agency	Requirements/Goals/ Objectives	Relationship to EPMP
PIPE	GMP, 2009	NPS	As per All Parks	
	RSS, in process	NPS	As per All Parks	
	FMP, 2004	NPS, joint agreement	As per All Parks	
	MN Noxious Weed Law, MN Statutes, § 18.75 – 18.91, as amended 2009	State; counties	Protects residents from injurious effects of noxious weeds on public health, environment, public roads, crops, livestock, and other property. Sections 18.76 to 18.91 contain procedures for controlling and eradicating noxious weeds on all lands within state.	Allows cooperative agreement with Cooperative Weed Management Areas; provides guidance on controlling and eradicating weeds
Park	**Policy/Plan**	**Responsible Agency**	**Requirements/Goals/Objectives**	**Relationship to EPMP**
TAPR	GMP, 2000	NPS, The Nature Conservancy (TNC)	As per All Parks	Along with the enabling legislation, the GMP contains "provisions requiring the Secretary to comply with applicable State noxious weed, pesticide, and animal health laws."
	FMP, in review	NPS, TNC, joint agreement	As per All Parks	Identifies fire and mechanical fuel treatments as potential management tools for exotic plant species.
	Cultural Landscape Report, 2004	NPS, TNC	Provides preservation treatment(s) for the landscape of the preserve based upon the historical significance and integrity identified through site physical history development, NRHP level evaluation, and the strategic vision embodied in the GMP.	Includes several treatment recommendations to maintain and enhance the natural and cultural landscape.
	Tallgrass Prairie Bottomland Restoration Plan, 2006	NPS, TNC	Provides general and specific information regarding prairie reconstruction on previously disturbed lands.	Includes treatment recommendations for exotic plant species.
	Kansas Noxious Weed Law, 1937	State; counties	Designed to control, manage, and eradicate 14 plants designated as noxious weeds	Guides park in which species to target

Alternatives

2

This chapter describes the alternatives to be analyzed, including the Preferred Alternative, and alternatives considered but eliminated from further analysis. Alternatives are presented in a comparative form, defining differences between each alternative in the summaries for each, providing a clear basis for choice among the alternatives.

1. ***Attain.*** *Attain or maintain desired conditions.*

2. ***Sustain.*** *Restore sustainable native plant communities.*

3. ***Prevent.*** *Prevent unacceptable levels of threat with least possible risk to people, park resources, and the environment.*

4. ***Plan.*** *Develop a plan and compliance documentation.*

5. ***Best Management Practices****. Use state-of-the-art treatment options, procedures, and mitigation measures.*

2.0 Aspects Common to All Alternatives

Alternatives for invasive plant management were developed during internal and external scoping (See Appendix E – Consultation and Civic Engagement). All alternatives are evaluated as to their effectiveness and feasibility in attaining the goals of the invasive plant management program for the Network and 15 member parks. Therefore, each alternative will be described with its effect on attaining these goals in mind. The goals are the same for all parks:

- **Attain.** Attain or maintain desired conditions for landscapes; support approved park Cultural Landscape Report (CLR) treatment plans enhancing historic context, setting, feeling, and association of cultural resources to the defined period of significance (also enhances visitor experience and supports interpretation programs).
- **Sustain.** Restore sustainable native plant communities, where appropriate, to reduce the need for ongoing invasive plant treatment; support a strategy of early detection and treatment within the parks.
- **Prevent.** Prevent unacceptable levels of invasive plant cover and threat, using environmentally sound, cost-effective management strategies that pose the least possible risk to people, park resources, and the environment.
- **Plan.** Develop an invasive plant management plan and compliance documentation that provides the necessary environmental assessment for invasive plant management strategies at the parks.
- **Best management practices.** Keep resource managers up-to-date with state-of-the-art treatment options and procedures (best practices or BPs) and mitigation measures, so that parks can select options that represent best management practices for their needs.

2.0.1 Management Actions Defined

Management actions defined in this EA are proposed for areas where invasive plants will be contained, controlled, or eradicated to protect cultural or natural resources. The actions do not apply to developed areas around a park's visitor facilities and operation areas, where landscapes are mowed or similarly maintained.

None of the alternatives addresses treatment of aquatic invasive species in aquatic environments, such as in streams, lakes, or open pools. The decision to exclude these species from this EPMP/EA occurred early in the internal scoping. Treatment of aquatic species embraces complexities that the Network does not have the information to address at this time. This exclusion does not extend to treatment of terrestrial species in wetlands and riparian areas.

Parks may exclude any treatment based on previous planning, impact analysis, or park policy, even if the treatment is proposed within an alternative. Thus, if park policy excludes the use of mowers in a certain area, even though the option of mowing as a treatment technique is in each alternative, it will not be implemented in areas under the exclusion policy. Allowed treatments and techniques will be considered for use where and when permitted by the parks.

Cultural Methods

Cultural methods (not to be confused with cultural resource treatments; see Secretary of Interior Standards and Guidelines[6]) include practices that reduce opportunities for invasive plants to establish and grow. Prevention and restoration are examples of cultural methods. As an example of prevention, equipment sanitation, such as mower cleaning, prevents the introduction of invasive plant seeds. Ensuring that cultural landscapes or developed areas in and around each park are free of invasive plants is another preventative measure. While parks cannot always affect their surroundings, partnerships with neighbors may contribute to creating an invasive-plant-free buffer around each park.

Cultural methods also include practices that promote the growth of desirable plants. For example, restoration of native plant communities or cultural landscapes may serve as a cultural method. The re-introduction of native plants through planting or seeding may increase competition and reduce the potential for invasive species to become established. Planting and seeding may be accomplished with hand tools (spud or shovel) or equipment (tractor pulled broadcaster and drag, or seed drill). Treatments that include the use of mechanical, manual, or other techniques to implement the restoration will be considered a connected treatment. Although the concept of site restoration is a cultural method, the implementation may fall into one of the other categories of treatment discussed in this EPMP/EA (e.g., Manual and Mechanical Treatments) as a connected treatment.

Manual and Mechanical Treatments

Manual treatments include hand pulling and removal, or use of hand tools for grubbing and cutting. Hand pulling removes as much of the root as possible, while minimizing soil disturbance. Pulling tools are used for removing small infestations of deep-rooted plants. Hand cutting tools are a treatment technique for removing the above ground portions of annual or biennial plants, or for grubbing roots. Use of hand tools, such as trowels, shovels, pullers, pruners, loppers, saws, and Pulaskis are simple forms of mechanical treatment, but will be classified as manual treatment in this document, so as to differentiate between treatments requiring use of internal combustion engines or electric motors and those not using an external power source. Hand tools permit great operator selectivity in targeting plant removal.

Light mechanical equipment and power tools are a treatment technique that includes tools, such as weed whips, small mowers (including lawn-tractors), chainsaws and mechanical devices, having negligible impact on soil. Power cutting-tools remove aboveground biomass and reduce seed production. They are useful for controlling annual and biennial plants before they set seed. Power tools, such as mowers, treat small to large infestations, depending on the size of the mower. Mowers work best on relatively flat treatment areas that do not include sensitive environmental resources. Weed whips can be used for small infestations, or in sites that are inaccessible to self-propelled equipment. They will work around rocks, trees, and other obstacles, and are preferred where archeological resources may be located in the upper soil stratum. Workers can also use chainsaws in rough terrain that is safely accessed to cut woody

[6] Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines [as amended and annotated]. http://www.nps.gov/history/local-law/arch_stnds_2.htm, last accessed July 31, 2012.

plants. Mechanical methods using light equipment are selective for individual or small groups of plants, and focus on specific treatment areas.

Heat techniques are another selective method that requires light equipment for application. Heat techniques use dry or wet heat to damage plant leaves and fruiting structures, thus killing the plant or severely reducing its ability to proliferate. Heat from this method dissipates at the soil surface or never reaches the soil. Methods include weed torch, hot foam, and hot water.

Heavy mechanical equipment includes that which could cause negligible to minor, short-term impact in compacting soil or suppressing growth of desirable plants. Examples of heavy equipment include tractors and UTVs that are propelling equipment such as large mowers, seed drills, or drags. Heavy equipment can be used to treat dense invasive plant infestations. Particular care must be taken if there are surface or subsurface historic structures or artifacts that could be damaged by the weight or actions of the heavy equipment. Managers must also realize that large equipment tends to cause soil and vegetation disturbance along the route to the site.

Very heavy equipment, such as bulldozers, will be excluded for the purposes of this plan, because they may (1) alter landscape contours, (2) create soil disturbance or compaction that exceeds moderate and short-term impacts, or (3) they result in a loss of natural qualities that would require several growing seasons to rectify through natural processes.

Biological Treatments (when included in alternative)

Biological treatment, sometimes called biocontrol, is the use of "natural enemies," such as insects and microorganisms, to reduce the abundance of an invasive plant species. Natural enemies are deliberately released into areas where the plant is invasive. Examples include plant-feeding insects such as flea beetles (*Aphthona lacertosa*) for leafy spurge (*Euphorbia esula*) and stem mining weevils (*Ceutorhynchus litura*) for invasive thistles (*Cirsium* spp.). These natural enemies limit the growth or reproduction of invasive plants. Biocontrol may be a long-term solution for treating some invasive species that are too widespread for other means. Biocontrol is best suited for infestations of a single, dominant invasive plant species that is not closely related to other native plant species. Biocontrol agents are restricted by the U.S. Department of Agriculture (USDA). Agents are rigorously tested and determined to be safe for use as directed. They must be used only in situations where they are approved and after consideration of other treatments.

Pesticide Treatments (when included in alternative)

Pesticide treatments consist of application of pesticides intended for preventing, destroying, or controlling any pest. They are applied according to their labels, using a variety of application methods. Examples of application methods include portable sprayers, boom sprayers, or wicks mounted to UTVs or tractors. Pesticides are particularly effective when targeting invasive plants while minimizing collateral damage to desired species. The amount of collateral damage is associated with the selectivity of the application method, pesticide, and timing. For example, hand-held sprayers are more selective than boom sprayers, grass-specific pesticides are more selective than pesticides that kill all plants, and treatment during the winter is typically more selective than summer treatments. Pesticides can deliver a near surgical strike against multiple invasive plant species in a small area, particularly when using spot spraying, stump treatment, frilling, hack-and-squirt, or dormant-season application. Applying pesticides with a boom

sprayer or a wick, however, is often necessary to treat large stands of a single invasive plant species.

Pesticide application methods must be considered, when determining treatment type. If trucks, UTVs, or tractors were used in pesticide application, managers must account for potential impacts made by the application method, such as those impacts discussed in the Manual and Mechanical Treatments section of this EPMP/EA, as well as the impact of the pesticide itself.

Aerial spraying is not being considered in the parks because it is not appropriate for the current park conditions. Future use of aerial spraying would require additional analysis of environmental impacts.

Prescribed Fire Treatments (if permitted in FMP)

The effect of prescribed fire as an invasive plant treatment depends strongly on the life history of the invasive plant as well as the timing of the fire. Depending on these variables, prescribed fire can affect plant abundance. The effects of the prescribed fire on the co-occurring species may also alter the competitive relationships among plant species and indirectly affect the abundance of invasive plants. Prescribed fires are most effective when the invasive plant is more susceptible to the effects of fire than are the native plants. An example of prescribed fire application is spring burns to control invasive cool-season plants within restored and reconstructed prairies.

The question of prescribed fire use will not be considered in this EA because it has already been addressed in each park's approved FMP. The EA for each FMP was part of a decision-making process and analyzed the impacts of fire on the environment. Those parks that have approved the use of prescribed fire for vegetation restoration and invasive plant treatment will continue to use their approved plans. The issue of fire use in the parks may be a connected, similar, or cumulative action, and must be part of the analysis as such. Therefore, although the question of use of fire is the same in all alternatives, it will be analyzed as a potential cumulative impact with each alternative.

2.0.2 Compliance with Regulatory Measures and Policies

Each of the alternatives will abide by all laws, regulations, mandates, and policies relating to actions proposed in this document. All alternatives conform to applicable state and local laws. The parks in this project are located in eight states, each of which has legislation that controls pesticide use and identifies noxious weeds. Cities and counties may have established local ordinances that regulate pesticide use, air quality controls, and other environmental conditions within their jurisdiction. Under all alternatives, each park will review all applicable state and local regulations on a regular basis.

2.0.3 Planning

Each of the alternatives will require that parks indertake some level of NEPA and National Historic Preservation Act of 1966 (NHPA) documentation based on specific projects detailed in work plans. This would include all proposed actions that have any chance of cultural resource impact, such as soil disturbance or restoration in a cultural landscape. The parks are required to complete their own NHPA, Section 106 (NHPA §106) compliance under each alternative, including consultation with the State Historic Preservation Office (SHPO) or the Tribal Historic Preservation Office (THPO), as applicable.

2.0.4 Best Management Practices Common to All Alternatives

Invasive plant management will follow all laws, regulations, and policies as previously stated. Similarly, actions implemented within each park will remain consistent with that park's policies, mission, and restrictions, remaining sensitive to the authority of the park. Treatments of invasive plants will be done with applicator, non-applicator, and environmental health and safety as the highest priority. All OSHA standards will be strictly followed. All equipment operators and pesticide applicators will be properly trained and meet the standards set by EPA, federal, state, and local governments, and the NPS.

2.0.5 Monitoring and Record Keeping

The Network has protocols in place for long-term monitoring of invasive plants and plant communities. Data from Vital Signs monitoring will be used to determine overall effectiveness of the invasive plant management in each park. The Network schedule appears in Table 2.0.5. The Vital Signs monitoring will also assist managers in determining whether management actions, including invasive plant management, adversely affected natural resources. Further study may be required to identify causes of changes in resource conditions.

2.0.6 Safety and Training

Safety of the public and NPS employees is the highest priority of the invasive plant management program. An emphasis on safety and health extends to the protection of applicators and non-applicators, as well as public and private property. All participants in treatment actions will have the appropriate PPE and will use that PPE while engaging in management actions. A Health and Safety Plan and a Training Plan are included in Appendix G. All NPS operators of mowers, chainsaws, and other power equipment must be trained and certified as required by NPS policy. All pesticide applicators will be certified in accordance with EPA requirements. Actions taken by contractors must meet all OSHA standards, as well as state, local, and EPA standards, when applicable.

Table 2.0.5 Vital Sign and other monitoring that remains the same for all alternatives

	Park Monitored														
	ARPO	**BUFF**	**CUVA**	**EFMO**	**GWCA**	**HEHO**	**HOCU**	**HOME**	**HOSP**	**LIBO**	**OZAR**	**PERI**	**PIPE**	**TAPR**	**WICR**
VITAL SIGNS MONITORING															
Wildlife species as indicators of landscape conditions															
Breeding birds and habitat	**1 in 4 years**			**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**		**1 in 4 years**		**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**
Fish		Annual		**1 in 4 years**	**1 in 4 years**	**1 in 4 years**		**1 in 4 years**			Annual		Annual	Annual	**1 in 4 years**
Bats		Park initiated [1]	Park initiated [1]								Park initiated [1]				Park initiated [1]
Deer	Annual		Annually - park initiated									Annual			Annual
Rare species	Park initiated [1]										every 2-4 years		Annual	Annual	
Vegetation community indicators															
Invasive species	**1 in 4 years**		**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**		**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**
Forest community				**1 in 4 years**				**1 in 4 years**	**1 in 4 years**	**1 in 4 years**		**1 in 4 years**			**1 in 4 years**
Grassland community				**1 in 4 years**	**1 in 4 years**	**1 in 4 years**		**1 in 4 years**					**1 in 4 years**	**1 in 4 years**	**1 in 4 years**
Wetland community			every 2-4 years												
Rare species (plants)													Annual		Annual
Water quality indicators (see also fish monitoring)															
Aquatic invertebrates		every 2-4 years	Park initiated[1]	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**		**1 in 4 years**			**1 in 4 years**		**1 in 4 years**	**1 in 4 years**	**1 in 4 years**
Water chemistry		Annual	Park initiated[1]	**1 in 4 years**	**1 in 4 years**	**1 in 4 years**		**1 in 4 years**	**1 in 4 years**	**1 in 4 years**	Annual		**1 in 4 years**	Annual	**1 in 4 years**
Wetland assessment			Annual												

[1] as park funding permits

2.1 Alternative 1 – No Action

The No Action Alternative is a status quo approach that continues established management that each park has taken toward invasive plants. Invasive plant management is based on past project decisions, management plans, and park policies (Table 1.8.0). Park actions rely on park base funds and project funds. The NPS does not implement the activities of a multi-park EPMP in this alternative, but individual parks persist in current practices based on park planning and compliance. General management plans and resource management program plans identify management objectives within the park. Some parks have implementation plans, such as vegetation management plans, that address invasive plant management. Existing plans that provide some guidance for invasive plant management is provided in Table 2.1.0.

Table 2.1.0. Existing plans referencing invasive plant management

Park Unit	Plan Title (see Table 1.8.0 for descriptions)
CUVA	Control Plan for Alien Plant Species, 1990
	Final Rural Landscape Management Program Environmental Impact Statement, 1993
	Riparian Buffer Plan for Proposed Agricultural Lands, 2002
	Wetland Protection Plan for Proposed Agricultural Lands, 2002
	Disturbed Site Restoration Management Plan, 1994 (major and small site plans)
	Wildland Fire Management Plan, 2011
	Degraded Wetland Restoration Plan, 2005
	Invasive Exotic Plant Management Recommendations for CUVA, 2007
	Resource Stewardship Strategies, in progress
EFMO	General Management Plan, in process
	Fire Management Plan, in review 2011
HOCU	General Management Plan, 1997
	Fire Management Plan, 2004
	Integrated Pest Management Plan, 2005
LIBO	Fire Management Plan, 2003
	Report on the Trends in the Tree and Shrub Vegetation 2004
	Forest Restoration: Presettlement, Existing Vegetation, and Restoration Management Recommendations 1989
ARPO	Fire Management Plan, 2004
	Cultural Landscape Report, 2006
	Draft Integrated Pest Management Plan, 2010
HOSP	Fire Management Plan, 2005, update 2011
	New GMP in progress that will address the need to control invasive
	New Cultural Landscape Report (January, 2010) specific to Historic District and few other areas
BUFF	Terrestrial Habitat Management Plan 2006
OZAR	Fire Management Plan, 2004
GWCA	Fire Management Plan, 2004
	Prairie Restoration Management Review, 2009
	Cultural Landscape Inventory, 2010
	Prairie Management Recommendations, 2010
	Prescription Burn History, 1982 - 2010
PERI	Fire Management Plan, 2005

	General Management Plan, 2005
WICR	Fire Management Plan, 2004
HEHO	Prairie Management Plan, 2003
	Fire Management Plan, 2008
HOME	Vegetation Management Action Plan, 2004-2014
	Fire Management Plan, 2009
	Cultural Landscape Report, 2000
PIPE	Fire Management Plan, draft in review, 2009
	Integrated Pest Management Plan, 2009
TAPR	Fire Management Plan, in review
	Cultural Landscape Report, 2004
	Tallgrass Prairie Bottomland Restoration Plan, 2006
	General Management Plan, 2000

2.1.1 Management Actions

This section explains the current state of invasive plant treatment in parks. Information on treatments that are used for each invasive species is located in Appendix B. A synopsis of treatments used in each park is in Table 2.1.1. Treatments are not standardized across parks and techniques are variable.

Table 2.1.1. Synopsis of treatments currently used at each park

Park	Treatment types						
	Cultural	Manual and Mechanical			Bio-control	Chem-ical	Pre-scribed Fire
		Manual	Light equipment mechanical	Heavy equipment mechanical[7]			
ARPO	X	X	X			X	
BUFF	X	X	X	X		X	X
CUVA	X	X	X	X		X	X
EFMO		X	X			X	X
GWCA	X	X	X			X	X
HEHO	X	X	X	X		X	X
HOCU	X	X	X	X		X	
HOME	X	X	X	X		X	X
HOSP	X	X	X	X		X	X
LIBO	X	X				X	X
OZAR	X	X	X	X		X	X
PERI	X	X	X	X		X	X
PIPE	X	X				X	X
TAPR	X	X	X	X		X	X
WICR	X		X			X	X

[7] Heavy equipment in this alternative includes that which could cause negligible to minor, short-term impact in compacting soil or suppressing growth of desirable plants.

Cultural Methods

All of the parks use cultural methods to some degree. In many cases, the sites requiring invasive species treatments are often restorations or reconstructions of a native vegetation community.

Prevention and Early Detection. Prevention of invasive plant infestations is difficult in parks, most of which are small, linear in shape, and/or surrounded by human development or agriculture. While park staff and volunteers keep an eye out for new plant invasions, the Network looks for invasive plants on watch lists on a recurring schedule.

Restoration (Seeding and Planting). As part of restoring native plant communities, many parks reseed restorations and reconstructions that do not have adequate seed banks to recover naturally. Some parks also require that weed-free native seed, mulch, and compost be used in restorations. Seeding and planting are typically conducted following treatments to reduce invasive plants. Restoration may require use of manual and mechanical equipment (see Manual and mechanical).

Manual and Mechanical Treatments

Most of the 15 parks currently use manual or mechanical treatments to manage invasive plants. The most common mechanical treatment used in the parks involves light equipment such as mowers, weed whips, and chainsaws. Some parks use mechanical treatments in concert with other treatments, such as application of pesticide treatment or restoration seeding. For example, stump treatment with pesticide to ensure root kill and prevent suckering follows manual cutting. This particular connected treatment is addressed as a pesticide treatment. Occasionally, seed drills and other large equipment have been employed in restorations (a cultural method) as a connected action that implements the restoration. This use of tools or equipment is considered under manual or mechanical action.

Biological Treatments

Biocontrols are not currently used in parks, but they are employed by other agencies or organizations around and near some parks.

Pesticide Treatments

All parks currently use pesticides to treat invasive plants under their management programs and this practice continues under the No Action Alternative. All pesticides in use are registered by the EPA as general use herbicides. Parks tend to rely on hand-held pump sprayers, backpack sprayers, or small (spread less than 20 feet) boom sprayers, but are not programmatically limited to specific techniques. The list of pesticides in Table 2.1.2 constitutes the chemicals known to have been used recently in the No Action Alternative, but may not be an exhaustive list.

Prescribed Fire Treatments

Eleven of the parks use prescribed fire as a management tool to restore native plant communities and processes, including reducing invasive plant cover. Other parks (e.g., CUVA, HOCU) have approved use of prescribed fire to treat invasive plants in accordance with an official FMP, but have not yet implemented such action. Although all of the alternatives retain prescribed fire as a potential tool for invasive plant management, fire management plans, rather than the alternatives in this document stipulate how, when, or where fire will be applied.

Table 2.1.2. Pesticides currently used in parks. [8]

PARK	2,4-D	2,4-D/Triclopyr	Aminopyralid	Clopyralid	Glyphosate	Imazapyr	Metsulfuron methyl	Triclopyr /	Triclopyr / Fluroxopyr	2,4 – Dichorophenoxyacetic acid	Imazapic	Prometon	Dicamba /2,4-D	Sulfosulfuron
ARPO					X			X						
BUFF	X		X		X			X	X		X			
CUVA					X									
EFMO					X			X						
GWCA			X		X			X	X					
HEHO					X									
HOCU		X	X		X			X						
HOME	X				X			X						
HOSP					X			X						
LIBO			X		X			X						
OZAR					X	X		X						
PERI					X									
PIPE				X	X	X		X						
TAPR	X				X	X	X	X		X	X	X	X	X
WICR					X				X					

[8] Information provided by parks.

2.1.2 Compliance with Regulatory Measures and Policies

Although all parks comply with regulatory measures and policies, the manner of compliance with NEPA and some NPS policies differs between parks, in the absence of a programmatic approach. Those differences will be addressed in this section.

Parks have accomplished compliance through CEs allowed by DO-12, as interpreted in the DO-12 Handbook, Section 3.4.E.2 and 3.4.E.3 (NPS 2009), for most treatment projects. As with all CEs, the proposed treatments must have no measurable environmental impacts, nor require mitigations to ensure no measurable environmental impacts. Measurable impacts are those that the interdisciplinary team completing an Environmental Screening Form (ESF) determines to be "minor" as defined by DO-12 or greater. Negligible impacts are impossible or exceedingly difficult to measure and affect few individuals; they must also be localized in extent, short-term, and have imperceptible or barely perceptible environmental consequences. Any proposed treatments not covered under a CE or other planning document must have additional NEPA documentation of decision, such as an EA or an EIS.

Some existing plans (Table 2.1.0) that include NEPA documentation provide guidance on invasive plant management and implementation actions that may be taken. In addition to the more general NEPA documentation, several individual parks have completed NHPA §106 documentation. Section 106 documentation is required for all federal actions and undertakings in historic sites or cultural landscapes, even those that otherwise may fall under a CE. The Programmatic Agreement of 2008 requires a Streamlined or Standard Review Process to determine if cultural resources are affected. Streamlined Review Process may be used only for certain categories of activities. Removal of invasive species is one of those activities, but a Streamlined Review Process may only occur where a cultural inventory has been completed and an approved cultural resource treatment plan exists. Under the No Action Alternative, individual parks are responsible for all planning and compliance, which may require Standard Review Process.

Additionally, parks make their own request for pesticide use through the NPS Pesticide Use Proposal System (PUPS) software. The PUPS software is the vehicle used for parks to comply with NPS pesticide use policies. This software is accessed by a designated pesticide use coordinator at each park. It not only allows parks to request the use of a pesticide, but it also records the pesticides actually applied.

2.1.3 Planning

As would be expected, the decision process for invasive plant management planning differs among parks. This continues under the No Action Alternative. Each park identifies invasive plants present and determines which have attained levels of infestation that meet action thresholds. Each park must then use existing management priorities to select which species should be managed and where treatments may occur. Several parks have addressed invasive plant management in a general way, as in a GMP, park program-level plan, or implementation plan, such as a vegetation management plan. A few parks have guidance that establishes the management objectives and thresholds for management action. The optimal treatment options are considered, taking into deliberation effectiveness, efficiency, compliance issues, availability of finances and personnel, and most importantly, the impact to the environment. Some parks have

implemented treatment of invasive species as if part of day-to-day park maintenance, and so are limited to those actions consistent with maintenance plans.

Several parks (CUVA, HEHO, HOME, and PIPE) have vegetation management plans that address specific invasive plant management activities. Many parks (ARPO, BUFF, EFMO, GWCA, HOCU, HOSP, LIBO, OZAR, PERI, TAPR and WICR) have developed annual treatment plans for high priority species that implement recommendations from one or more plans or reports, such as a Cultural Landscape Report[9], Vegetation Mapping Program[10], Natural Resource Condition Assessment[11], or other documents. Eleven parks address the use of prescribed fire to restore natural processes and control invasive plants in their fire management plans. Screening for impacts to resources is usually done through the Environmental Screening Form and the NHPA §106 Form (see Appendix D –for blank form examples).

Under No Action, funding remains variable and relies on park base accounts and project funds. Currently, parks for which data are available annually expend between $3,000 and $40,500 on invasive plant management. The majority of these funds provide personnel to plan and execute invasive plant management projects.

2.1.4 Best Management Practices

Mitigations and BPs may be employed by parks, but are not formally directed as a standard for all parks. Some parks contract for treatment services and use a scope-of-work to set best management practices.

2.1.5 Monitoring and Record Keeping

The current standards for monitoring and record keeping related to pest management are detailed in the NPS-77 Reference Manual. Some details for singular projects may be documented in the NPS Project Management Information System (PMIS) or other project reporting systems with acreage reported as a measurable result. Government Performance Reporting Act (GPRA) systems also contain measureable results of completed treatment. The NPS encourages monitoring for effectiveness and impacts of treatment. Currently, the Network monitors invasive plants and vegetation every four years and the fire program monitors vegetation following prescribed fires. Several individual parks have developed geodatabases to document occurrences of invasive plants and to manage treatment records. The parks use PUPS software to propose the use of certain pesticides on park land and to record the actual pesticides applied, rate of application, the acreage on which each was applied, and other environmental and project information. These records are kept within the system and can be accessed in subsequent years.

---

[9] A Cultural Landscape Report is the primary report that documents the history, significance, and treatment of a cultural landscape.

[10] The USGS-NPS Vegetation Mapping Program (VMP) is a cooperative effort by the U.S. Geological Survey (USGS) and the NPS to classify, describe, and map vegetation in national park units.

[11] The Natural Resource Condition Assessment (NRCA) Program established to provide funding and technical assistance to assess resource conditions in national park units.

2.1.6 Safety and Training

Safety and training to encompass invasive plant management projects is the responsibility of each park in the No Action Alternative. Each park procures, maintains, and stores PPE, and it trains personnel for certification as equipment operators and pesticide applicators as needed for implementation of approved actions. Some parks have safety plans and Job Hazard Analyses for invasive plant techniques. Parks sometimes contract for treatment services, but contractors must adhere to all federal laws and regulations for workplace safety and environmental protection.

2.1.7 Education Programs

Education about invasive species impacts and the prevention of infestation and spread occurs to varying degrees within individual parks. Currently, some parks have displays and site bulletins explaining the impacts of invasive species on native communities. Individual parks take responsibility for education in this No Action Alternative.

2.1.8 Collaboration

Numerous individual park projects to address invasive plants have been proposed or undertaken, and some involve partnerships with other agencies, organizations, or stakeholders. The amount of collaboration varies greatly among park units. Some of the land included within the parks is privately owned or owned by other agencies, but collaboration with these owners varies among the parks. Collaboration between parks does not occur without the involvement of the EPMT.

2.1.9 In Summary

The No Action Alternative results in variability in practices used to treat invasive plants across parks. When pesticides are used, an IPM program must be employed. The decision process, level of expertise, and funding available differs among parks. Parks work independently of one another. The activities are funded through a combination of park base funding and project funding. Project funding is not a predictable, nor is it a sustainable funding source.

Under the No Action Alternative, individual parks are responsible for their own planning, consultation, and compliance. Some parks have no or little planning that focuses strictly on invasive plants. This limits the types of actions that parks can take without extensive NEPA documentation.

Under the No Action Alternative, establishing mitigations and BPs are the responsibility of the individual parks. Actions requiring mitigations cannot be implemented under a CE. Parks complete their treatment location tracking and record keeping to varying degrees. The Network Vital Signs data supplement park monitoring and provide insights on long-term management effectiveness, but the amount of monitoring varies by park.

Under the No Action Alternative, all safety and training is the responsibility of the parks. Parks continue the treatment and management of invasive plants independently with little collaboration under the No Action Alternative. Compliance is ultimately the responsibility of the parks under each alternative, but no programmatic NEPA documentation would exist under the No Action Alternative. The programmatic characteristics of a Network-wide collaboration would not occur under the No Action Alternative.

2.2 Alternative 2, Preferred Alternative – IPM

Under Alternative 2, the Preferred Alternative, the Network would use an IPM approach to eradicate, control, or contain invasive plants in the parks. Integrated Pest Management is a science-based decision-making process that guides parks when managing plant or animal pests, including invasive plants. The IPM approach determines a strategy that balances costs, benefits, public health, environmental quality, the significance of a site, and the importance of protecting resources. It also encourages managers to place pest problems in the context of ecological systems and processes (McCrea and DiSalvo 2001). It coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage to resources.

This Preferred Alternative also consolidates expertise, administration, and funding to create a Network invasive plant management program that plans and organizes actions, disperses funds, lends specialized expertise, and coordinates parks to manage invasive plants. This effort is collaborative, involving all parks. Under this Preferred Alternative and Alternative 3, collective exotic and invasive plant management becomes an invasive plant management program.

The roles of park staff and invasive plant management program staff (EPMT) are clearly outlined. Park staff has jurisdiction and responsibility for approving all actions that occur on parks, including finalizing the Letter of Compliance Completion that authorizes implementation. On-the-ground actions may be EPMT directed or park-staff directed, creating two distinct leadership entities:

- Park – actions taken by the park are funded by the park, project funds, or with assistance from the Network program. When the park implements an invasive plant action, it may do so with its own staff, equipment, and procedures. The park is ultimately responsible for implementing the actions in accordance with the completed compliance for that project, whether it is authorized through this EPMP/EA or park planning. The EPMT may assist with field implementation.
- EPMT – actions led by the Network EPMT staff. These actions are developed with park recommendations and are in complete compliance with this EPMP/EA. Any additional compliance documentation needed to implement these actions would be determined and completed by the park. A Letter of Compliance Completion or similar document would precede implementation.

Together, the parks and the EPMT form the Network invasive plant management program. No single team, park staff or EPMT, implements all actions without program collaboration. The program collaboratively provides recommended work plans based on the EPMP/EA and funding.

2.2.1 Management Actions

Integrated Pest Management integrates multiple management practices rather than relying on a single solution, wherever technically and economically feasible, to resolve a problem. All of the treatments described in Chapter 2.0.1, Management Actions, apply to this alternative. Practices under the Preferred Alternative include:

- Cultural methods.
- Manual and mechanical treatments.

- Biological control treatments (i.e., biocontrol).
- Pesticide treatments (i.e., chemical herbicides).
- Prescribed fire treatments (when allowed in the FMP).

Individual treatments or combinations of these treatments would be implemented, as determined appropriate through an IPM process, to manage invasive plants in parks.

Decisions regarding which treatments to employ against invasive plants on national parks must be made within an IPM framework (NPS 2006d). These steps have been organized into a decision-tree that is explained under the heading 2.2.3 Planning. The process includes identification and analysis of the problem, setting priorities, selecting tools, developing annual work plans, and confirming compliance with all regulations and existing NEPA documentation.

Three treatment strategies exist for each infestation that occurs in a park: eradication, control, or containment. The IPM approach determines an appropriate and cost effective management solution for a specific pest situation, while minimizing resource threats and impacts. The EPMT coordinator would work with park managers to focus efforts on the most critical resource threats, such as threats to habitat for rare species or to cultural landscapes.

Eradication is the elimination of the entire population of an invasive species, including any resting stages, in the managed area. Eradication as a rapid response to an early detection is often the key to a successful and cost-effective solution. However, eradication should only be attempted if it is feasible. Eradication efforts are most successful for infestations less than three acres in size. Eradication of infestations larger than 250 acres is largely unsuccessful, costly, and unsustainable (Rejmanek and Pitcairn 2002).

In situations where eradication is not feasible or warranted, control may provide long-term reduction in density and abundance to levels below an acceptable threshold. Suppression of the invasive population below that threshold can tip the balance in favor of native competing species. Under the best scenario, the reduced abundance of the invasive species allows native species to regain ground and even further diminish the abundance.

Containment is implemented when neither eradication nor control are feasible options. Containment aims to restrict the population to a defined geographical range or locations in order to limit its spread. The methods used for containment are the same as those described for prevention, eradication, and control.

2.2.2 Compliance with Regulatory Measures and Policies

Department of Interior Manual, Sec. 517, Integrated Pest Management Policy: Including the Use of Pesticides and Biological Control Agents states that IPM will be included into all Department of Interior 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.*" Similarly, the NPS Management Policies 2006, 4.4.5.2 Integrated Pest Management Program, page 48, states that the NPS conducts an IPM program to reduce risks to the public, park resources, and the environment from pests and pest related management strategies.

All of the compliance and regulatory measures common to all alternatives (see section 2.0.2) would be instituted here. Additionally, the NPS pesticide policies outlined in the No Action

Alternative (see section 2.1.2) would result in the use of the PUPS software system to attain approval for the use of specific pesticides for designated purposes with the Preferred Alternative.

Because there is such a broad range of actions that could be undertaken with this programmatic EPMP/EA, compliance would require the EPMT coordinator remaining up-to-date with changes to federal law. Each park would assist the program in remaining up-to-date with state laws and local ordinances. This would occur easily in those parks providing staff certified in pesticide use, since that training would include familiarizing trainees with changes and additions to pesticide use laws. The use of pesticides is the treatment most impacted by changes to law and regulation.

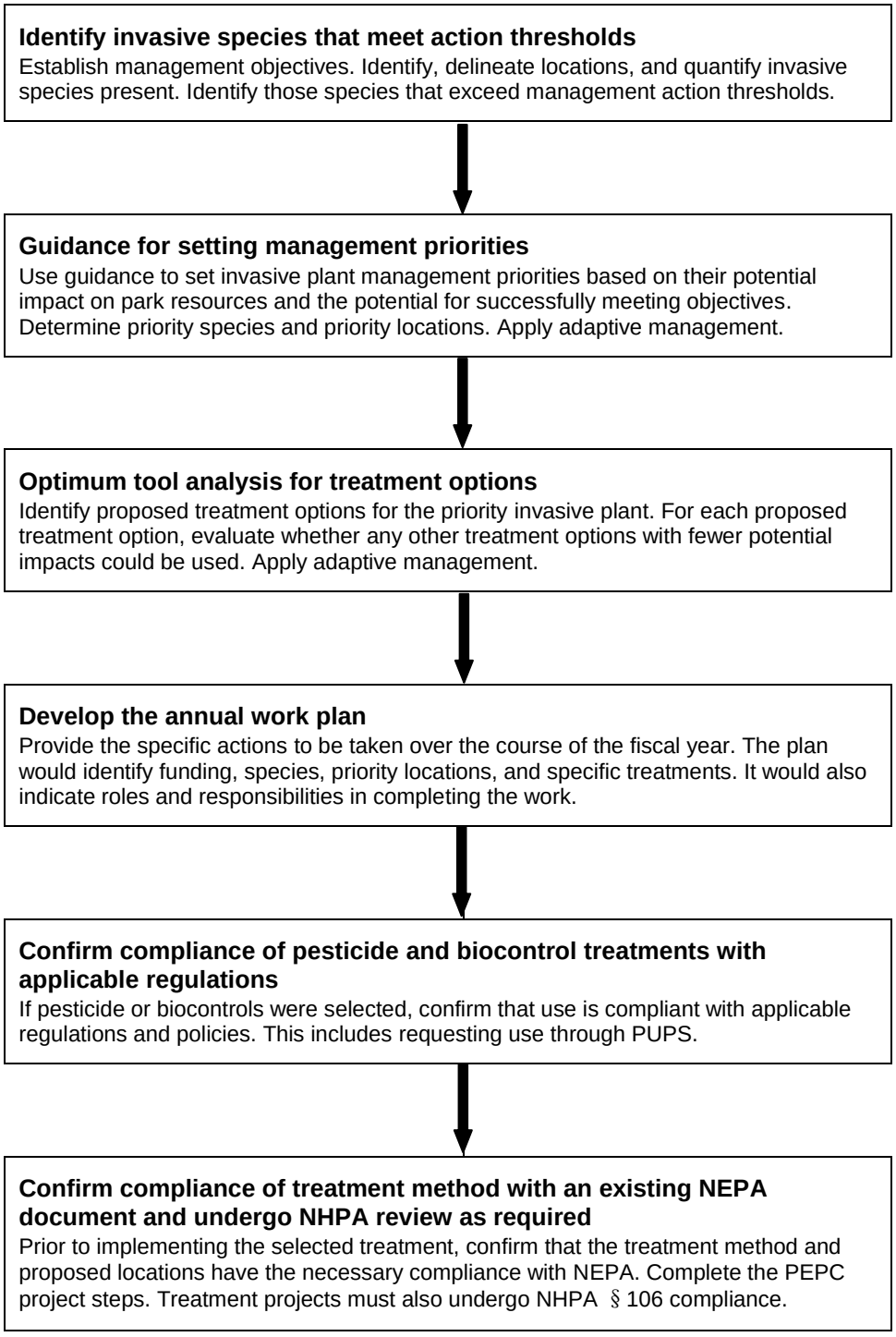
Further compliance for annual work plans could tier from the programmatic EPMP/EA. It would be addressed on a yearly project basis as needed. An ESF would be completed to cover the projects described in work plans. A procedure for checking compliance with regulatory measures would occur as a part of the planning phase (see the section on compliance within section 2.2.3 Planning). If the project actions remain consistent with the existing EPMP/EA and site or environmental conditions remain unchanged, then the routine NHPA §106 form would be the only additional documentation completed by the parks. The NHPA §106 review would be initiated in PEPC and documentation of determination would occur in PEPC as well. Some projects might be done in conjunction with the NHPA §106 filing completed for routine maintenance actions. Any and all ground disturbing activities would require NHPA § 106 review. Similarly, methods and species used in restoration projects would be reviewed with regards to impacts to subsurface archeology and cultural landscape. As a courtesy to park partners, notification should be given to partners about the planned projects for the year.

If a project deviates from the stipulated treatments delimited within this EPMP/EA, it may be necessary for the actions to be analyzed under a new EA initiated by the park. Should the deviation be minor and consistent with this EPMP/EA and the environmental screening does not indicate the need for an EA or EIS, then other NEPA documentation, such as a Memo to File, may be considered.

2.2.3 Planning

This EPMP/EA would provide the for implementation planning for the 15-park coordinated program. Under the Preferred Alternative, a formal decision-making process (Figure 2.2.1) would guide all actions taken, as part of the EPMP/EA. Effective management of invasive plants requires matching management strategies with project objectives. The process would identify invasive plants, determine invasive plant management priorities, identify potential treatments, evaluate the efficacy and environmental effects of the proposed treatments, consider other treatment options, justify selection of a particular course of treatment, and confirm compliance with applicable policies and regulations. Resource managers would also be able to use the results to explain to the public how each of these factors was addressed in selecting management techniques.

Figure 2.2.1. Plant management decision tree overview.



Funding

Funding would continue through a special park-base funding source, dedicated to implementing invasive plant management in all 15 parks. The EPMT would administer a budget, allocated and distributed in accordance with an annual program work plan. Each park's work plan, developed cooperatively with the park's resource manager through a formal decision-making process in Appendix H, would contribute to the annual program work plan. The Network board of directors would approve the Network funded actions in the annual program work plan.

Formal Decision-making Process

The EPMT and resource managers would use the methods described in the Invasive Plant Management Protocol (Young et al. 2007) for the Network and park methods to assess quantitatively the abundance of invasive plants in a park's native plant communities, and to the extent possible, identify temporal changes in the distribution and abundance of those plants. Changes would be assessed with respect to past actions used in invasive plant management or general vegetation management. Adaptive management methods would facilitate prioritization and the decision process. The decision-making process consists of six steps (Figure 2.2.1). An associated decision tree for each step is presented in Appendix H.

Identify Invasive Plants That Meet Action Thresholds

Under the Preferred Alternative, resource managers would establish specific invasive plant management objectives for their park with the EPMT coordinator and establish action thresholds. A management objective is a desired state of the system that the resource manager determines appropriate to reach goals or desired conditions. These management objectives would be developed based on NPS policy, resource management goals for the park, and the extent and type of invasive plant infestations within the park. If the extent and distribution of invasive plants were not known, additional data collection may be required before management objectives or thresholds can be established. Some examples of past invasive plant management objectives established by parks include:

- Manage vegetation to resemble historic site conditions during a Civil War battle.
- Exotic plant cover will not exceed 8% total cover.
- Identify and control occurrences of invasive plants by containing large populations and reducing or eliminating small populations.
- Control intrusions of invasive native trees in habitat for a threatened native plant species.

Management objectives developed by each park would be specific and measurable so that the overall effectiveness of the invasive plant management program can be evaluated. Resource managers should also update short-term management objectives on a regular basis to address the ever-changing invasive plant management issues. Objectives must remain consistent with approved park and program objectives. Success in reaching short-term objectives informs adaptive management strategies.

Once management objectives are established, plant species lists for the park would be reviewed to identify invasive plants. Invasive plants that are not maintained for an identified park purpose and may be eradicated, controlled, or contained if (1) prudent and feasible and (2) the species is considered a pest under criteria in NPS policy (NPS 2006d, page 48, Section 4.4.4.2). Attention

should be given to a species (1) when it has a substantial impact on park resources, and (2) where successful control is expected. These criteria have been adopted as general "action thresholds" for this EPMP/EA. An action threshold is the point at which approved invasive plant management treatments are implemented because of current or potential levels of intolerable impacts to environmental resources.

The EPMT coordinator and resource manager may determine an action threshold met when the species' population may not pose an immediate threat as described above, but would likely reach those levels if not managed at current levels. It may be prudent to treat a small infestation of a species, if trends indicated that the species would meet the stated criteria in the future. Early detection and treatment may result in lower cost and collateral damage than waiting for populations to reach levels that meet the action thresholds. Determining whether an invasive plant meets an action threshold would be done on a case-by-case basis, at the discretion of each park resource manager and the EPMT coordinator.

The EPMT coordinator and resource managers must remain sensitive to cultural landscapes, traditional uses of specific plants or plant communities, and visitor experiences in selecting species for treatment and methods of treating. Both cultivated and non-cultivated species may be historically appropriate or important ethnographic resources. Examples of plants that meet an identified park purpose include:

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

Exotic plants within cultural landscapes that do not pose a significant threat or nuisance to natural areas are exempt from management efforts under the EPMP/EA. These plants would be managed in accordance with NPS and park management guidelines. Determining if species are part of an historic landscape or an archeological feature must be done in consultation with the appropriate cultural resource specialist in the park or regional specialists in the Midwest Regional Office or Midwest Archeological Center (MWAC) of the NPS. Any subsequent treatment of non-native species in a cultural landscape must be done under the guidance of a cultural landscape management plan. Invasive plants that pose a threat or nuisance to resources would be further evaluated to determine whether management is prudent and feasible and whether their management is a priority.

Guidance for Setting Management Priorities

This decision-tree would assist the resource manager in determining management priorities based on potential impacts to park resources and the potential for controlling the invasive plant. Invasive plants that are listed as county, state, or federal noxious weeds are considered a high management priority. In accordance with NPS policies, highest priority would be to manage invasive plants that disrupt, or potentially would disrupt, park resources, purpose, and operations, and impact public health and safety, while having a reasonable expectation of being controlled.

Disruptive species typically have one or more of the following characteristics within a project area:

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

Low priority would be assigned to innocuous plant species, species in project areas where impacts to resources are limited or minor, or where control is not feasible. Innocuous species do not significantly harm park resources, do not invade native ecosystems without human-caused disturbance, and their populations generally do not expand within the park. Some innocuous species may invade native ecosystems, but do not displace native species to a significant extent. Low priority may also be ascribed to locations that are hard to access, thus reducing feasibility of cost effective treatment.

The results of either the qualitative or the quantitative rankings would be used to determine relative management importance. Characterization of the potential problem may be based on invasiveness rank (I-rank), calculated using a protocol and a data form developed by Nature Service (Morse, et al. 2004). The ecological impact rank characterizes the effect of the plant on ecosystem processes, community composition and structure, native plant and animal populations, and the conservation significance of threatened biodiversity. General management difficulty ranks would be assigned based on the resources and time generally required to control a plant, the non-target effects of treatment on native populations, and the accessibility of invaded sites. Ranks are given as high (H), medium (M), low (L), insignificant (I), unknown (U), or a combination of ranks.

Project areas would be determined using maps of important resources at a park and data on the distribution and abundance of invasive plants. Parks may propose project areas based on other data sources or local knowledge. Project areas would be mapped and maintained in a geodatabase (see Data Management System, 2.2.5 Monitoring and Record Keeping). The delineation of project areas recognizes that specific resources or environmental conditions affect decisions on prioritizing management actions. For example, an exotic plant may be disruptive in native ecosystems that are highly disturbed, but may be innocuous in a healthy native ecosystem.

Optimum Tool Analysis for Treatment Options

Planning for treatment projects must consider not only the plant species and project area prioritized for control, containment, or eradication, but also the treatments that can be used within proposed project areas. The strategy for implementing the IPM program proposed in this Preferred Alternative includes selection of the Optimum Tool.

The Optimum Tool Analysis decision tree identifies a proposed treatment and assesses whether it represents the most cost-effective option, resulting in fewest impacts. The Optimum Tool analysis is based on the concept of Minimum Requirement Analysis that is used by the NPS to evaluate activities in wilderness areas. An Optimum Tool is a treatment or activity, necessary to accomplish an essential task, which uses the least intrusive technique or tool that would achieve

the management objective. This should not be confused with equipment or methods using the simplest available technology.

At the beginning of Optimum Tool decision tree, the resource manager would identify a proposed treatment. The proposed treatment must be feasible, given potential costs, cost-effectiveness, available resources, potential impacts and effectiveness, and applicable regulations and policies. The next step would be to consider whether there are any other treatment options, techniques, or tools available that would result in fewer impacts than the proposed treatment, given potential costs, available resources, impacts, and effectiveness. If there were no feasible options available, the resource manager would select the proposed treatment. However, if the resource manager identifies another option that has fewer impacts than the proposed treatment and it is feasible, the new option proceeds through the Optimum Tool Analysis.

Resource managers monitor treatment areas to determine whether management objectives established during the initial planning stages are met. If management objectives were not met, the selected treatment may be modified, or other treatments may be considered through adaptive management. Adaptive management [*516 Departmental Manual 4.16*] is a system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and facilitating management changes to ensure that objectives are met or to reevaluate objectives for feasibility. The NPS must use adaptive management to comply fully with *40 CFR*, which requires a monitoring and enforcement program to be adopted, where applicable.

The Preferred Alternative does not restrict the use of individual tools. As new tools become available, they would be considered under the Preferred Alternative in the Optimum Tool Analysis.

Annual Work Plan

In consultation with parks, the EPMT coordinator would produce an annual work plan based on a completed project decision process for each park. The annual work plan outlines the short-term projects to be completed that contribute to management objectives. Projects would be selected to maintain the long-term, sustainable strategy intended to successfully management invasive plant populations. Annual work plans also budget for the projects to be undertaken and determine what can be completed feasibly and practically with the leveraging of funds through collaboration and partnerships. The annual work plan would be the basis for annual compliance documentation, when required. It would contain all of the information parks need to submit the project for NHPA §106 review.

Confirm Compliance for Pesticides and Biocontrol Agents

If pesticides or biocontrol agents were selected, the resource manager would confirm that this treatment is justified and compliant with NPS policies using this decision tree. According to NPS policies (NPS 2006d: page 49), a designated IPM specialist must first determine that the use of a pesticide or biocontrol agent is necessary. In addition, all other treatment options considered must be either not acceptable or not feasible. If the use of pesticide or biocontrol agents had not been determined necessary, or if there are other treatment options that are acceptable or feasible, the resource manager returns to the Optimum Tool Analysis to consider these treatments further.

Pesticides: In accordance with NPS-77 (*Natural Resource Management Guidelines*, NPS 1991), only those pesticides that are registered by the EPA can be used. Pesticides must also be used in accordance with product labels. Pesticides having use restrictions would be used only for sites that meet the conditions specified on the product label. General use pesticides would be used whenever possible.

If the pesticide were registered with no existing site conditions restricting use, the next step would be to submit a pesticide use request to the regional and/or national IPM coordinator. Pesticide use requests that involve any of the following actions must be approved by a national IPM coordinator (NPS 1991):

- Aquatic applications or situations in which the applied pesticide could reasonably be expected to get into waters or wetlands.
- Applications that may affect rare, threatened, or endangered species or associated critical habitat.
- The use of restricted-use pesticides as defined by the EPA.
- Treatment areas are equal to or larger than four sections (2560 acres) of land.

In addition, a draft of DO-77-7 (in preparation) stipulates that the following actions must also be approved by a national IPM coordinator:

- Any aerial application of pesticides [not a part of this Preferred Alternative].
- Application on area greater than 400 contiguous acres (as opposed to the current 2,560 acres permitted under existing NPS-77).

The regional IPM coordinator may approve other pesticide use requests that do not fall into these categories. Once the pesticide use request has been approved, the resource manager may purchase pesticides. However, according to NPS policy, no pesticides may be purchased unless it is projected that the product would be used within one year from the date of purchase (NPS 2006d: page 49).

A pesticide-use proposal form (PUPS request form) is used for screening of the risks associated with a selected pesticide for the intended use. The form provides the regional IPM coordinator with information that may be used in the pesticide approval process in accordance with NPS policies. Because of this comprehensive pesticide-use request system, each proposed action is assessed by a specialist in pesticide law, impacts, and efficacy. This EPMP/EA does not examine a comprehensive or inclusive list of pesticides in the Preferred Alternative, but proposes the use of the most appropriate pesticides available in accordance with label directives and IPM coordinator approval.

Biocontrol Agents: Only biocontrol agents that have been approved by APHIS for release would be considered for use under the Preferred Alternative. The next step would be to submit a biocontrol use request to the regional and national IPM coordinators. Once the biocontrol use request has been approved by the national IPM coordinator, the EPMT coordinator or resource manager can then identify a procurement source for the biocontrol agents. If biocontrol agents were to be obtained from another state, a permit must be obtained from APHIS. Transportation and handling of biocontrol agents would comply with any conditions specified in this permit.

At this time, no specific biocontrol agents are in use or proposed. Biocontrols are being used by partners near or around some parks. This is the case for Missouri parks, where the state has

implemented an active biocontrol program for spotted knapweed, using root weevil (*Cyphocleonus achates*) and seed head weevils (*Larinus minutus, Larinus obtusus*). Should this program prove successful, it would strengthen the consideration for use within Missouri parks. This EPMP/EA would not take a leadership role in biocontrols, but would work cooperatively with partners when the biocontrols prove to be safe, effective, and feasible options. Therefore, in the interests of maintaining a true IPM program, this Preferred Alternative would consider the use of biocontrol agents in the decision process. If biocontrol were selected, the regional and/or national IPM coordinator, regional NEPA coordinator, park superintendent, and EPMT coordinator would determine whether this EPMP/EA has adequately analyzed impacts of its use.

Confirm Compliance of Proposed Treatment Method with NEPA through PEPC

Completion of the NEPA process in PEPC would ensure that all NEPA compliance has been completed before actions are initiated. Appendix H would guide park managers through confirming compliance with a flow chart for NHPA compliance and one for NEPA compliance. After entering a project in PEPC (see *Annual Work Plan*), a park would use an ESF (PEPC version is in Appendix D) to identify potential impacts to the environment and to identify compliance documentation required to take the proposed actions. Public scoping or agency consultation, if desired by the park, may follow. The ESF would also assist the park in confirming that the selected treatment method has been considered in the EPMP/EA or under another current and up-to-date environmental document for the proposed use.

Park-specific annual work plans that include invasive plant management treatments and associated potential impacts considered in this EPMP/EA may not require additional compliance with NEPA after completion of the ESF. However, resource managers and the EPMT coordinator would consult regularly with a regional NEPA Compliance Specialist to confirm that this EPMP/EA or other existing documents have adequately addressed any NEPA requirements. The best management practices that lessen risk of potential impacts would be identified and recorded in PEPC.

If the proposed treatment method had not been addressed in this EPMP/EA or in another NEPA document, or if the document is out-of-date, preparation of a new NEPA document would be required. Preparation of additional NEPA documentation may also be required in cases where the proposed treatment could not be covered using CEs that tier from this or another approved plan. Treatments that have potential impacts and that are not reasonably a part of this EPMP/EA, or that may have cumulative impacts with this plan, would require further planning and analysis, including NEPA documentation.

If the selected treatments comply with the EPMP/EA or another NEPA document, the park would document this compliance in PEPC and file hard copies of the appropriate documents for future reference. Once the park superintendent becomes satisfied that compliance is complete, he or she would then sign the Letter of Compliance Completion in PEPC or by hardcopy for the work plan specific to that park and forward a copy to the EPMT coordinator. No action would be taken by the EPMT Program without a Letter of Compliance Completion.

Annual work plans would be subject to NHPA §106 review. The park would complete this activity because of the ongoing relationship that each park shares with its SHPO or THPO. Ultimately, Superintendents are responsible for compliance with 36 CFR 800 by satisfying the NHPA §106 Programmatic Agreement. The annual work plan would contain the information

needed for this review. A Streamlined Review Process may be possible in the case of invasive plant management if the cultural resources have been inventoried in the area of the project and if a cultural treatment plan that allows the proposed actions has been completed.

In addition to NEPA, other federal, state, and local laws may have information requirements that overlap with NEPA. The compliance review should also confirm that proposed treatment has addressed these other requirements (section 2.0.2 Regulatory Measures and Policies).

2.2.4 Best Management Practices

A number of conservation measures have been developed as best management practices to lessen potential impacts to the environment. Conservation measures fall into two categories, (1) BPs that are employed at all times as standard operations, and (2) mitigations that are employed when certain sensitive resources or other special conditions exist. Sensitive resources, special conditions, and corresponding mitigations and BPs would be included in each annual work plan by reference number. The following best management practices are not an exhaustive list, but rather, the list is dynamic, growing as resources are better understood and techniques improved.

Best Practices

One of the most important BPs is for the EPMT coordinator to remain up to date on developments and improvements in the tools and techniques available for the safe management of invasive plants. Standard best practices would be incorporated into treatment selection and implementation. Reference numbers would be used to call attention to specific best practices within an annual work plan that should be reviewed.

Mitigations

Mitigations are actions that address specific resource concerns or environmental conditions. Treatments may be excluded from some areas because of the potential impact on resources. See Table 2.2.1 for examples of buffers and exclusions. All pesticide mitigations on labels would be followed (Appendix X.). An extensive list of mitigations appears in Appendix X. These mitigations would be used in treatment selection, development of annual work plans, and compliance documentation. They would be implemented in the field.

Table 2.2.1. Treatments excluded as mitigation or best management practice when certain resources are present.

	Treatment Type					
		Manual and Mechanical				
Sensitive Resources	**Cultural**	**Manual**	**Power tools Mechanical**	**Heavy-equipment Mechanical**	**Biocontrol**	**Pesticide**
Aquatic resources present	X	X	X	B	X	B or E
Archeology present	X	B	B	B or E	X	B or E
Archeology potentially present	X	X	X	E	X	X or B
Classified structures or NRHP structures	X	X	B	E	X	B
Cultural landscape	X	X	X	X	X	X
Ethnographic resources	X	X	X	B	X	B
Fences (culturally significant)	X	X	B	E	X	B
Karst features	X	X	B	E	X	B
Rare animal species	X	B	B	E	X	B
Rare plant species	X	B	B	E	X	B
Rare vegetation communities	X	X	X	B	X	X
Road (culturally significant)	X	X	X	B	X	X
Specimen trees; witness trees	X	X	B	E	X	B
Springs	X	X	X or B	B	X	E
Wells (historic or modern)	X	X	X	B or E	X	B or E

X = potentially would be used in accordance with this plan; all restrictions or mitigations apply

E = excluded at immediate site of resource; there may be a buffer added around the location

B = buffer zone around sensitive area to prevent adverse impact

2.2.5 Monitoring and Record Keeping

Monitoring would be a critical feature in determining effectiveness of treatment. The record keeping and monitoring currently in place for the parks would be continued (Table 2.0.5). In addition, the EPMT coordinator would ensure the accurate collection of information needed to evaluate program effectiveness for projects implemented by the EPMT. The EPMT coordinator would report measurable accomplishments and treatments employed in a program evaluation annually. The evaluation would lead to a plan as to how those areas would be maintained in subsequent years. Parks would also have the report as the basis for GPRA reporting. Data would be maintained primarily in a pesticide use log and a data management system (geodatabase).

The pesticide use log summarizes information on the dates, weather conditions, products, and amounts of pesticides applied in a particular project area. This information would be used to complete annual PUPS reports.

The data management system would consist of two geodatabases: a project planning geodatabase and a treatment geodatabase. The project planning geodatabase would consist of polygons that delineate documented locations of invasive and exotic plants, potential project areas, and areas requiring mitigations. The EPMT would also develop a treatment geodatabase and would support data collection in the field by providing parks with GPS units, training, and technical assistance as requested. The geodatabase would be populated with locations of areas treated, invasive plants treated, plant cover estimates, pesticides applied (if used), and application methods. Data may be used, along with regularly collected monitoring data (Young et al. 2007), to plan projects, document activities, and assess the effectiveness of previous treatments. If management objectives were not met, the selected treatment may be modified, or other treatments may be considered through adaptive management.

Adaptive management acknowledges that understanding about natural resource systems may be incomplete and allows for recalibration of management techniques over time. Evaluation is critical to adaptive management, where actions are predicated on a structured, iterative process of decision making that relies on monitoring and data analysis to improve future management decisions. The data would be well managed and accessible to decision-makers. Statistical analysis of change in community structure or other measures of success would be made.

2.2.6 Safety and Training

Safety and training would be the responsibility of the EPMT coordinator, whenever EPMT staff implements a treatment. When the park implements treatments independently, the park would use its own safety procedures and standards for training and certification.

The EPMT coordinator would integrate occupational safety and health into all activities and functions of EPMT in compliance with Director's Orders 50A and 50B. Job Hazard Analyses would be conducted to minimize the occupational risks to employees and ensure that appropriate PPE is identified. Prior to pesticide treatment in a park, the EPMT coordinator would discuss public safety issues with park representatives to coordinate trail closures or temporary sign installation. All EPA pesticide label specifications, restrictions, requirements, and mitigations would be followed. The OSHA standards for using power equipment and chemicals in the work environment would be strictly followed during the course of this program.

Training would be required to ensure program safety and effectiveness. The EPMT coordinator would ensure that all EPMT employees are trained and certified to the level needed in order to operate equipment safely, such as UTVs, chainsaws, brush cutters, etc. The EPMT coordinator would oversee appropriate pesticide applicator training for EPMT staff involved in pesticide use. Team members would attend additional training as assigned by the EPMT coordinator.

The EPMT coordinator would make certification status and pesticide use logs available for inspection by state officials upon request. The EPMT coordinator would receive concurrence from parks that approval by regional IPM coordinator had been given for all pesticides utilized by EPMT staff. The MSDS sheets and EPA labels would be with the EPMT in the field during the pesticide application.

2.2.7 Education Programs

One of the benefits of standardizing invasive plant management in parks, as outlined in the Preferred Alternative, is that park staff can effectively explain the standardized practices to the public and to park employees. Education would help create an understanding of invasive plant management and promote acceptance of needed actions.

Internal training and awareness programs would educate park employees and volunteers about the early detection watch list for their park. Parks would be encouraged to complete seasonal staff training with an overview of the EPMP/EA to help staff and volunteers understand the decision-making process, treatments in use, justification for their use, and protection of sensitive resources. Reports provided to the park would interpret and communicate the results of the latest actions to resource managers, interpreters, maintenance personnel, and other park personnel. Resource summaries produced by the Network would help staff understand status and trends of resource conditions.

2.2.8 Collaboration

Collaboration of invasive plant management activities with other entities is a key component of the Preferred Alternative, particularly collaboration among Network parks. Collaboration would be an ongoing process that would build consensus with interested parties including adjacent landowners, decision-makers, technical experts, and the public. Several types of collaboration would be conducted under the Preferred Alternative, including:

- Collaboration between NPS resource managers and invasive plant management experts from both inside and outside the NPS.
- Collaboration among the parks, public, and neighboring landowners.
- Collaboration among parks within the Network.
- Collaboration with local, state, and federal officials involved in invasive plant management, with particular attention to the Cooperative Weed Management Areas.

Each year, parks and EPMT coordinator would collaborate to develop a list of projects for the annual work plan. The projects would attempt to leverage funding and create an economy of scale by:

- Clustering certain treatments for parks with similar needs, to best utilize human resources to complete the projects.

- Sharing equipment and personnel among parks.
- Administering outsourced projects, such that multiple parks may benefit.
- Sharing trained staff and training park staff to maintain a monitoring protocol that shows the effectiveness of treatment.

This Preferred Alternative would result in a cooperative, multi-park program for addressing invasive plant management issues coordinated through the EPMT program. The parks would work cooperatively to address invasive plant management issues in all 15 parks. Under this arrangement, the Network board of directors ensures that all funds allocated to a park would be used for invasive plant management purposes. To the extent possible, park managers would be encouraged to proactively leverage available funds and work with local partners, neighboring landowners, and volunteers.

A Cooperative Weed Management Area (CWMA)[12] is a partnership designed to promote collaboration and education in the management of invasive species in natural areas and agricultural lands. Agencies and weed management experts share experiences, while also informing the public about the importance of preventing the escape and distribution of weed plants into natural areas. Parks within a CWMA would be encouraged to participate in their CWMA. Currently, the following parks lie within CWMAs:

- EFMO – Northeast Iowa Cooperative Weed Management Area
- HEHO – Hawkeye Cooperative Weed Management Area
- HOME – Five Rivers Weed Management Area

The Network found that parks are most likely to use visitor education programs and materials developed by their own interpreters. Therefore, the EPMT would provide support and ideas for development of educational materials at the park level, but would leave visitor awareness and public education program development to the parks. Some parks may also organize volunteer efforts to provide the public with "hands-on" opportunities to become involved in invasive plant management.

2.2.9 In Summary

The Preferred Alternative differs from the No Action Alternative in procedural and organizational structure of invasive plant management, and not in the actual treatments proposed. The Preferred Alternative is a strategic, standardized, systematic, and collaborative IPM program. Systematization would implement project-planning tools that assist park managers and EPMT staff in planning and assessing individual projects on each park. This differs from the No Action Alternative, where processes for selecting management actions are park-specific.

Under the Preferred Alternative, invasive plant management would include the entire range of control measures available. Inclusiveness and integration of techniques are goals of the NPS IPM program. Currently under No Action, using CEs and existing management plans, individual parks have not always been able to consider all control measures. Categorical Exclusions should

[12] CWMAs are a local organizations, but program information is at http://www.invasiveplantcenters.org/cwmas.html (9-13-2010).

only be used when relatively small numbers of invasive plants are removed and such removal is non-controversial and results in only minor impacts (NPS 2009). This restriction can limit available treatments.

The Preferred Alternative would remove some responsibility for compliance from the parks by creating an over-arching EPMP/EA, as the NEPA documentation for an invasive plant program. The parks would still be required to complete NHPA §106 compliance on individual work plans as needed. This EPMP/EA would provide parks a much stronger basis for responding rapidly to control incipient invasive plant populations. The programmatic approach may allow the use of a Streamlined Review Procedure in NHPA §106 compliance in some cases.

Dedicated funding would support the program and allow treatment strategies to be sustained over time. Addressing the invasive plant problem requires a significant resource commitment for planning, training, compliance, and operations that may not be available to individual parks under the No Action Alternative. Sustained funding under the Preferred Alternative would support long-term strategies to guide short-term project objectives that achieve goals. In the No Action Alternative, invasive plant management at many parks can only react to immediate problems due to uncertain funding and the need to address only existing threats to resources.

In the Preferred Alternative, more education and collaboration would likely occur than in the No Action Alternative.

2.3 Alternative 3 – No Pesticides, Biocontrol Methods, or Heavy Equipment

The use of pesticides and biocontrols can be controversial in a national park. Stakeholders in a park may feel strongly about managers employing plant control methods that do not exceed the limitations applied in the production of organic foods. This approach is often seen as environmentally friendly. The NPS mission of preservation of resources is consistent with that which is popularly termed "environmentally friendly" management. Biocontrols, although sometimes a part of organic food production, can be controversial because of fears that release of certain biocontrol agents could adversely affect desirable plants. Similarly, heavy equipment, such as vehicles and implements that can cause moderate or long-term damage from soil compaction or disturbance can be controversial. These three treatment types have the highest potential for environmental consequences, when not properly used with BPs and mitigations.

Alternative 3 will outline the restrictions of what may be considered for use in the eradication, control, or containment of invasive plants within the framework of a very conservative tactical approach to invasive plant management. This alternative cannot be considered an IPM option, because it removes several potential treatments from consideration without the scientific evidence that they are always inappropriate as a feasible, cost effective, efficient control measure with low environmental risk.

2.3.1 Management Actions

Treatments proposed in the Preferred Alternative would be used in this alternative with the exception of all heavy-equipment, pesticides, and biocontrols, which are excluded from potential use. This alternative differs from the No Action Alternative, which relies heavily on pesticide use, and the Preferred Alternative, which frames an IPM approach to management. There are no parks using biocontrols at this time, nor does the Preferred Alternative propose a specific biological agent, but this alternative excludes further consideration of all use of biocontrols under this compliance documentation. Heavy equipment, used in restoration projects historically at some parks and a potential tool with restrictions under the Preferred Alternative, would be excluded entirely in this alternative. Earth moving equipment and equipment with greater than adverse moderate, short-term, local impacts are excluded from both Alternatives 2 and 3, but not from the No Action Alternative.

2.3.2 Compliance with Regulatory Measures and Policies

All compliance and regulatory measures would apply to the treatments used, as is the case in the other alternatives. Compliance with regulations and policies would be easier than in the other alternatives, because highly regulated treatments, such as pesticides, biocontrols, and heavy machinery, would not be a part of the actions in this alternative. Compliance would be accomplished through this EPMP/EA, and the individual parks would complete subsequent NHPA § 106 compliance for annual work plans.

2.3.3 Planning

Planning would be through this EPMP/EA with annual work plans derived from this program plan, identified invasive plant problems, park needs, and the results of monitoring. The planning

process would be the same as for the Preferred Alternative with the exception of removal of pesticides, biocontrols, and heavy equipment from the Optimal Tool Analysis. It differs from the No Action Alternative, where individual park planning drives the treatment decisions. The planning process would be strategic, systematic, and standardized as in the Preferred Alternative.

2.3.4 Best Management Practices

All mitigations listed in the Preferred Alternative with applicability to actions in this alternative would be applied. Best practices listed in the Preferred Alternative would be used in this alternative as applicable, as well. Procedures for implementing best management practices are the same as those in the Preferred Alternative.

2.3.5 Monitoring and Record Keeping

Monitoring would be done by the EPMT program with park managers contributing short-term monitoring for adaptive management purposes. The EPMT coordinator would take responsibility for maintaining the record keeping through a geodatabase on completed treatment. Monitoring and record keeping would be the same as for the Preferred Alternative. There would be no need for using the PUPS system to record pesticide use.

2.3.6 Safety and Training

Safety and training would meet all requirements and policies of the NPS, as with each of the other alternatives and would be the responsibility of the EPMT for all EPMT implemented actions, but would be the responsibility of the park when EPMT personnel are not implementing the actions. Personal protective equipment, training, and operator certifications would be needed for manual and mechanical treatment, but not for pesticides or heavy equipment, since they would not be used.

2.3.7 Education Programs

Education programs would be similar as for the Preferred Alternative. Pesticide use, biocontrols, and use of heavy equipment would not be presented as treatments used in the parks. Therefore, the amount of specific education, covering the efficacy of these techniques, may reduce the need for education in Alternative 3 than for the other alternatives.

2.3.8 Collaboration

Collaboration would exist between all participating parks as with the Preferred Alternative. This differs from the No Action Alternative, where collaboration between parks is rare. The EPMT coordinator would be a central point of collaboration among parks and with other land managers, invasive plant management experts, and cooperating agencies in Alternatives 2 and 3. The No Action Alternative does not exclude inter-park collaboration, but rather the EPMT could facilitate collaboration in the Preferred Alternative and Alternative 3.

2.3.9 In Summary

Alternative 3 would resemble the Preferred Alternative in its programmatic and strategic approach, using a decision tree to select actions. It would exclude three areas of treatment or technique that are available to the No Action Alternative and the Preferred Alternative:

pesticides, biocontrols, and heavy equipment. Therefore, this alternative is not an IPM program. This alternative would place responsibilities for funding, planning, and collaboration activities on the program, as with the Preferred Alternative. In both the Preferred Alternative and Alternative 3, more education and collaboration may occur because of the15-park program programmatic approach, than in the No Action Alternative that promotes independence of parks. Parks and EPMT would share responsibilities for safety and training, depending on who implements the treatment, but it is likely that the existence of the invasive management program will ensure availability of trained staff to implement treatment.

2.4 Alternatives Considered and Rejected

A number of alternatives were developed based on the results of internal and external scoping (See Appendix E – Civic Engagement and Consultation). Alternatives are different ways to meet the purpose and objectives, while resolving needs or issues of environmental concern. The following section discusses those alternatives considered but eliminated from further study. Alternatives were eliminated from detailed study because they did not meet one or more of the following criteria.

1. The alternative must be consistent with NPS management policies and guidelines.
2. The alternative must respond to the purpose of and need for action.
3. The alternative must be feasible from a technical and economic standpoint, while remaining environmentally responsible.
4. The alternative must be compatible with the policies and regulations of other agencies and jurisdictions.
5. The alternative must be capable of being implemented in a timely manner because the purpose of and need for action is immediate.

2.4.1 Alternative 4

Stop all invasive plant management activities within parks

This alternative was eliminated from detailed study because stopping all invasive plant management activities within parks is inconsistent with E.O. 13112 on Invasive Species, the Federal Noxious Weed Control Act, NPS Management Policies 2006, NPS resource management guidelines (NPS-77 and draft DO-77), and state noxious weed laws. This alternative also disregards the resource management objectives at each park. Therefore, cessation of invasive plant management is not considered because it does not meet criteria #1, #2, and #4.

2.4.2 Alternative 5

Use prescribed fire as the only invasive plant management treatment

Most of the parks had an active prescribed fire program for at least 10 years. Within this time, parks have found that fire assists in controlling some species of invasive plants, but does not adequately control all species. Currently, fire is the primary treatment for bluegrass (*Poa* spp.) and smooth brome. One park (HOCU) does not use prescribed fire, because of archeological concerns. Prescribed fire alone has been dropped from consideration because it cannot achieve the goals of the program, and so prescribed fire alone does not meet criteria #1, #2, and #4.

2.4.3 Alternative 6

Exclude prescribed fire as management technique

The question of prohibiting use of prescribed fire will not be considered in this EA. Each park has an approved FMP with its own EA. Each FMP has addressed the use of prescribed fire within the respective park and the EA that was part of that decision has analyzed the impacts of fire on the environment. Those parks that have approved the use of prescribed fire for the

purposes of vegetation restoration and invasive plant control will continue to use their approved plans. Fire use in the parks may be a cumulative impact and must be part of the analysis as such within this EPMP/EA. Therefore, although the question of exclusion of fire will not constitute an alternative, fire will be considered as a potential cumulative impact in each alternative.

2.4.4 Alternative 7

A program of only spot spraying

Integrated Pest Management is a science-based decision-making process that guides park managers when selecting a treatment and delivery method. The IPM approach determines the most appropriate and cost effective management solution for the specific pest situation. It considers impacts to the environment and weighs that against potential damage to resources from invasive species. Broadly limiting application methods for pesticides limits the efficiency and efficacy of the IPM program with no proven benefit to resources, employee and visitor safety, or the environment. Each park has the option of limiting application methods and restricting timing to meet their individual needs, concerns, and policies. Limiting pesticide application methods across all parks has been dropped from further consideration, because it impedes IPM methods that are required by NPS policy without providing significant benefits across all parks and so does not meet criteria #1, #2, and #3.

2.4.5 Alternative 8

A program using only general use pesticides

The IPM approach determines the most appropriate and cost effective management solution for the specific pest situation. Removing options from the suite of possible tools employed by an IPM program reduces the effectiveness of treatment. Since IPM is the only scenario under which pesticides will be used in accordance with NPS policy, the full range of pesticides will be retained across all parks. The Preferred Alternative encourages general use pesticides, when they would be effective and the rare implementation of restricted use pesticides for cases when a general use pesticide would not be effective and restricted use pesticides would be safe. Any individual park may ban from use at that park any pesticide or other technique that is inconsistent with park policies. Therefore, this restriction, using only general-use pesticides, has been dropped from further consideration, because it does not meet criteria #1, #2, and #3.

2.4.6 Alternative 9

A program using only pesticides

Pesticides alone cannot be considered as an alternative under the NPS Management Policies 2006. Pesticides may only be used as one tool in a full IPM program. The IPM approach selects the most appropriate and cost effective management solution for the specific pest situation, and it uses pesticides only when no other method with low environmental risk is feasible and effective. Ruling out all non-pesticide options will not fit the NPS IPM program directives. Therefore, this alternative will not receive further consideration, because it does not meet criterion #1.

2.5 Environmentally Preferable Alternative

NPS policy requires that an EA identify the environmentally preferable alternative. The alternative that causes the least damage to the biological and physical environment and that best protects, preserves, and enhances historic, cultural and natural resources is the environmentally preferable alternative (NPS 2001b: 22-23). In accordance with *Management Policies 2006*, the environmentally preferable alternative should meet the following six criteria, set forth in NEPA, § 101(b) (42 U.S.C. 4321-4347):

> *1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.*
>
> *2. Ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings.*
>
> *3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences.*
>
> *4. Preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice.*
>
> *5. Achieve a balance between population and resource use that would permit high standards of living and a wide sharing of life's amenities.*
>
> *6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.*

Because these criteria are broad, determining whether an alternative meets or does not meet a criterion is not always straightforward. However, the environmentally preferable alternative can be determined by applying the criteria suggested by the Council on Environmental Quality (CEQ), which provides direction in its guidance "Forty Most Asked Question's Concerning CEQ's National Environmental Policy Act Regulations" (46 FR 18026). CEQ defines the environmentally preferable alternative as "…the alternative that causes the least damage to the biological and physical environment. It also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources.

Based on the impact analysis, Alternative 2 - Integrated Pest Management is the Environmentally Preferable Alternative. Alternatives 2 and 3 meet the purpose and need of the program, but the No Action Alternative does not. Parks that do not have a standardized approach to assist in decision-making under the No Action Alternative may have difficulty selecting the most appropriate treatment option and implementing the best action under existing planning documentation. Alternative 3 approaches invasive plant management very conservatively and may limit the tools available for treatment. It also strains the intentions of the NPS policies that require the use of IPM in managing pest species. Alternative 2, the Preferred Alternative, realizes positive impacts over the long-term because it provides for effective and efficient control of invasive plants with the least adverse impact to the environment. This makes Alternative 2 the alternative that best protects, preserves, and enhances historic, cultural, and natural resources. A comparative summary of the alternatives retained for in-depth analysis follows in Table 2.5.1.

Table 2.5.1. Comparison of the features of the proposed alternatives

Features of Alternatives	Alternative 1, No Action	Alternative 2, Preferred Alternative	Alternative 3, No Pesticide, Biocontrol, or Heavy Equipment
Meet Stated Goals of Program as listed in Chapter 2.0	**Attain, Sustain, and Prevent (1, 2, 3)** -- Treatments rely on existing park plans and their limitations. Plans are not highly specific regarding invasive plant management at many parks. Funding results in opportunistic treatment. **Develop plan (4) –** Planning is done by parks. No new plan or compliance would come from this EPMP/EA effort. Long-term strategy may not be in place. **Best management practices (5) –** Parks are responsible for all areas of training, mitigation, and monitoring. Best management practices are identified by the park.	**Attain, Sustain, and Prevent (1, 2, 3) –** Strategic approach achieves long-term goals and short-term objectives. Attaining and sustaining desired conditions rely on long-range planning and maximum leveraging of funding. Collaboration enhances cost-effectiveness. Funding is available for implementation. **Develop plan (4) –** EPMP focuses on invasive plant management with all strategizing and planning centering on this key issue. Implementation of a formal plan would facilitate cooperation among parks, training, and staging of resources. A formal decision tree guides decision making to prevent and respond to invasions. A full IPM program with a broad range of tools ensures attainment of reasonable treatment objectives. **Best management practices (5) –** Scientific support and on-going training sustain a program of early detection and treatment. Standard set of BPs and mitigations.	**Attain, Sustain, and Prevent (1, 2, 3) –** Strategic approach allows long-term goals and short-term objectives. Attaining and sustaining desired conditions rely on long-range planning and maximum leveraging of funding. Collaboration enhances cost-effectiveness. Funding is available for implementation. **Develop plan (4) –** EPMP focuses on invasive plant management with all strategizing and planning centering on this key issue. Implementation of a formal plan would facilitate cooperation among parks, training, and staging of resources. A formal decision tree guides decision making to prevent and respond to invasions, but limits treatment options. **Best management practices (5) –** Scientific support and on-going training sustain a program of early detection and treatment. Standard set of BPs and mitigations.
Treatments	A broad range of treatments is currently in use, but no park currently employs biocontrols.	Program would use IPM approach with a full suite of tools.	Program would use a limited or conservative approach to treatment and would exclude pesticides, biocontrols, and heavy equipment.
Compliance with Regulatory Measures and Policies	Parks take individual responsibility for preparation of compliance documents. Parks submit requests for use of pesticides through PUPS. Parks complete NEPA and NHPA § 106 in accordance with park policy. All actions taken by park staff	EPMT would create strategic plan through this EPMP/EA. EPMT would provide annual work plan for a PEPC project that facilitates compliance completion by parks. Parks would submit requests for use of pesticides through PUPS. Parks would complete NHPA, § 106 for annual work plans. Park provides Letter of Compliance Completion to EPMT coordinator.	EPMT would create strategic plan through this EPMP/EA. EPMT would provide annual work plan for a PEPC project that facilitates compliance completion by parks. Parks have no need to submit requests for use of pesticides through PUPS. Parks would complete NHPA, § 106 for annual work plans. Park provides Letter of Compliance Completion to EPMT coordinator.

Features of Alternatives	Alternative 1, No Action	Alternative 2, Preferred Alternative	Alternative 3, No Pesticide, Biocontrol, or Heavy Equipment
	would comply with all laws, regulations, and policies.	All actions taken by EPMT staff would comply with all laws, regulations, and policies.	All actions taken by EPMT staff would comply with all laws, regulations, and policies. Compliance is not needed for pesticides, biocontrols, or large equipment.
Planning	Parks maintain individualized programs based on individual park planning documents. Parks are limited to the approved actions within their own individual plans.	EPMT would lead the planning process, forming annual work plans that implement the EPMP. A formal decision tree would determine the Optimum Tools to use at each park annually. Annual work plans, developed by EPMT with park input, would include collaboration among parks.	EPMT would lead the planning process, forming annual work plans that implement the EPMP. A formal decision tree would determine the Optimum Tools to use at each park annually. Annual work plans, developed by EPMT with park input, would include collaboration among parks.
Best Management Practices	No formal set of mitigations, beyond pesticide label mitigations, are adopted by all parks. Each park develops its own mitigations and BPs.	An extensive list of mitigations and BPs would be applied. These were attained through research and consultation.	The mitigation and BPs from the Preferred Alternative that apply to treatments permitted in this alternative would be adopted.
Monitoring and Record Keeping	Network assists monitoring by park and would perform a survey once every four years. Parks maintain their own records, usually in paper form and in PUPS. Some parks use geodatabases for planning and record keeping.	EPMT assists parks in monitoring and would perform a survey once every four years. Effects of treatment would be monitored. EPMT would maintain records of activities and monitoring in a geodatabase, providing GIS layers to the parks. Parks would enter PUPS pesticide use records.	EPMT assists parks in monitoring and would perform a survey once every four years. Effects of treatment would be monitored. EPMT would maintain records of activities and monitoring in a geodatabase, providing GIS layers to the parks. Parks would have no pesticide use records.
Safety and Training	Parks lead safety and training program.	EPMT would ensure safety training and hazard analyses that are standardized for each treatment. EPMT would include funding to purchase PPE for use in projects. EPMT would make available trained equipment operators or pesticide applicators as feasible and practical, directly or through contract for projects.	EPMT would ensure safety training and hazard analyses that are standardized for each treatment. EPMT would include funding to purchase PPE for use in projects. EPMT would make available certified equipment operators as feasible and practical, directly or through contract for projects.

Features of Alternatives	Alternative 1, No Action	Alternative 2, Preferred Alternative	Alternative 3, No Pesticide, Biocontrol, or Heavy Equipment
Education Programs	Parks initiate interpretive and educational programming without multi-park collaboration.	Parks initiate interpretive and educational programming, but EPMT would provide opportunities for collaboration and multi-park products or projects. Use of pesticides, biocontrols, and heavy equipment may increase the need to educate the public about IPM.	Parks initiate interpretive and educational programming, but EPMT would provide opportunities for collaboration and multi-park products or projects.
Collaboration	Parks maintain individualized programs with little collaboration.	EPMT would provide opportunities for collaboration and would organize work plans to take maximum advantage of economy-of-scale, resulting from working in multiple parks.	EPMT would provide opportunities for collaboration and would organize work plans to take maximum advantage of economy-of-scale, resulting from working in multiple parks.

3

Affected Environment

This chapter provides an overview of the current conditions of resources present within the project areas. Information on desired conditions and current conditions may be found in the individual parks' General Management Plans, Resource Stewardship Strategies, Cultural Landscape Reports, Cultural Resource Inventories, and other program and implementation plans.

"Exotic species are those species that occupy or could occupy park lands directly or indirectly as the result of deliberate or accidental human activities. Exotic species are also commonly referred to as nonnative, alien, or invasive species. Because an exotic species did not evolve in concert with the species native to the place, the exotic species is not a natural component of the natural ecosystem at that place."

3.0 Resource Topics

Chapter 3, Affected Environment, addresses the key components that, in accordance with law, regulation, or policy, must be analyzed within the affected environment. Potentially affected environment was identified in external scoping, using the scoping issues (see section 2.5), and by subject matter experts and park management detailing the areas where invasive plants might be treated. Detailed discussions are provided for resources and values that an invasive plant management program would potentially affect. These are referred to as resource topics. Park resources outside of the affected environment are not discussed in detail, but may be included for the sake of a broad understanding of resource relationships. Some portions of the environment may be omitted entirely from this document because they are not affected by the project. Maps showing the park areas of treatment and areas of exclusion are in Appendix K. Only the land areas outside of visitor facilities, administrative areas, and operational facilities are considered for inclusion in the affected environment of the proposed plan. Open water will not be included in the plan, although riparian areas may be.

Resource topics have been broken into two primary groups, natural and cultural resources, for the convenience of subject matter experts wishing to review their areas of expertise. Natural and cultural resources are inextricably intertwined in the parks and overlap will be apparent. The manner of resource topic organization was selected to increase readability and reduce redundancy, but does not represent exclusive categories of resource issues.

3.1 Natural Resources

Natural resources are discussed within the context of ecoregions (Bailey 1995), where similarities in ecosystems and management form an ecological group. Park-specific issues are discussed for each park within the ecological group. The following descriptions of natural resources for each park are taken primarily from Supplemental Document 14: Ecological and Natural Resource Overview of HTLN Parks and Supplementary Document 1-15 Park Summary of the *Heartland Inventory and Monitoring Network and Prairie Cluster Prototype Monitoring Program Vital Signs Monitoring Plan* (DeBacker, et al. 2005) with review and corrections by park resource managers. Information from this source and resource managers is not cited. Invasive species information comes from invasive plant reports completed by the Network between 2005 and 2011 for many of the parks, which are listed in the bibliography. Park threatened, endangered, and management concern species lists were derived from NPSpecies[13], the National Park Service Biodiversity Database, with park review and corrections.

3.1.1 Overview

The NPS has established certain guidelines or desired conditions for categories of natural resources. Parks may have more stringent definitions for desired conditions than the generalized conditions provided in Table 3.1.1. These standards for condition must be attained or maintained, and may not be adversely affected by the proposal in a manner that would cause non-attainment.

[13] The National Park Service Biodiversity Database. IRMA version. https://irma.nps.gov/Species.mvc/Search (park-species list - evidence counts; accessed April 11, 2011)

Table 3.1.1. Desired conditions to be maintained for natural resources

Current laws and policies require that the following conditions be achieved for natural resources in the parks.

Resource	Desired Condition	Source
Landforms, geology, soils, landforms (caves and karst)	A condition where natural systems associated with caves, such as karst and other drainage patterns, airflows, mineral deposition, and plant and animal communities perpetuate.	NPS Management Policies 2006
	A condition where soil resources and geologic processes function in as natural a state as possible.	NPS Management Policies 2006
Aquatic resources	The pollution of park waters by human activities occurring within and outside of parks is avoided whenever possible.	CWA; E.O. 12088; NPS Management Policies 2006
	A condition where surface waters and ground waters perpetuate as integral components of park aquatic and terrestrial ecosystems.	CWA; E.O. 11514; NPS Management Policies 2006
	Natural floodplain values are preserved or restored.	E.O. 11988; Rivers and Harbors Act; CWA; NPS Management Policies 2006; NEPA
	Natural and beneficial values of wetlands are preserved and enhanced.	E.O. 11990; Rivers and Harbors Act; CWA; NPS Management Policies 2006
Vegetation, wildlife, fish	A condition where, as parts of the natural ecosystems of parks, all native plants and animals are maintained.	NPS Management Policies 2006
Endangered, threatened, and rare species	A condition where federal- and state-listed threatened and endangered species and their habitats are sustained.	ESA; NPS Management Policies 2006; NEPA
	Populations of native plant and animal species function in as natural a condition as possible.	NPS Management Policies 2006
	Extirpated native plant and animal species are restored to parks.	NPS Management Policies 2006

Figure 3.1.1 shows the ecoregions used in establishing the ecological groups. Four distinct ecological groups characterize the general setting and principal resources of Network parks: Eastern Deciduous Forest, Mississippi Embayment, Interior Highland, and Tallgrass Prairie parks (Table 1.6.0). Ouachita Mountain ecoregion can be coupled with the two Ozark ecoregions to form the Interior Highland parks for the purposes of this document, because of the similarities relative to environmental impacts from invasive plant actions on the resources located there.

This is a polygon-coverage of the Major Land Resource Regions and Major Land Resource Areas, characterized by a particular pattern of soils, climate, water resources, and land uses. (USDA, Soil Conservation Service, 1981). Source: http://www.epa.gov/airmarkets/cmap/data/index.html

Figure 3.1.1. Major land resource regions for network parks (DeBacker, et al. 2005)

The description of each ecological group provides an overview of regional resources and management issues, but does not provide the detail needed to determine impacts of invasive plants and their management on park resources. Disturbance regimes are regional in type and so presented in the group overview. They affect management priorities. In addition, Appendix M - Management Priorities clarifies the relationship of invasive plant management to resource conditions and anthropogenic influences within each park.

Within the descriptions provided for each park, four natural resource areas are detailed because of their importance to the resource topics:

- Landforms, Geology, and Soils
- Aquatic Resources
- Vegetation, including endangered and threatened species
- Wildlife and Fish, including endangered and threatened species

Karst landforms are described in the geology section, but also in the aquatic resource section for their connections to water quality issues, and karst is mentioned in the wildlife section for its connection to cave dwelling animals. Threatened and endangered species, a resource topic, appears under the headings for vegetation and for wildlife and fish, respectively. A list of threatened and endangered species potentially affected by this EPMP appears in Appendix L. Table 3.1.2 provides a quick reference to the natural resources within the parks.

Table 3.1.2. Ecosystems by area within the Network parks[14]

Park	Streams & Riparian (miles)	Springs (#)	# Lake/ Ponds; acres	# Wetlands; size in acres	Forest (acres)	Savanna (acres)	Prairie (acres)	Geology	Developed, Agricultural (acres)
ARPO	7	NA	5; 121	0	627	0	0	Alluvium, escarpment	10
BUFF	175	> 500	350; 175 acres	10 acres	88,970	4,000	650	Karst, alluvium	2,100
CUVA[15]	220	>700	70; from 0.5 – 12 acres	1,490; from 0.1 – 136 acres	27,000	0	0	Escarpment, alluvium, glacial deposition	4,160
EFMO	5.5	0	110 acres	655 acres	2,200	70 acres	80 acres	Driftless, escarpment	
GWCA	3 streams	2	1; 0.74 acres	0	60	0	130	Gentle hills, thick soils	20
HEHO	< 1	0	0	0	0	5 acres	81	Rolling, deep loess	50
HOCU	3.5, park boundary	Yes	1; 1 acre	Unknown	110	0	107	Low plateau, alluvium, glacial	800
HOME	1.34	0	1; 0.03 of 4 acre pond is NPS	2; under 1 acre	60	0	100	Rolling, deep loess	4
HOSP	Yes	Yes	2; 10 acres and 1.6 acres	Approximately 200 acres	5,000	Unknown	0	Mountains, valley alluvium	50
LIBO	0	0	constructed; < 1 acre	0	150	0	0	Low hill, plateau, alluvium and loess	50
OZAR	134	>300	Unknown	Unknown	75,000	0	0	Hills, karst, alluvium	2,600
PERI	5.4	3	2 ; <1 acre	0	3,760	112	59	Hills, ridges , loam	700
PIPE	60	0	2 ; 1 acre total	3	0	16	244	quartzite outcrop, glacial tills, alluvium, shallow loess	20
TAPR	50	>200	25; 60 acres	Unknown	0[16]	0[17]	10,000	Rolling plains, organic soils; limestone outcrop	45
WICR	4.8 miles	10	0	0	475	50	1,244[18]	Karst, thin to thick loam, alluvium	200

Green shading indicates areas that potentially would be affected by invasive plant management.

[14] Information provided by parks.
[15] Values derived from CUVA GIS data sets, January 2012.
[16] Not including riparian
[17] Not including hayed brome
[18] Includes old field

3.1.2 Eastern Deciduous Forest Parks (CUVA, EFMO, LIBO, HOCU)

Parks in this group are uniquely challenged with balancing the needs of resource protection with human interaction from historic land use, land use outside of the parks, park management actions, and, for some parks, high visitor use resulting from proximity to large urban centers. Historic and recent land disturbance has resulted in areas of varying successional regeneration within these parks. Thus, the distribution and management of invasive species is a common management issue. While many unique habitats are found in these parks, the areas are predominately forested. Each also contains relatively small areas of restored prairie or open fields.

Fire may be important for maintaining forests and savannas. The suppression of fire in oak (*Quercus* spp.) dominated forests may be responsible for the lack of oak regeneration and increasing red maple (*Acer rubrum*) dominance. White-tailed deer (*Odocoileus virginianus*) grazing is a natural disturbance that affects plant composition. Over-browsing by large populations of white-tailed deer may contribute to opportunities for invasive plant propagation by suppressing forest regeneration and creating gaps in vegetation cover.

Cuyahoga Valley National Park

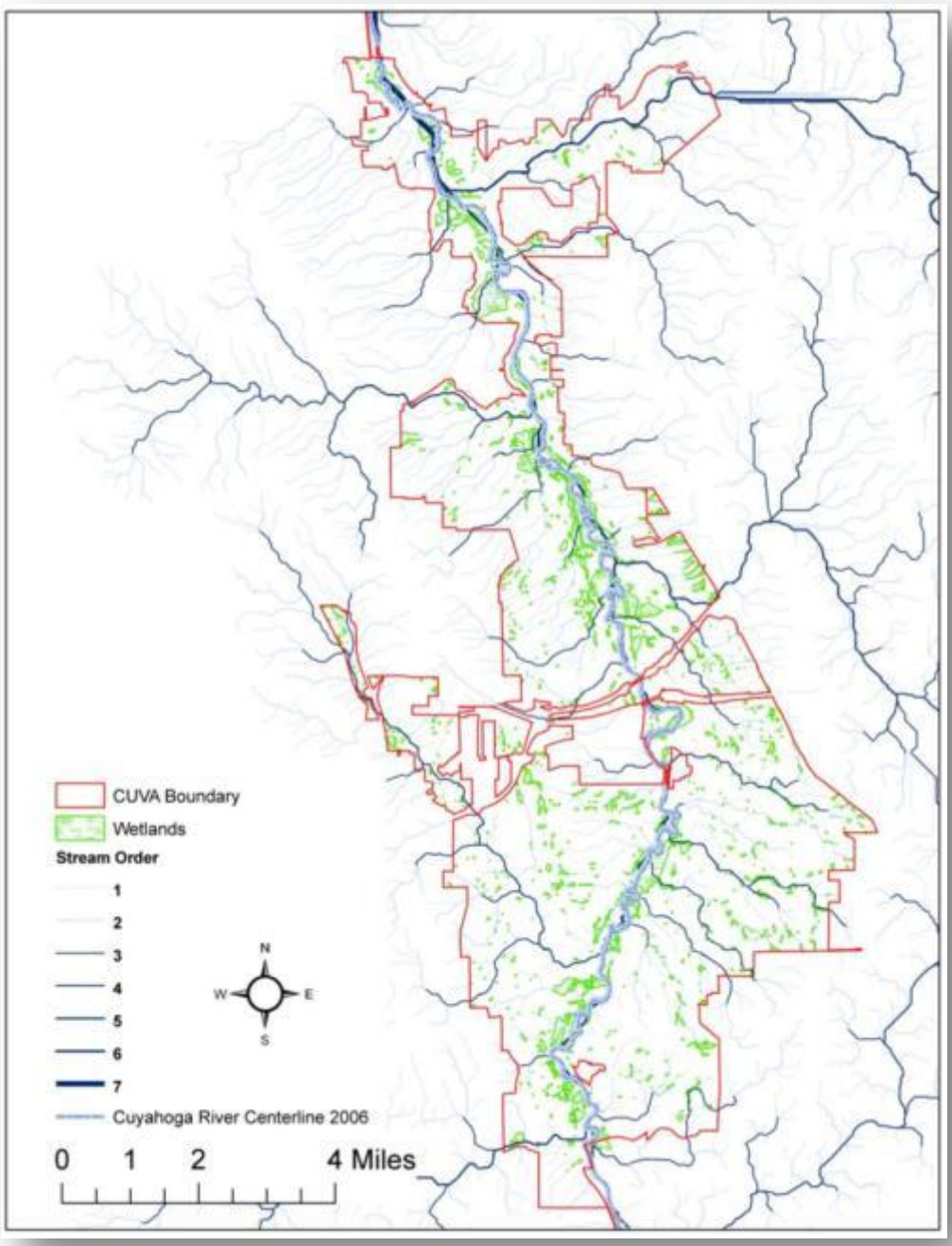
Located in northeastern Ohio, CUVA encompasses over 32,856 acres of relatively undeveloped open space between the metropolitan areas of Cleveland and Akron within the Cuyahoga Valley. The park was established as a National Recreation Area in 1974 and was re-designated as Cuyahoga Valley National Park in 2000. The Cuyahoga River was designated as one of 14 American Heritage Rivers in 1998. The park prepared a Statement for Management in 1993 that states, "*in addition to preserving natural and historic resources, the NPS also has the task of restoring abused resources.*"

Landforms, Geology, and Soils. The main natural feature at CUVA is the Cuyahoga River Valley. The Cuyahoga River drains more than 800 square miles of glaciated terrain, but only 6.5% of this watershed is within CUVA. Valley walls and tributary ravines characterize the watershed with steep forested slopes rising 100 to 600 feet above the floodplain. The soils at CUVA were formed during glaciations of the Allegheny Plateau. Soils tend to be clay-like and unstable with most being poorly drained. Subsoil is often alkaline.

Aquatic Resources. The park protects a complex of fluvial landforms, including a 22-mile corridor of the Cuyahoga River, its floodplain, and adjacent ravines that contain nearly 200 miles of perennial tributaries. Water quality in the Cuyahoga River has been historically poor, but is gradually improving, although segments of the river are still on the Clean Water Act's 303(d) list of impaired waters (Ohio EPA 1999). Flood control and power dams have altered natural flow regimes of the Cuyahoga River. Most park streams meet the warm water habitat standards set by the State of Ohio (Ohio EPA 1999). Many park wetlands are affiliated with these surface waters, but there are also many wetlands created by groundwater seeps on slopes and other sources. The park has identified nearly 1,490 wetlands of varying size within its boundaries, encompassing approximately 1,900 acres. The four, most-common types of wetlands at CUVA are wet meadow, marsh, scrub/shrub, and forest (Figure 3.1.2).

Figure 3.1.2. Wetlands and streams associated with CUVA

(source Sonia Bingham, written communication August 2011)



Vegetation. CUVA supports a variety of habitats, but forest dominates vegetation cover. Mixed forests cover approximately 27,000 acres (80 percent) of CUVA with the oak-hickory association being the most common. Other common forest associations at the park include maple-oak, oak-beech-maple, maple-sycamore, pine-spruce, and hemlock-beech. A long history of intensive land use has created forests at CUVA with vastly different ages and community structures. Interspersed among forests are grasslands (approximately 2,000 acres or 6 percent of CUVA), wetlands (approximately 1,900 acres or 6 percent), open water (approximately 150 acres or about 0.5 percent), and agricultural land (approximately 1,300 acres or 4 percent).

The forests of CUVA can be broadly categorized as upland or bottomland, based on landscape position. In upland forests, the dominant vegetation is a mix of hardwood trees, mainly oaks, hickories (*Carya* spp.), maples (*Acer* spp.), and American beech (*Fagus grandifolia*). Groundcover in upland forests tends to be sparse, consisting of mayapple (*Podophyllum peltatum*), trout lily (*Erythronium americanum*), spring beauty (*Claytonia virginica*), violets (*Viola* spp.), Jack-in-the-pulpit (*Arisaema triphyllum*), and other herbaceous species. Shrub cover in upland forests at CUVA also is typically sparse but, when present, often is dominated by maple-leaved viburnum (*Viburnum acerfolium*), spicebush (*Lindera benzoin*), and witchhazel (*Hamamelis virginiana*).

The long history of intensive land use has left the park with forests differing in age and structure. A recent study suggested that the ability of bottomland forests to regenerate over time is being severely impacted by white-tailed deer (NPS 2001). Roads, suburban development, recreational areas, a railroad, utility corridors, and agricultural lands fragment the forests. The largest and oldest semi-contiguous tracts of mature forest are between approximately 750 and 1,800 acres in size, but even these patches are internally fragmented and dissected by roads and trails. The largest and oldest bottomland forests are generally located in floodplains of the Cuyahoga River and its tributaries, and typically support an overstory of ashes (*Fraxinus* spp.), eastern cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), box elder (*Acer negundo*), Ohio buckeye (*Aesculus glabra*), silver maple (*Acer saccharinum*), and red maple. Herbaceous groundcover is more common in bottomlands than uplands with common species including enchanter's nightshade (*Circaea lutetiana*), bluegrass species, sedges (*Carex* spp.), violets (*Viola* spp.), moneywort (*Lysimachia nummularia*), wingstem (*Verbesina alternifolia*), smartweed (*Polygonum* spp.), jewelweed (*Impatiens* spp.), wild leeks (*Allium tricoccum*), and garlic mustard. Shrub cover is sparse or more frequently absent in these areas. When present, bottomland shrubs consist mainly of viburnums (*Viburnum* spp.), non-native honeysuckles (*Lonicera* spp.), common privet (*Ligustrum vulgare*), and multiflora rose.

Open fields are dominated by grasses (e.g., orchard grass [*Dactylis glomerata*], bluegrass, and switchgrass [*Panicum virgatum*]) with many forbs present as well (e.g., goldenrods [*Solidago* spp.], dogbane [*Apocynum* sp.], and asters [family Asteraceae]). Many fields at CUVA are mowed and support few woody plants. Older fields support more woody growth, including extensive stands of common privet, multiflora rose, and autumn olive. Early successional trees, such as eastern cottonwood and ashes, also may be present. Shrub-scrub habitats are dominated by dense stands of shrubs and saplings with a few taller trees scattered throughout. Common species in shrub habitats include hawthorn (*Crateagus* sp.), dogwood (*Cornus* sp.), viburnums, common privet, multiflora rose, and autumn olive.

Federally listed threatened, endangered, or candidate plant species: No federally listed plant species occur in the park.

Ohio state-listed plant species at CUVA: Thirty-three plant species in the park are listed as state endangered (6 species), threatened (9 species), or potentially threatened (18 species), and inhabit forests, grasslands, and wetlands (See Appendix L).

Wildlife and Fish. Animal species documented in the park include 241 species of birds, 91 aquatic invertebrates, 64 fish, 39 mammals, 20 amphibians, and 20 reptiles. In addition, 61 butterfly species have been documented. At least 10 bird species are of conservation concern nationally or regionally, and they are considered priority species by the international conservation consortium, Partners in Flight. Federally protected bald eagles have nested at the park since 2006 and have fledged several offspring in subsequent years; non-breeding eagles also have been seen perched on trees near the Cuyahoga River during winter months. Whitetail deer have been studied for their impact to bottomland forests (NPS 2001).

Federally listed threatened, endangered, or candidate animal species: The presence of the federally listed endangered Indiana bat was documented in 2002 during a Network-funded inventory.

Ohio state-listed animal species at CUVA: Sixteen observed bird species are listed as threatened or endangered (Ohio DNR 2010; see Appendix L), although many of these species are transients that do not breed in the park. One mammal and two turtles are state-listed species documented to occur in the park (see Appendix L).

Effigy Mounds National Monument

Satellite view of primary park area, excluding the Sny Magill Unit

Located along the Mississippi River in northeastern Iowa, EFMO encompasses 2,526 acres with over 200 mounds of which 31 are effigies. It was established by Presidential Proclamation 2860 to include lands located along the Mississippi River in northeastern Iowa, originally consisting of two areas: the Jennings-Liebhardt tract (South Unit) and the Yellow River unit (North Unit). The Sny Magill Unit was not initially included in the park due to land title problems, but was federally owned and later added to the park (P.L.87-44). The Heritage Addition, acquired in 2000, is the most recent addition (P.L.106-323).

Landform, Geology, and Soils. The park lies in the unglaciated North Central U.S. Driftless and Escarpment Section of northeastern Iowa on the Paleozoic plateau and Silurian escarpment of the Interior Plains Geologic Province. Prairie du Chien dolomite and Jordan sandstone comprise the dominant geologic strata and allow the formation of karst landscape. An intricate system of rivers and streams drain the erosional topography with the erosional forces leaving steep-sided bluffs rising about 500 feet above the adjacent Mississippi and Yellow Rivers. Fayette silt-loams are the principal soils of the hilltop prairies. These soils are comprised of well-drained loess. Thin soils associated with goat prairies are found in areas of steep rocky land. In many areas, the topsoil is very thin or absent and bedrock is exposed.

Aquatic Resources. About 110 acres of ponds and lakes are found within the floodplains of the Mississippi River, the Yellow River, and Sny Magill Creek in the park. Dousman Creek, a perennial cold-water stream, is recognized as a high quality native trout stream. The Yellow River flows into the Mississippi at the park boundary. Water volume is high and flow is relatively slow in the Yellow River. As a result, sediment accumulates on the river bottom. The Yellow River is listed as impaired under the Clean Water Act through the park.

Vegetation. Vegetation surveys have concluded that the forest at the park is progressing through successional stages after major logging operations around the turn of the nineteenth to the twentieth century (NPS 2008). The majority of the uplands and bluffs are forested. Three common mesic-forest communities dominate. They are sugar maple-basswood (*Tilia americana*) forest on dry-mesic to mesic slopes and ravines, oak-hickory on dry-mesic sites, and chinquapin oak (*Quercus muehlenbergii*) woodlands mixed with goat prairies on bluff tops and south-facing slopes. Important overstory species in the North Unit include white oak (*Quercus alba*), red oak (*Quercus rubra*), big-tooth aspen *(Populus grandidentata*), and shagbark hickory (*Carya ovata*). Forested and herbaceous wetlands occur along a gradient of inundation along backwater sloughs, streams, and rivers. The Sny Magill unit is a river floodplain that is inundated annually by spring floods. The dominant overstory vegetation in this area is silver maple, American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), and swamp white oak (*Quercus bicolor*). In the last 20 years, natural resource management has focused on returning to the landscape processes that have been interrupted in the post-European settlement era. These processes involve the implementation of prescribed fire to replicate pre-settlement fire regimes and promote declining native vegetation communities.

Federally listed threatened, endangered, or candidate plant species: No plant species occurring in the park are federally listed as threatened, endangered, or candidate species.

Iowa state-listed plant species found at EFMO: The state-listed threatened species, golden corydalis (*Corydalis aurea*), occurs in the park. Six other species of concern have been documented in the park as well (See Appendix L).

Wildlife and Fish. Results from breeding bird surveys conducted during 2002 indicated that 107 bird species were observed with 79 species observed during the breeding season and an additional 28 during migration. Subsequent monitoring of breeding birds (Peitz 2010d) identified 71 species, including 15 species of continental importance[19]. Nine native fish species have been collected in monitoring. Although Dousman's Creek is listed as a state trout stream, only non-native brown trout (*Salmo trutta*) has been collected during surveys.

Federally listed threatened, endangered, or candidate animal species: The endangered Higgins-eye pearly mussel is present in the Yellow River within the park. The federally protected bald eagle, now delisted from ESA protection, is a breeding bird in the park. The delisted peregrine falcon (*Falco peregrinus*) and gray wolf (*Canis lupus*) have been observed in the park, although the latter is probably not resident.

Iowa state-listed animal species found at EFMO: Appendix L contains a complete list of state-listed species for the park. One amphibian on the state list is documented in the park. Species of special interest include an Iowa state-endangered bird species, red-shouldered hawk (*Buteo lineatus*). The principle state-listed aquatic species documented in the park include one fish and four unioid mussels, three endangered and one threatened. Additionally, an endangered terrestrial snail has been found. One threatened mammal and a species of special concern were documented as present in the park. Despite recent delisting, the park treats bobcat (*Lynx rufus*) and river otter (*Lutra canadensis*) as species of concern. Several bird species are on the National Audubon Society's List of Declining Species and include the cerulean warbler (*Dendroica cerulea*), northern parula (*Parula americana*), and sandhill crane (*Grus canadensis*), but are not listed by state or federal authorities. These species are mobile and not expected to be affected by treatment because of their mobility and because they are unlikely to frequent treatment habitats.

[19] Bird species of continental importance are designated by Partners in Flight, a consortium of governmental and non-governmental agencies involved in bird conservation (PIF 2002).

Hopewell Culture National Historical Park

At the southern terminus of the Wisconsin glaciations, HOCU is located in south central Ohio near Chillicothe in Ross County. The primary resource for which the park was established is the remnant large prehistoric geometric earthworks and mounds built by the Hopewell culture (200 B.C. – A.D. 500). The park is now composed of five geographically separate units that encompass a total of 1,170 acres. The NPS owns 1,086 acres and HOCU's partner, the Ohio Historical Society, owns 85 acres. The remaining 89 acres are in private ownership. Mound City Group, totaling 120 acres of which 40 are a hay field, 40 are an early successional mixed mesophytic forest, and the remaining acreage is developed, such as restored earthworks and mounds, parking lots, park offices and the visitor center. Visitor facilities are within this developed area.

- Hopeton Earthworks – approximately 380 acres of which 14 acres are a seasonal stream surrounded by forest, 4 acres are black walnut (*Juglans nigra*) grove, 110 acres are active soybean cultivation, and remaining acreage is a mix of fallow hay fields and restored grasslands.
- Hopewell Mound Group – approximately 310 acres of which 36 acres are a semi-mature mixed mesophytic forest, 6 acres are restored prairie, 140 acres are hay fields, and remaining acreage is upland escarpment area with mixed grasses and forbs. Visitor facilities at this site include a hiking trail, picnic area, and parking lot. The Adena recreational bicycle trail passes in this unit.
- Seip Earthworks –approximately 126 acres of main tract, consisting of 14 acres of a Paint Creek riparian corridor and remaining acreage in fallow field. The Dill Road tract is 26 acres of fallow field. The park may receive additional acreage from the Ohio Historical Society including a picnic area, parking lot and several fields currently under active cultivation.
- High Bank Works - approximately 152 acres with 31 acres of riparian woodland, 70 acres of fallow hay field, and remaining acreage in soybean cultivation to be planted with native prairie species in 2012. The central third of the unit is owned and managed by the Ohio Historical Society.

Landform, Geology, and Soils. The five units of HOCU are located within the Appalachian Plateau topographic province on floodplains and Wisconsin age terraces consisting predominantly of sandstone and shale. The soils in all park units are silt-loam underlain by sand and gravel typified by the Fox-Ockley-Genesee-Ross soil association.

Grassland is the principle cover in the mounds units

Aquatic Resources. The park is located in the Scioto River watershed, and all five units are adjacent to or very near segments of the Scioto River and its tributaries. Portions of the Scioto River, including all segments adjacent to the park, are listed as Clean Water Act § 303(d), impaired waters, due to agricultural run-off and other non-point pollution sources. Flood control and power dams have altered natural flow regimes of the Scioto River. Good water quality in the Paint

Creek tributary at the Seip Earthworks led to listing as an Outstanding Natural Resource Water[20].

Vegetation. Lands at HOCU have been clear-cut and cultivated with agricultural activities having severely disturbed the vegetation. All five HOCU sites are situated along rivers or creeks in a forest and grassland riparian landscape.

While oak-hickory upland forests and mixed bottomland forests prevailed in the area prior to European settlement, cultural resource protection necessitates management for grasslands. Native grasses cover the earthworks whenever possible, but there are situations where protection of the archeological resource necessitates the use of nonnative grasses. The five sites also contain upland forests, riparian forests, lawns, and farm fields with native and invasive species. Since parklands have been disturbed by logging and farming, most areas are populated with at least some non-native plants. The successional fields include a number of invasive plants such as musk thistle, Canada thistle, and bull thistle (*Cirsium vulgare*). Johnsongrass has invaded recently restored sites. The park instituted IPM that includes invasive plant control (NPS 2005c).

Federally listed threatened, endangered, or candidate plant species: No federally listed species are documented. The USFWS indicates running buffalo clover (*Trifolium stoloniferum*), could occur in the area, but it is not documented in the park.

Ohio state-listed plant species found at HOCU: One state endangered species and three potentially threatened species (See Appendix L) have been documented, including October lady's tresses (*Spiranthes ovalis* var. erostellata) found at the Mound City Group.

Wildlife and Fish. A number of animal inventories were completed at HOCU, and park staff, Network staff, and citizen scientists continue to monitor populations. Sixty-seven species of birds have been recorded for the park with 30 summer residents. Fifteen species of continental importance have been recorded during breeding bird monitoring. Eleven mammal species have been documented, all of which are common to the region. Several reptiles are common locally and are likely to occur in the park, including eastern box turtle (*Terrapene carolina* carolina) and midland painted turtle (*Chrysemys picta* marginata). The wildlife populations present at the park include those species generally found throughout the region. At present, wildlife management in the park consists primarily of monitoring and, if necessary, removing pest species that threaten the integrity of the archeology sites.

Federally listed threatened, endangered, or candidate animal species: No federally listed species are documented for the park, but the park lies within habitat range of federally protected bald eagle and Indiana bat. The USFWS initiated a Conservation Action Plan for the timber rattlesnake (USFWS 2011, consultation letter). None of these species is documented to occur within the park units (NPS 2004c). Based on a herpetological survey conducted in 2002-2003, habitat for the timber rattlesnake was not found within park boundaries (Dafna Reiner, 2011, personal communication).

Ohio state-listed animal species found at HOCU: Park staff documented 34 bird species with some level of concern, but only six resident bird species are listed as state threatened or of concern (See Appendix L).

[20] The NPS National Wild and Scenic Rivers Program, http://www.nature.nps.gov/water/Program_Briefs/WSR_programbrief_web.pdf (March 5, 2012).

Lincoln Boyhood National Monument


Yellow line indicates park boundary

The park is located in southwest Indiana and is a roughly rectangular-shaped property of 200 acres. The setting memorializes President Abraham Lincoln as it recalls aspects of Lincoln's childhood and protects the gravesite of Mary Hanks Lincoln. At some time during the mid-1800s, the majority of the current LIBO property was cleared and several buildings were erected as part of the Lincoln City development.

Landform, Geology, and Soils. The park is located in the Wabash Lowlands physiographic province of southwestern Indiana in a transition to the Crawford Upland to the east. Elevation in the park ranges from about 415 feet to 512 feet above sea level. The land above 450 feet is comprised of steep sloping hills dissected by shallow ravines. Below 450 feet, the landscape is gently undulating. The land is underlain by Pennsylvanian age sedimentary rocks—sandstone, shale, and thin Carbondale Group coals. The lowland surficial material is alluvium derived from weathered shale and sandstone. The upland surficial material is comprised mainly of weathered loess derived from Wabash River outwash from the late Wisconsin glaciations. Soils consist of silt-loams derived from alluvium, loess, and weathered sandstone and shale bedrock. Five soil series occur within the park. Well-drained soils occur in the high relief areas in the southern half of LIBO. Poorly drained soils are associated with flat land in the North Forty and ephemeral drainages in the southern property.

Aquatic Resources. The only permanent water source at LIBO is a small constructed pond. During the spring, the northern one-third of the park contains several ephemeral pools and streams that are not obvious during the remainder of the year.

Vegetation. An analysis of pre-settlement vegetation of Spencer County indicated a mosaic of upland xeric (dry) and mesic oak-hickory forest with patches of mesic mixed-hardwood forest grading into bottomland forests along stream banks. Mature forest covers approximately 120 acres at LIBO. The forests are largely the result of reforestation by the Civilian Conservation Corps during the Olmstead plan implementation of the 1930s and 1940s, although there are a small number of older, open-grown trees left for ornamental purposes (Pavlovic and White 1989). The mature forest contains a canopy of red oak, black oak (*Quercus velutina*), and white oak, as well as pignut hickory and shagbark hickory. Other successional uplands have not been planted, but they have succeeded to tulip poplar (*Liriodendron tulipifera*), red maple, sweetgum (*Liquidambar styraciflua*), and sassafras (*Sassafras albidum*). A mixed maple-tulip poplar forest, planted during the 1920s and 1930s, covers much of the southeastern section of the park. Mesic species, such as tulip poplar, sweetgum, and maples dominate the lower elevations of the park. The bottomlands consisted largely of successional forests with an overstory of sweetgum and red maple. Pin oak (*Quercus palustris*) dominates the remnant mature bottomland forests. Home sites, present before site development into a memorial unit, supported numerous invasive pasture grasses such as tall fescue (*Schedonorus phoenix*), orchard grass, and bluegrass.

Federally listed threatened, endangered, or candidate plant species: No federally listed species occur in the park.

Indiana state-listed plant species found at LIBO: Indiana's endangered species act[21] does not cover plants, but only covers animals. Despite this, the park has documented 13 species of management concern within the park (See Appendix L).

Wildlife and Fish. A wildlife inventory was completed in 1996-97. During the inventory, 67 bird species were counted during breeding bird surveys, including 26 Neotropical migrants, 26 migrants that winter in the U.S., and 26 resident species. Since that inventory, 42 species of breeding birds have been found during monitoring. Twenty-one of the 42 species are year round residents, with the remaining species being summer residents and 12 species are of continental importance (Peitz 2011a). The most common bird species included northern cardinal (*Cardinalis cardinalis*), Canada goose (*Branta canadensis*), American crow (*Corvus brachyrhynchos*), tufted titmouse (*Parus bicolor*), and blue jay (*Cyanocitta cristata*).

Five large mammals, including white-tailed deer and coyote (*Canis latrans*), were identified in surveys. Nine small mammal species were documented with mice (*Peromyscus* spp.) being among the most frequently recorded. An inventory also documented seven frogs and toads, four salamander, two lizard, four turtle, and six snake species.

Federally listed threatened, endangered, or candidate animal species: No federally listed species occur in the park, but the park is in the range of the Indiana bat.

Indiana state-listed animal species found at LIBO: Indiana's endangered species act covers animals, excluding insects. The act does not require agency consultation. There are three bird species, one reptile, and one mammal that are listed as state species of concern that occur in the park (Appendix L).

[21] Ind. Code 14-22-34-1 et seq. Indiana endangered species legislation covering animals, excluding insects.

3.1.3 Mississippi Embayment Park (ARPO)

The area has been greatly changed by natural forces and human intervention. Dams and levees have changed the river hydrology that shaped the vegetation communities by affecting flooding, river braiding and migration, and deposition of silt within the delta region. Although fire may have occurred periodically in the prairies and upland forests at ARPO, the frequency of fires in the moist alluvial soils and bottomlands would have been infrequent. White-tailed deer grazing is a natural disturbance that affects plant composition. Over-browsing may contribute to opportunities for invasive plant propagation by suppressing native forest regeneration or creating gaps in vegetation cover.

Arkansas Post National Memorial

According to the GMP (NPS 2003), the park consists of 758 acres, comprised of the Memorial Unit (main unit of 389 acres) and the Osotouy Unit (361 acres) that are broadly separated by the Arkansas River and land. The Memorial Unit, a peninsula within the Arkansas River, was first designated to preserve and commemorate the first European settlement in the lower Mississippi Valley. The Osotouy is land-based along Lake Dumond and a bayou, and it was added to the park because of its mounds and cemetery associated with pre-Columbian and early European settlement. The southern border is contiguous with USFWS land, while other portions of the boundary abut private land.

Landforms and Geology. The park is situated in the Atlantic Plains Geologic Province on an escarpment above the Arkansas River. The topography at ARPO consists of flat alluvial floodplains punctuated by terrace scarps and levees. The Memorial Unit soils consist of parent material of loess, 1 to 8 feet thick overlying alluvium. Soils are strongly acid throughout, with a moderate natural fertility, and a have medium organic matter content. Soil types are:

- Grenada silt-loam – moderately well drained and strongly acidic throughout. Infiltration is slow with excess water at or near the surface.
- Calloway silt-loam – less acidic than the Grenada and has low organic matter content. Infiltration is slow and moisture is near the surface.
- Tichnor silt-loam – strongly acidic, frequently flooded, and usually found around water or bayous. Infiltration is slow with excess water ponding until infiltration or subsurface runoff occurs.

Farming, terracing, damming, and drainage over the last 200 years have modified the soils and hydrological regimes at ARPO.

Aquatic Resources. Arkansas River flow rates at ARPO are slow, even in the main channel, due to the lack of relief in the Mississippi Delta floodplain. Dams and levees have altered flow regimes from their natural dynamic. The Osotouy Unit lacks the water features and wetlands that characterize the Memorial Unit.

Rivers, wetlands, and bayous surround the Memorial Unit with parts of those waterways included in the boundary (Figure 3.1.3.1). Moore Bayou, now referred to as Post Bayou, lies along the north/northwest border, and Post Bend, a backwater of the Arkansas River, lies on the north and northeastern border. Both bayous, as well as the backwater, empty into the Arkansas River along the southern edge of the Memorial Unit. Post Lake was created in the late 1960's when the U.S. Army Corps of Engineers constructed dam number two on the Arkansas River,

Figure 3.1.3.1 Boundary of Memorial Unit

approximately two miles south of ARPO. A slough in the northwest section of the park empties into Post Bayou. South of the picnic area, Alligator Slough and its associated intermittent spring both flow west into Post Bayou.

The Osotouy Unit is bordered by Lake Dumond, an old oxbow of the Arkansas River, on the southwest. Menard Bayou enters the Osotouy Unit from the east and exits out across the northern boundary.

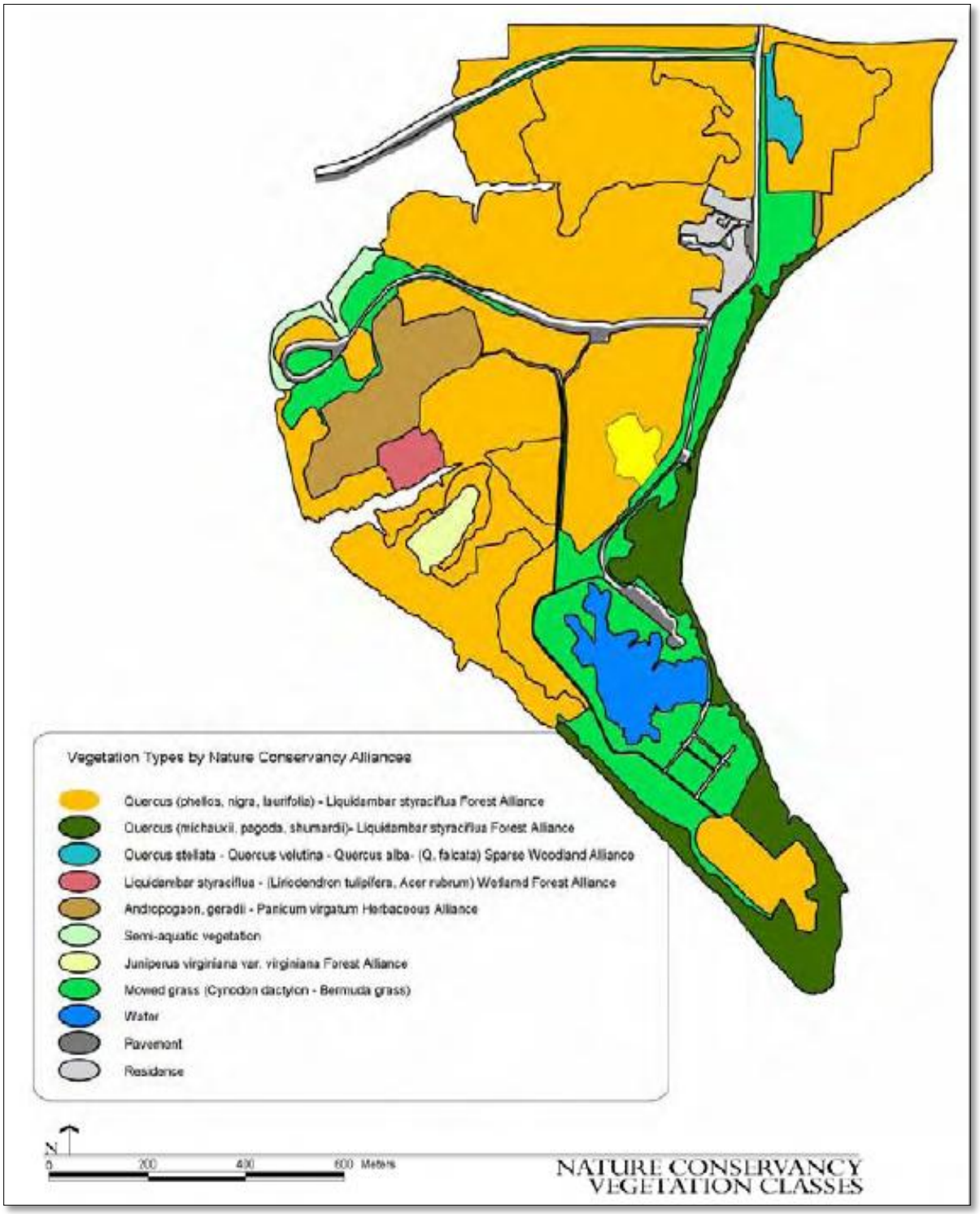
Vegetation. Located at the northern edge of the Gulf coastal plain, native growth ranges from prairie grasses and bottomland hardwood forests to wetland marshes near the bayous and river. Vegetation includes a wide range of plant communities including bottomland and upland forests, swamps, fresh water marshes, canebrakes, isolated prairie relics, and manicured lawns. As many as 272 vascular plant species, none of which were listed as rare, endangered, or threatened, are documented. The Memorial Unit consists of 13 different vegetation types, which range from primarily oak-dominated forest to pine forest to restored prairie (Figure 3.1.3.2).

Trees cover approximately 80% of the park. Eastern North American forest types, such as oak, hickory, black walnut, and other mesic deciduous forest taxa can be found mixed with bottomland sweetgum-oak associates as topography transitions into the bottomland forest. The forests at ARPO, although highly disturbed by human use and manipulation, are typical of Mississippi Delta alluvial floodplains. Upland species, such as oaks and hickories, are found on well-drained soils. Successional communities of cherrybark oak (*Quercus pagoda*), water oak (*Quercus nigra*), sweetgum, eastern red cedar, and loblolly pine (*Pinus taeda*) on moderately well drained sites succeed to mature oak forests. The Osotouy Unit consists of common bottomland species including bald cypress (*Taxodium distichum*), northern pecan (*Carya illinoiensis*), sycamore, and occasional small stands of oaks, as well as some tallgrass areas. Flooded sites at ARPO support forests of water oak, willow oak (*Quercus phellos*), overcup oak (*Quercus lyrata*), water hickory (*Carya aquatica*), northern pecan, Carolina ash (*Fraxinus caroliniana*), sugarberry (*Celtis laevigata*) and bald cypress. Trifoliate orange, common vinca (*Vinca minor*), Chinese privet, and Japanese honeysuckle have invaded forests.

Federally listed threatened, endangered, or candidate plant species: No federally protected endangered or threatened species occur in the park.

Arkansas state-listed plant species found at ARPO: The state does not have an endangered species act, but two plants are documented and as many as 12 plant species of management concern may be present, based on habitat availability (Appendix L).

Figure 3.1.3.2 Vegetation types as established using the Nature Conservancy Alliances[22]



[22] As taken from Exhibit 24 of the Cultural Landscape Report 2005 (NPS 2005).

Wildlife and Fish. The inventory to document the baseline bird community at the Memorial and Osotouy Units found 60 different species at the Memorial Unit and 42 species at the Osotouy Unit. Since then, 66 breeding bird species have been monitored (Tappe 2004; Peitz 2011). Examples of birds at the Memorial and Osotouy Units include the American crow, indigo bunting (*Passerina cyanea*), and red-shouldered hawk. A survey in the spring of 2000 (Trauth and McCallum 2003) identified 8 amphibians and 21 reptiles, four of which were new county records. Blanchard's cricket frogs (*Acris crepitans* blanchardi) are abundant in the park, as documented by the Network herpetofauna inventory, but they are not common outside of park boundaries. While a formal mammal inventory has not been completed for the Memorial Unit or Osotouy Unit, white-tailed deer are common in the park and are monitored. Bats were inventoried in 2005 and four species were recorded with the most common species being evening bat (*Nycticieus humeralis*) and red bat (*Lasiurus borealis*), followed by Rafinesque's big-eared bat (*Plecotus rafinesquii*) and the eastern pipistrelle bat (*Pipistrellus subflavus*). Armadillo (*Dasypus novemcinctus*) populations vary seasonally and annually at the park, but are common to the region.

During the herpetofauna survey in 2000, one nesting American alligator was observed within the area of Alligator Slough. Twenty-two hatchlings were observed near the nest 10 months later. This suggests that Alligator Slough may be an important habitat for American alligators. Herpetofauna species abundance and richness was also much higher at Alligator Slough than anywhere else in the park; 76 % of the amphibians and reptiles at the park utilize this habitat.

Federally listed threatened, endangered, or candidate animal species: Two federally protected species, the endangered least tern and American alligator, which retains protection status as "threatened due to similarity of appearance" to the endangered crocodile, are documented as present in the park. The least tern habitat is not associated with treatment areas.

Arkansas state-listed animal species at ARPO: The state does not have an endangered species act. Several species of state management interest were documented in the park. One amphibian, 23 birds, one mammal, and two reptiles were reported (See Appendix L).

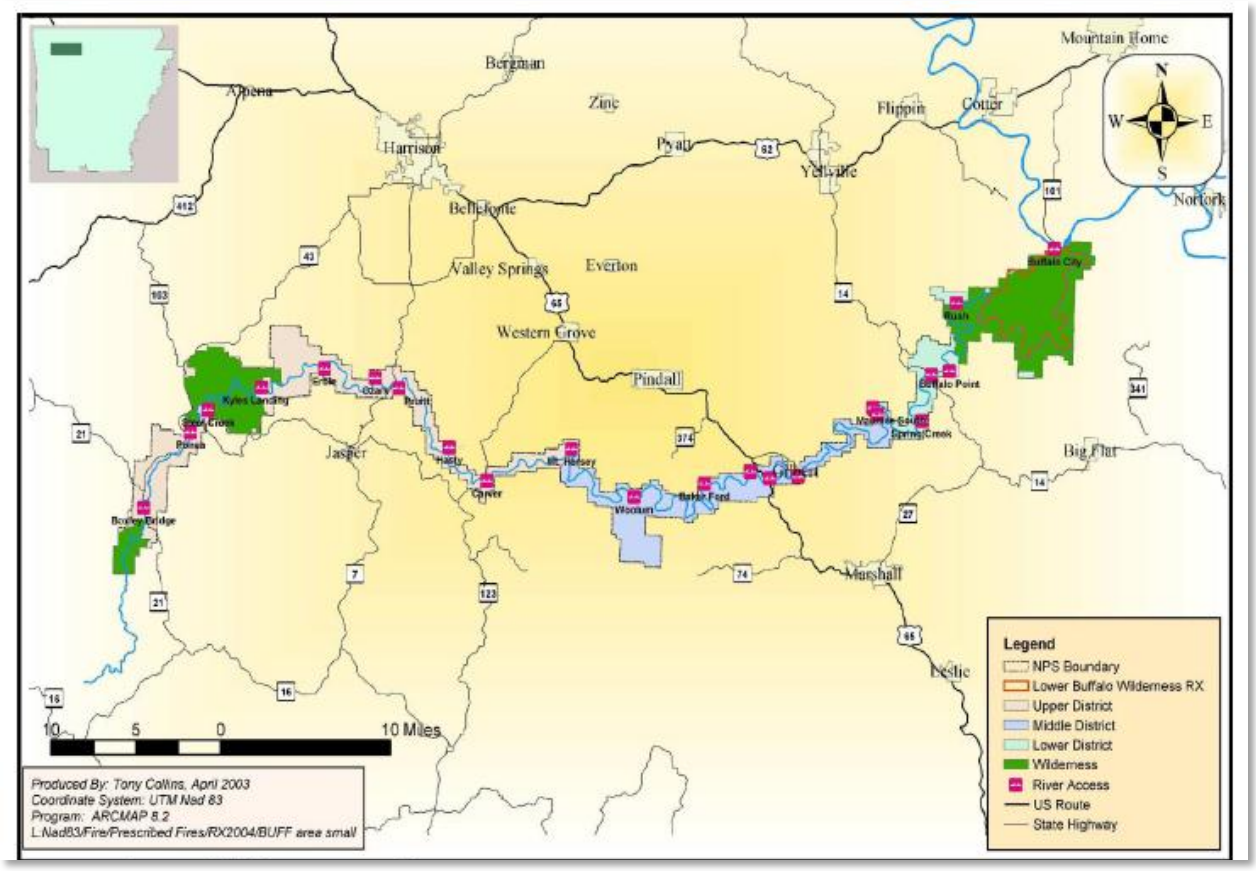
3.1.4 Interior Highland Parks (BUFF, GWCA, HOSP, OZAR, PERI, WICR)

The parks of the Interior Highland include small historic parks, battlefields, and national rivers. Climate conditions, particularly in the mountainous areas, allow the development of forest vegetation. This area has high tornado activity that may affect forest composition by creating windfall openings. Fire appears to be critical for maintaining upland forests and savannas by reducing understory. Current white-tailed deer populations are much larger than historical populations, resulting in over-browsing that may contribute to opportunities for invasive plant propagation by suppressing native forest regeneration or creating gaps in vegetation cover.

Buffalo National River (BUFF)

Congress established the Buffalo River as the first National River in the United States in 1972 "*for the purposes of conserving and interpreting an area containing unique scenic and scientific features, and preserving as a free flowing stream an important segment of the Buffalo River in Arkansas for the benefit and enjoyment of present and future generations.*" The Buffalo River is one of the few remaining free-flowing rivers in the lower 48 states, encompassing 150 miles from the Boston Mountains to the White River (Figure 3.1.4.1). The park contains approximately 95,730 acres of 857,607 acres in the Buffalo River watershed. Farms and working forests predominate in areas surrounding the park boundaries.

Figure 3.1.4.1 Buffalo National River area map.



Landform, Geology, and Soils. The park is located in the Salem Plateau of the Ozark Highlands in northern Arkansas. Sections of BUFF lie within the Boston Mountains with elevations up to 2000 feet. Steep-sided valleys and high ridges characterize the topography. The karst landforms of the region feature a large number of sinkholes, springs, and seeps that formed in the limestone and dolomite. The park has the largest cave system in the state of Arkansas. Conduits of rock create complex water flow, where surface water can affect ground water through quick recharge. Soils in BUFF vary from fairly thick and sandy to very thin and gravelly. The Buffalo River originates primarily composed of Pennsylvanian clastic sediments where soils are sandy to clayey. Rocky soils can range from very thin to over 30 feet in depth.

Aquatic Resources. Water has been mandated as the number one natural resource at BUFF in its Terrestrial Habitat Management Plan (NPS 2006e). The main stem of the Buffalo River is not dammed. Springs provide significant contributions to the base-flow in the river and supports aquatic species during dry periods. Both normal and high flows of the river transport sediment and maintain important physical habitat. Portions of the river have been designated by state agencies as impaired because of non-point pollution.[23] The Buffalo River and a major tributary, Richland Creek, are both listed as Outstanding National Resource Waters[24].

Runoff enters the groundwater by percolating through thin or sandy to clayey soils until it reaches open fractures in the underlying bedrock. Water transport in these karst systems is relatively rapid and there is little effective filtration or adsorption of contaminants. Contaminants can quickly enter the shallow aquifers and impact aquatic species in springs and streams.

Vegetation. The park contains many land uses, including approximately 3,700 acres of agricultural use. Natural plant communities at BUFF include oaks, hickories, American beech, and Ozark chinquapin (*Castanea pumila* var. ozarkensi) forests, relic post oak (*Quercus stellata*) barrens, eastern red cedar and sandstone glades, and rare river cane communities. These land cover types have been divided into principle groups in the Terrestrial Habitat Management Plan.

Forest Upland refers to forested land with greater than 50 percent canopy cover on non-alluvial soils that generally are not inundated by water. Oaks and hickories, blackgum (*Nyssa sylvatica*), shortleaf pine overstory with a mid and understory of dogwood, mulberry (*Morus* sp.), redbud (*Cercis canadensis*), and a generally sparse herbaceous ground cover typify this forest.

Bottomland Forest refers to forested land with greater than 50 percent canopy cover on periodically flooded alluvial soils. Sycamore, box elder, sweetgum, silver maple overstory species with a mid- and understory of pawpaw (*Asimina triloba*), witch hazel (*Hamamelis virginiana*), inland sea oats (*Chasmanthium latifolium*), rivercane, and Canada wild rye (*Elymus canadensis*) typify this forest.

Early Succession Old Fields: The old-field systems are open lands that have not been maintained since the federal government acquired the property. They are in various stages of plant succession and typically are dominated by eastern red cedar, black locust, fescue (likely *Schedonorus phoenix*), and Chinese bushclover.

[23] Arkansas Department of Pollution Control and Ecology, 1992 determination.
[24] The NPS National Wild and Scenic Rivers Program, http://www.nature.nps.gov/water/Program_Briefs/WSR_programbrief_web.pdf (March 5, 2012).

Special Use Permit Fields: These fields are agricultural fields, primarily cut for hay, that preserve the pastoral setting. Tall fescue, a potentially invasive species, is common.

Glades are treeless or sparsely wooded openings in forests with bedrock at or near the surface that have thin, well-drained soils.

Savannas are characterized by widely spaced trees and diverse ground vegetation that combines the floristic characteristics of both grasslands and woodlands.

Cane Communities are areas, usually alongside streams, where river cane is the dominant understory vegetation. These areas provide a unique habitat for native wildlife.

Federally listed threatened, endangered, or candidate plant species: No federally listed plant species are documented in the park.

Arkansas state-listed plant species found at BUFF: Although the state does not have an endangered species law, 19 vascular plant species of state management concern occur in the park (See Appendix L).

Unique Vegetation Communities: Several unique vegetation communities have been identified in the park. Savannas or "post oak barrens" are characterized by open areas of widely scattered trees with a diverse herbaceous ground cover. Dense thickets of river cane are found in riparian areas. Additionally, 42 populations of rare plants are associated with park springs and seeps.

Wildlife and Fish. Over 300 caves exist in BUFF, including the longest cave system in the state. The caves provide habitat for bat species. The forests provide habitat for a variety of migratory songbirds. The river provides habitat for wetland-dependent birds. The park environs are home to the Ozark region's only elk herd, with approximately 400 animals (NPS 2006e). White-tailed deer are common in the park. Browsing and grazing can promote new plant growth and maintain successional diversity, provided browsing pressure does not become too intensive or extensive which could result in detrimental impacts to vegetation communities.

Sixty fish species have been documented within BUFF, of which 10 are endemic to the Ozark Highlands Region. Large numbers of aquatic invertebrate species, including 23 native mussel species, are found in the river, its tributaries, and springs. Additionally, the Buffalo River is a state designated "blue-ribbon" smallmouth bass (*Micropterus dolomieu*) sport fishery with numerous other sport fishes present as well.

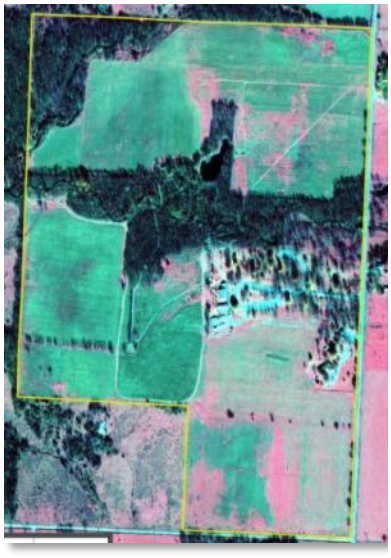
Federally listed threatened, endangered, or candidate animal species: Three federally endangered bats, gray, Indiana, and Ozark big-eared bats (Bitting and Slay 2004), and one endangered salamander, Ozark hellbender, are present in the park. The park staff documented the federal candidate species the Neartic paduniellan caddisfly (*Paduniella nearctia*).

Arkansas state-listed animal species found at BUFF: Thirty-one bird, four amphibian, one reptile, and four fish species of conservation status were documented in the park (See Appendix L). In addition to the federally listed bats, the state also includes the small-footed myotis (*Myotis leibii*) among mammals of conservation status in the park.

Wilderness. The Buffalo National River Wilderness[25] was designated in 1978 and now totals 34,933 acres, adjoining the Ozark National Forest designated wilderness.

[25] 1964 Wilderness Act, http://wilderness.nps.gov/tb2.cfm, accessed March 22, 2012.

George Washington Carver National Monument



Boundary of GWCA in yellow with open land (light green and pink) and woods (dark green) shown.

The park, established in 1943, is located in the southwest corner of Missouri and encompasses the original 240-acre Moses Carver farm. The park is predominantly a cultural site commemorating George Washington Carver's life, but natural resources contribute to interpretation of Carver's childhood.

Landform, Geology, and Soils. The park lies in the gently rolling landscape of the Springfield Plateau. Elevation ranges from 1040 feet to 1080 feet. The topography is dissected by stream channels that carry water from natural springs. Soils are several feet thick throughout the park. Hagerstown and Eldon silt-loams and Baxter gravelly loam are the predominant soil series.

Aquatic Resources. Three small streams, Carver Creek, Williams Branch, and Harkins Branch, occur in the park, none of which is listed as Clean Water Act § 303(d) impaired water. The park also has two springs of historical and natural significance. The south-central, west-central, and east-central sections of the park often retain standing water during the winter and spring. Some of the water originates from runoff, while much of it results from groundwater seepage.

Vegetation. Approximately 130 acres of the park are in various stages of restoration from agricultural field to native tallgrass prairie. Approximately 60 acres are upland or riparian forests. The remaining 20 acres of GWCA include park development for operations and visitor services. Surrounding farmlands in the park consist of a mixture of pastures and forest. The royal catchfly *(Silene regia*), formerly a federal candidate species, is found in the prairie at GWCA.

Federally listed threatened, endangered, or candidate plant species: No federally listed species occur in the park.

Missouri state-listed plant species found at GWCA: No state-listed species occur in the park.

Wildlife and Fish. Herpetofauna inventories at GWCA identified three salamander, ten frogs and toads, six turtle, six lizard, and 12 snake species present. Forty-nine bird species were identified in breeding bird surveys, six of which are species of continental importance. Twenty-six fish species were identified. Wildlife studies consist of a small mammal inventory completed in 2005 for prairie communities, and ongoing fish, bird, and invertebrate species surveys.

Federally listed threatened, endangered, or candidate animal species: Three federal candidate species, regal fritillary (*Speyeria idalia*), Arkansas darter, and loggerhead shrike (*Lanius ludovicianus*), were found in the park. No listed endangered or threatened species are documented as occurring in this park.

Missouri state-listed animal species found at GWCA: Thirteen state-listed endangered, threatened, or conservation species birds have been observed in the park (see Appendix L). No other state species are designated to be of conservation concern for the state.

Hot Springs National Park

Located in west central Arkansas at the southeastern edge of the Ouachita Mountains, HOSP is approximately 5,450 acres and is adjacent to the City of Hot Springs. Hot Springs Reservation was established around thermal springs in 1832. It became a National Park in 1921. The park's enabling legislation mandates that the thermal waters be preserved and provided to the public in an unending and unaltered supply.

Landform, Geology, and Soils, including geothermal water. The Ouachita Mountains lie south of the Ozark Plateau parks and has geologic distinctions from the Salem and Springfield plateaus. The park falls within a sub-group of the Ouachita Mountains called the Zig-Zag Mountains. This mountain group consists of severely fractured folds that are truncated by thrust faults. There is no limestone or dolomite, and therefore there is no karst.

The geothermal aquifer of HOSP is thought to be approximately 12 to 15 square miles in extent, although the precise boundary is unknown. The hot springs are geothermally heated to 61 degrees Celsius at a depth of several thousand feet. The water then rises through faults in the sandstone formation, mixes with less than 20-year-old ground water, and emerges from the thermal springs. Through radiocarbon dating, this process has been determined to take over 4,000 years. During and after storm events, the contribution of young, proximal recharge area water to the thermal springs appears to be greater than during base-flow conditions (Stephen Rudd 2011, personal communication).

Aquatic Resources. Two cold-water springs, a few intermittent and perennial streams, and a few small lakes occur within the boundaries of HOSP. The cold-water springs, Whittington and Happy Hollow Springs, and thermal water fountains are used by the public as sources of drinking water. The perennial streams include Gulpha Creek, Whittington Creek, Bull Bayou, and Hot Springs Creek. The headwaters of Gulpha Creek, Hot Springs Creek, and Bull Bayou are outside park boundaries. The headwaters for Wittington Creek are within park boundaries. Gulpha Creek is a perennial stream that enters the park at Stone Bridge and flows through the HOSP campground where visitors recreate and fish in it. Wittington Creek flows into Hot Springs Creek before the creek enters the canal under the main street of Bathhouse Row. Bull Bayou, a backwater slough of Ouachita River, forms a boundary of HOSP.

Vegetation. Forest vegetation in HOSP lies within a transition zone between the upland hardwood forests characteristic of the Ozark Plateau to the north and west and the southern short-leaf pine dominated associations of the Gulf Coastal Plain to the south. The vegetation at HOSP is organized along elevation and aspect gradients.

Wooded entrance to West Mountain drive (NPS 2010a) shows typical forest cover.

Dense forest covers much of HOSP. Typical overstory species include shortleaf pine, Spanish oak (*Quercus falcata*), red oak, black oak, white oak, and hickories. North slopes are dominated by mesic hardwood forests, while shortleaf pine, oaks, and hickories occupy dry south-facing slopes. Nutrient rich bottomland forests in the valleys support a mixture of hardwood species including sweetgum, sycamore, American beech, American

hornbeam (*Carpinus caroliniana*), and white oak, while less fertile bottomland sites support loblolly and shortleaf pines.

Comprehensive floristic inventories of Sugarloaf Mountain and North Mountain identified 309 vascular plant taxa. Asteraceae was the largest plant family represented in the study with 42 taxa, followed by Poaceae (40 taxa) and Fabaceae (22 taxa). Eleven taxa of ferns were found. The six most frequent species were woody and include (in order of most frequent) muscadine grape (*Vitis rotundifolia*), cat greenbrier (*Smilax glauca*), black cherry (*Prunus serotina*), lowbush blueberry (*Vaccinium pallidum*), roundleaf greenbrier (*Smilax rotundifolia*), and white oak. The most frequent herbs were woodland sunflower (*Helianthus divaricatus*), stalked goldenrod (*Solidago petiolaris*), flowering spurge (*Euphorbia corollata*), and poverty oats (*Danthonia spicata*).

In 2009, crews documented 37 invasive plant taxa at HOSP. The most widespread and abundant of the exotic plant species observed included Chinese privet and Japanese honeysuckle, each of which covered at least 4 acres within the study area. In general, several invasive plants are major problems at HOSP, but successful control is possible (Short et al. 2010b).

Federally listed threatened, endangered, or candidate plant species: No federally listed species were encountered in the inventories.

Arkansas state-listed plant species found at HOSP: In the absence of state endangered species legislation, the state recognizes species of conservation concern, including seven of state management concern (see Appendix L). Arkansas Natural Heritage Commission tracks three taxa as elements of special concern: Ozark chinquapin, hairyflower Arkansas bedstraw (*Galium arkansanum* var. pubiflorum), and compact blazing star (*Liatris squarrosa* var. compacta).

Wildlife and Fish. Wildlife within the park is typical of the region. The park documented 135 species of birds. Aquatic wildlife is limited to portions of several small creeks, and there are few game fish (NPS 2005b). The park has identified 12 frogs, two salamanders, four snakes, and four turtles among the herpetofauna species in the park.

Federally listed threatened, endangered, or candidate animal species: No federally listed species are documented for the park.

Arkansas state-listed animal species found at HOSP: In the absence of state endangered species legislation, the state recognizes species of conservation concern, including one bat, one fish, and five bird species (see Appendix L).

Ozark National Scenic Riverways


Aerial photo of OZAR shows forest cover and terrain.

Ozark National Scenic Riverways was established in 1964 to "*conserve and interpret unique scenic and other natural values and objects of historic interest, including the preservation of the Current River and the Jacks Fork River as free-flowing streams, preservation of springs and caves, management of wildlife, and provision for use and enjoyment of the outdoor recreation resources.*" The park is located on the Salem Plateau of the Ozark Plateau's physiographic province in southeastern Missouri. The park was the first in the NPS specifically designated to preserve the scenic river experience.

Landform, Geology, and Soils. The Salem Plateau consists of steep-sided valleys with maximum elevation of the ridges at approximately 1600 feet. Karst topography characterizing OZAR formed from the dissolution of underground pathways, conduits, and caverns that have surface expressions of sinkholes, losing streams, caves, and springs. As a result, the area is underlain by complex pathways of water, where surface constituents can disappear into the ground to emerge from springs elsewhere.

Soils along the park have formed primarily in loess, hill slope sediments, or gravelly alluvium. Most soils are highly weathered Ultisols and Alfisols. Soils range from shallow unconsolidated materials over bedrock to deep, highly weathered soils in hill slope sediments. Bedrock outcrops occur near the confluence of the two rivers. Alluvial soils on upland drainages, terraces, and floodplains are deep, coarse-textured, and have medium base saturation.

Aquatic Resources. One-hundred thirty-four miles of the Current River and its major tributary, the Jacks Fork River, comprise the park's river ways. The Current River basin includes cold-water habitat maintained by a nationally ranked spring discharge system with warm-water habitats in reaches dominated by runoff. Over 300 springs are documented in OZAR and their contribution to the hydrological budget in this region is so significant that spring inputs may exceed runoff. Because of the porous karst system underlying the surface features, the water discharging from the springs may have fallen as rain hours before or may be hundreds of years old. Using dye-tracing methods, water has been shown to travel underground in this karst terrain as quickly as 3 miles per day. The recharge zones for these springs extend underground as far as 40 miles, and can cross surface watershed-divides. The park contains four of the ten largest springs in Missouri, including Big Spring. Big Spring is one of the largest springs in the United States, delivering 288 million gallons of water per day to the Current River.

Vegetation. A vegetation classification identified several natural communities for the FMP (NPS 2004a). The xeric communities included treeless glades, cedar glades, bluff and rock ledge, and open forest of upland sites. Eastern red cedar has increased in glades following fire suppression. Mesic site communities included

- Hardwood forests of ridges and upper slopes.
- Hardwood-pine forests of ridges and upper slopes.
- Forests in draws and ravines.
- Forests on lower slopes.
- Vegetation on steep rocky banks and talus slopes.

- Forest in river bottoms.
- Open fields.

Federally listed threatened, endangered, or candidate plant species: No federally listed species occur in the park.

Missouri state-listed plant species found at OZAR: No state-listed species occur in the park.

Wildlife and Fish. The Ozark region is one of the oldest exposed landmasses in North America and has been free of glaciers or inundation for at least 200 million years. These conditions, combined with climate changes, contribute to a high incidence of endemism, relicts, and edge of range distributions for many Ozark species, particularly crayfishes (Cambaridae), fish, aquatic insects, and cave-dwelling species.

A herpetofauna inventory documented 73 herpetofauna species, including 13 turtle species, 13 salamander species, 13 frog species, and 27 snake species. The Current River basin contains 112 of the 270 fish species known to occur in the entire Mississippi River system, including six endemic species and one subspecies found only in the Current River. The forests provide habitat for a great variety of migratory songbirds, both sustaining breeding populations and as temporary residents migrating through the park. The rivers provide habitat for wetland-dependent birds. During a comprehensive mammal study, 49 species were documented.

Federally listed threatened, endangered, or candidate animal species: Two federally endangered bats are present in the park, Indiana bat and gray bat. One federally endangered giant salamander species is present in the park, the Ozark hellbender. The delisted bald eagle is a resident of the park and retains federal protection.

Missouri state-listed animal species found at OZAR: The state recognizes 17 bird species, four amphibians, one reptile, 12 fishes, and seven mammal species that are located in OZAR as endangered, threatened or of conservation concern (see Appendix L). Several Missouri species of concern are not included among the NPSpecies lists, but are reported in the park. They include several invertebrates, Salem cave crayfish (*Cambarus hubrichti*), winter stonefly (*Allocapnia pygmaea*), elktoe (*Alasmidonta marginata*), Ouchita kidneyshell (*Ptychobranchus occidentalis*), black sandshell (*Ligumia recta*), and Arkansas brokenray (*Lampsilis reeviana*).

Pea Ridge National Military Park


Split rail fence on battlefield with woods bordering, where flat terrain rises to uplands (James 2008)

Pea Ridge National Military Park is located three miles west of the town of Garfield in Benton County, Arkansas. The park was established in 1956 to preserve, commemorate, and interpret events associated with the March 1862 battle that occurred on the site.

Landform, Geology, and Soils. The park is on the Springfield plateau with rolling hills and prominent ridges. The highest elevation in the park is at the eastern end of Elkhorn Mountain, approximately 1,610 feet above sea level and about 150 feet higher than surrounding ground. Another prominent feature is Round Top located one-half mile south of the western end of Elkhorn Mountain and at the eastern edge of the park prairie. An abundance of sandstone is found on Elkhorn Mountain. Other area formations are mainly limestone, but there are no well-developed karst features, such as caves or karst streams. Flat lands extend into the western quarter of the park. The lowest elevation in the park, 1,260 feet above sea level, is on the southern edge. Soils consist primarily of Toloca silt-loam, Pearidge silt-loam, Captina silt-loam, and Jay silt-loam. Soils occur on somewhat poorly drained slopes of 1-3 % grade, but provide fertile topsoil.

Aquatic Resources. Relatively rapid precipitation runoff with limited surface water sources characterizes the area. There are no major perennial streams in the park, but several streams originate in the park, and livestock ponds persist as remnants from agricultural practices prior to park establishment. Big Sugar Creek drains the northern quarter of the park, while Little Sugar Creek drains the rest of the park. The park does not have any bodies of water listed as Clean Water Act § 303(d) impaired water or Outstanding Natural Resource Waters.

Vegetation. The landscape is comprised primarily of deciduous hardwood forests (3,600 acres), but also includes ledges and bluffs, riparian vegetation, restored prairies, a limestone and sandstone glade, and fields. Forests, cultivated fields, or abandoned fields at different stages of ecological succession are present throughout the park. Restoration and reconstruction of a prairie is underway in the western quarter of the park. The park's hardwood forest vegetation varies with site conditions. Distinct forest types include post oak/blackjack oak (*Quercus marilandica*) forest, oak/hickory forests, and mixed forest types typical of the region (James 2008).

Approximately 600 acres of open fields are maintained in their historic appearance by haying under agricultural special use permit to local farmers and by prescribed fire. Abandoned field vegetation includes tall grasses and mixed shrubs. Eastern red cedar is a native invasive species, which now dominates old fields that were abandoned at the time of the park's establishment. A 2001 flora inventory identified 226 species as present in the park. Asteraceae and Fabaceae families predominate, as represented by 22 and 17 taxa, respectively.

Federally listed threatened, endangered, or candidate plant species: No federally listed species occur in the park.

Arkansas state-listed plant species found at PERI: Arkansas has no endangered species legislation, but seven vascular plants in the park are listed as conservation species (see Appendix L). Ozark chinquapin, in decline throughout the region, occurs at five sites in the park.

Wildlife and Fish. The wildlife species found in the park are typical of northwest Arkansas. Animal populations vary among the different plant habitats. Sixty-three species of breeding birds are confirmed through ongoing monitoring efforts with 16 being species of continental importance (Peitz 2009). The yellowthroated vireo (*Vireo flavifrons*) was the most commonly occurring species during the breeding season, and indigo bunting and northern cardinal were common. Three grassland obligate species were recorded, the eastern meadowlark (*Sturnella magna*), grasshopper sparrow (*Ammodramus savannarum*), and Henslow's sparrow (*Ammodramus henslowii*) (Peitz 2009).

The white-tailed deer population may be taxing the carrying capacity of the habitat. The index of white-tailed deer density declined sharply between 2005 and 2007, coincident with an outbreak of hemorrhagic disease throughout the area (Cribbs and Peitz 2007). Population size has increased gradually since 2007, with another small decline in 2010 and small rebound in 2011 (Peitz 2011c).

In a 2000 herpetofauna inventory, 11 frog and toad, seven salamander, two turtle, four lizard, and 15 snake species were documented. Black bear (*Ursus americanus*) have also been incidentally sited in the park.

Federally listed threatened, endangered, or candidate animal species: No federally listed species occur in the park. A gray bat hibernaculum is located 10 miles from the park, and gray bats probably forage in the park, but there is no confirmed report of occurrence. A bat inventory was conducted in the spring and summer of 2002.

Arkansas state-listed animal species found at PERI: One fish species, one amphibian, and four bird species in the park are considered conservation species of management interest by the state (see Appendix L).

Wilson's Creek National Battlefield

Wilson's Creek National Battlefield is located in southwest Missouri, 10 miles south of the city of Springfield. The park was established in 1960 to commemorate the first Civil War battle west of the Mississippi River.

Landform, Geology, and Soils. Karst formations include five caves with approximately 60 feet of undeveloped cave passages within the park. Topography is gently rolling Springfield Plateau. Primary soils range from deep, stony and chert silt-loam, to shallow mixes (9 to 20 inches in depth) over fractured limestone. Alluvial soils are present along Wilson's Creek and its tributaries. Limestone glades with shallow, rocky soils, scattered throughout the park, support characteristic vegetation, including several rare, protected species.

Aquatic Resources. The primary waterway is Wilson's Creek with two tributaries, Skegg's Branch and Terrell Creek. Water quality and hydrology are critical issues in Wilson's Creek, because of a sewage treatment plant upstream from WICR that discharges 42.5 million gallons of treated sewage effluent each day into Wilson's Creek. During low flow periods, an estimated 80% of the water flowing in the creek is treated sewage effluent. Wilson's Creek has been listed as a Clean Water Act § 303(d) impaired stream within the park.

Vegetation. The NPS restored approximately 1,100 acres of disturbed land to oak savanna or historic fields, similar to those present during the battle. Of 140 plant species documented, 110 were native species. Invasive plant species infest over 500 acres. Chinese bushclover, a plant targeted for control, is the most conspicuous of the invasive plants affecting native communities. Park staff has also targeted eastern red cedar, an invasive native species that alters habitat for federally endangered Missouri bladderpod.

Federally listed threatened, endangered, or candidate plant species: The federally threatened species, Missouri bladderpod, resides in the park.

Missouri state-listed plant species found at WICR: The federally listed Missouri bladderpod is also recognized as a state species in need of conservation.

Wildlife and Fish. Thirty-five species of songbirds, common to the area, have been identified. Bald eagle and other accipiter species, great blue heron (*Ardea herodias*), killdeer (*Charadrius vociferus*), American crow, turkey vulture (*Cathartes aura*), and various waterfowl have been observed. Breeding-bird monitoring has found 10 bird species of continental importance and two grassland obligate species (Peitz 2009b). Mammal species are those common to the region, although the caves provide significant habitat for bats. The only large herbivore in the park, white-tailed deer, has become abundant and potentially threatens plant communities and restricts forest regeneration (Cribbs and Peitz 2008). Generally, fish communities in the three streams are diverse and healthy, although individuals in Wilson's Creek have a high incidence of physical anomalies (Dodd et al. 2011).

Federally listed threatened, endangered, or candidate animal species: The federally endangered species, gray bat, inhabits caves at WICR. The delisted bald eagle migrates through the park.

Missouri state-listed animal species found at WICR: The state lists the gray bat as endangered in the state. There is also one bird documented in the park on the state list. (See Appendix L.)

3.1.5 Tallgrass Prairie Parks (HEHO, HOME, PIPE, TAPR)

Invasive species are a pervasive problem in small parks that are often inadequately buffered against edge effects and outside influences. Within the prairie region, water pollution from external non-point sources poses a serious threat. Some of these parks are also faced with protecting unique habitats or managing state or federally listed threatened and endangered species within a relatively small park setting.

The Tallgrass Prairie parks historically experienced grassland fire regimes. Fire in grasslands from natural and anthropogenic sources retards succession to forest, helping to maintain the balance between prairie and woodland. The removal of vegetation and plant surface litter also results in exposed soil that is warmer and drier than that of unburned prairie. This contributes to early greening when spring fire occurs, but rarely results in impacts to the soil matrix where prairie root systems are extensive. While high winds and tornadoes are more common in the Tallgrass Prairie parks than in the forested parks of the Network, the ecological effect is less pronounced due to the impacts being restricted to herbaceous plant tissue above ground, capable of regeneration.

Herbert Hoover National Historic Site

The park, established in 1965, is approximately 187 acres with natural resources, including a small tributary to Wapsinonoc Creek referred to as Hoover Creek, reconstructed prairie, woodlots, and associated habitat. The natural resources on site contribute to the park mission by creating a serene landscape to commemorate the life and times of the 31st United States President, according to the GMP from 2006.

Landform, Geology, and Soils. The park lies on the northern edge of the Southern Iowa Drift Plain, which is characterized by abruptly rolling hills. Side hill seeps can occur where loess and glacial till meet on the hillsides (NPS 2003b). Soil originated from loess deposition on top of pre-Illinoisian glacial material. Native prairie once dominated the silt-loam soils and developed rich topsoil. Soils consist of five distinct silty-clay-loam types: Tama silty-clay-loam, Coco-Ely-Judson complex, Colosilty clay-loam, Downs silt-loam, and Adair clay-loam. These soils have moderate to somewhat slow permeability, and are susceptible to sheet erosion, except where prairie plants retain soil within their vast, deep root structure.

Aquatic Resources. The west branch of Wapsinonoc Creek drains a watershed of approximately 5000 acres above the confluence with Hoover Creek, which drains approximately 1700 acres, mostly outside the park. Stream flow alternates between stable discharges during spring and early summer to intermittent flow during late summer and winter. Ground water is relatively deep in the uplands, but can be within 10 feet of the surface in low-lying areas and may seep from rills. Hoover Creek generally lies 8 to 10 feet below the surrounding riparian terrace.

Vegetation. The park includes 50 acres of developed land outside of the project area, 86 acres of reconstructed tallgrass prairie, several small treed woodlots, scrub and treed or scrub riparian areas, and a 40-acre abandoned row-crop farm.

The prairie at HEHO contains native grasses and forbs, and invasive species.

The reconstructed tallgrass prairie was originally seeded in the spring of 1971 with five species of native grasses: big bluestem (*Andropogon gerardii*), switchgrass, Indian grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), and sideoats grama (*Bouteloua curtipendula*). Park managers added forbs in 1976 and made subsequent additions of forbs and Canada wild rye in 1992 and 1994. In 1997, a small tree planting (approximately 2 acres) was created on the southeast ridge of the prairie. Only a few oaks remain in this planting. In 2000, the park planted 200 nut trees immediately south and west of the Gravesite and survival is estimated at about 50 trees. Other wooded areas occur within the riparian area and on the edges of the prairie. These are dominated by black walnut, green ash, and hackberry (*Celtis occidentalis*), and several invasive trees and shrubs.

Federally listed threatened, endangered, or candidate plant species: No federally listed species occur in the park.

Iowa state-listed plant species found at HEHO: Two state species of concern occur at the park, purple coneflower (*Echinacea purpurea*) and prairie rosinweed (*Silphium terebinthinaceum*). Although purposefully planted before local ecotypes were known and now common in the HEHO prairie, purple coneflower is not indigenous to the local area. Pale purple coneflower (*Echinacea pallida*), also purposefully planted after local ecotypes were established, is the native analogous species. Therefore, the park promotes the local genotype recommended by the state supported Iowa Ecotype Project.[26]

Wildlife and Fish. The inventory to document species composition, distribution, and relative abundance of breeding birds was completed in the 2002. Several grassland obligate species were recorded during that inventory and in subsequent monitoring within the prairie. They are sedge wren (*Cistothorus platensis*), dickcissel (*Spiza americana*), grasshopper sparrow, Henslow's sparrow, boblink (*Dolichonyx oryzivorus*), and eastern meadowlark. Eight species of continental importance have been recorded during breeding bird monitoring (Peitz 2010c). The herpetofauna inventory completed in 2002 documented three snake species: northern brown (*Storeria dekayi*), fox (*Elaphe vulpine*), and plains garter (*Thamnophis radix*). Additionally, bullsnake (*Pituophis catenifer* sayi) and smooth greensnake (*Opheodrys vernalis*) have been observed by park staff. No amphibians were recorded. The extreme variability in prairie stream discharge and environmental conditions results in aquatic organisms that have stress-tolerant survival strategies (Bowles et al. 2010), including some species of minnows and suckers (Cypriniformes) (Hope Dodd, personal communication).

Federally listed threatened, endangered, or candidate animal species: No federally listed threatened, endangered, or candidate species occur in the park. The bald eagle is frequently observed flying through the park or roosting in trees, but no nests have been found.

Iowa state-listed animal species found at HEHO: Bullsnake and smooth greensnake, both species of concern, and one threatened species, Henslow's sparrow, have been confirmed in the park (Appendix L).

[26] Tallgrass Prairie Center, University of Northern Iowa, http://www.uni.edu/ecotype/, accessed March 6, 2012.

Homestead National Monument of America

Established in March 1936 to commemorate the Homestead Act of 1862, HOME is located in southeast Nebraska. The 211-acre park includes 163 acres of the original Daniel Freeman homestead and the Freeman schoolhouse.

Landform, Geology, and Soils. The park lies within the glaciated Drift Hill Region of Southeast Nebraska. The gently rolling topography of HOME has relief of 70 feet. Mollisols, characterized by dark A-horizons with organic matter, are the dominant soils. Soil losses due to sheet or rill erosion are typically low in tallgrass prairie cover, even in burned prairies where surface roughness is adequate to maintain low overland flow velocities. Immediately prior to the establishment of the park, the Freeman family had used the lands heavily for farming, grazing, and occupation. Because of this use, a great deal of erosion existed, especially along the upland areas near the south property boundary.

Aquatic Resources. Cub Creek, a tributary of the Big Blue River, meanders for 1.34 miles through the park. The Cub Creek Watershed drains 92,350 acres located in Gage and Jefferson counties of Nebraska and is approximately 35 miles in length. During periods of heavy precipitation, the creek occasionally floods, causing widespread erosion and threatening developed areas. Under normal conditions, Cub Creek flows 1 to 3 feet deep at a width of approximately 20 feet. Land use in the watershed is predominately row crop agriculture, where farm chemicals are in use. Water quality problems include excessive runoff of sediment, nutrients, pesticides, and bacteria.

Vegetation. The vegetation at HOME is roughly two-thirds prairie, reconstructed in 1939, and one-third woodland, that follows Cub Creek. The approximately 100 acres of reconstructed tallgrass prairie, includes dominant grass species such as big bluestem, little bluestem, and Indian grass. Common forbs include goldenrods, sunflowers (*Helianthus* spp.), leadplant (*Armorpha canescens*), and roundhead lespedeza (*Lespedeza capitata*). This is the second oldest prairie restoration in the nation. The Freeman School grounds contain an approximately 0.75-acre remnant of untilled native prairie.

Division of land into prairie (red hatch) and burr oak forest (yellow hatch).

About 60 acres of the park are deciduous riparian forest, dominated by oaks, silver maple, hackberry, and cottonwood (*Populus* sp.). The understory is nearly absent of shrubs and dominated by a dense herb layer of graminoids, prominent early in the season, and tall coarse perennials, prominent as the season progresses. Native edge plants include wild plum (*Prunus americana*), dogwood, and coralberry (*Symphoricarpos orbiculatus*). An inventory documented a rare mesic bur oak forest at HOME. A report by Mlekush and DeBacker (2003) contains a complete discussion of the woodland community. The developed areas consisting of manicured lawns and parkland are to be maintained in a manner that ensures visitor appreciation, satisfaction, and safety and are not part of this proposal.

During surveys in 2006 and 2009, crews documented 14 invasive exotic plant taxa in the restored prairies and the forest. The most widespread and abundant species in 2009 included smooth

brome, Osage orange (*Maclura pomifera)*, reed canarygrass, and white mulberry (*Morus alba*). Bluegrass showed relatively high increases in frequency and abundance from 2006 to 2009. With the exception of bluegrass, smooth brome, and reed canarygrass, invasive plant species generally occur at such low abundance that on-going park efforts to control these species are likely to be very effective (Young et al. 2010b). Osage orange is a cultural feature in the park and its management must be compatible with cultural resource guidance.

Federally listed threatened, endangered, or candidate plant species: No federally listed species occur in the park.

Nebraska state-listed plant species found at HOME: No state endangered or threatened species occur in the park. The state recognizes mesic bur oak forest as a rare community of conservation importance.

Wildlife and Fish. Species that inhabit or migrate through the park include white-tailed deer, beaver (*Castor canadensis*), coyote, eastern cottontail *(Sylvilagus floridanus*), and squirrels (*Sciurus* spp. and *Spermophilus* spp.). Herpetofauna found at HOME include common garter snakes (*Thamnophis sirtalis*), northern brown snake, tree frogs (*Hylidae* spp.), and other common frogs and toads. Cub Creek provides habitat for carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus*), several sunfish (*Lepomis* spp.), and minnow species (Cypriniformes). Inventories have identified over 100 bird species, but only 43 were recorded during breeding bird surveys in 2009. Nine species are of continental importance (Peitz 2010b). According to the park Resource Management Plan 2000, game birds include common pheasant (*Phasianus colchicus*), northern bobwhite (*Colinus virginianus*), and the occasional wild turkey.

Federally listed threatened, endangered, or candidate animal species: No federally listed species occur in the park.

Nebraska state-listed animal species found at HOME: No state-listed species occur in the park.

Pipestone National Monument

Pipestone National Monument is located in southwest Minnesota and borders the north side of the City of Pipestone. It was established in 1937 to administer and protect the pipestone quarries, and their associated resources and values. It consists of 366 acres of unusual and diverse landscape within an agricultural area.

Landform, Geology, and Soils. The park is located on slightly sloping land in a shallow glacial valley. The Sioux Quartzite provides the critical fundamental resource associated with the park. A 15-foot high, Sioux quartzite outcrop runs north to south through the eastern half of PIPE. Soils are glacially derived tills, loess, and alluvium and vary in depth, fertility, and productivity. In 1976, the USDA Soil Conservation Service identified 13 different soil types, but the area is characterized by shallow soils in many areas and bedrock outcrops are common.

Aquatic Resources. Pipestone Creek enters the park from the east, cascading over the Sioux Quartzite escarpment, forming Winnewissa Falls. Downstream of the waterfall, the water flows into a pond, Lake Hiawatha. From there the creek meanders northwesterly across the glacial valley until it exits the northwestern boundary of the park at Indian Lake. The deeply incised creek drains approximately 30,000 acres of land. The extreme hydrological alterations of the creek's watershed have caused increased sediment deposition and a change to the floral and faunal composition along the creek corridor. Above the falls, the creek has been channelized by blasting and dredging and now flows well below the original creek bed. In 1982, a fish kill occurred in Pipestone Creek, illustrating pollution problems within the park from contamination sources upstream. The NPS has been monitoring aquatic invertebrates as an indicator of the health of the Pipestone Creek ecosystem since 1997. The creek is listed as a Clean Water Act § 303d, impaired water. Also on the surface and in cracks of the quartzite formation, small vernal pools form, creating habitat for aquatic and semi-aquatic species. Unique and rare invertebrate species have been identified in these pools (Bowles 2009).

Vegetation. Vegetation mainly consists of four plant communities: virgin native prairie, restored prairie on former old fields, degraded prairie, and oak savannas. The park's IPM plan has contributed to invasive plant management (NPS 2009a).

The Sioux quartzite prairie found along the quartzite outcrop is considered a significant resource and rare plant species occur throughout this habitat.

Federally listed threatened, endangered, or candidate plant species: A small population of the federally threatened western prairie fringed orchid is found at PIPE.

Minnesota state-listed plant species found at PIPE: The western prairie fringed orchid is also listed as endangered by the state. Additionally, three other plant species listed as endangered, three species listed as threatened, and five species of state conservation concern occur in the park (see Appendix L).

Western prairie fringed orchid

Unique or rare habitats: The Sioux quartzite prairie has been designated by The Nature Conservancy (TNC) *"as endangered throughout its range and one of the few intact examples of this rare community type."*

Wildlife and Fish. A fish survey identified 25 fish species in Pipestone Creek (Dodd, et al. 2010a). Small vernal pools of the

quartzite formation provide a unique habitat for rare aquatic and semi-aquatic invertebrate species (Bowles 2009). Over 125 terrestrial insect species have been collected since 2000. During bird inventories, 83 bird species have been recorded over the years. Subsequent breeding bird monitoring has identified 40 species, three of which, brown thrasher (*Toxostoma rufum*), dickcissel, and grasshopper sparrow, are species of continental importance (Peitz 2010). No recent comprehensive mammal inventory has been completed, but the common mammals of rural northern plains are expected or have been sighted. The least weasel (*Mustela nivalis*) has been reported by park staff. In the early 1990's, 19 species of butterfly were collected at PIPE, including the Poweshiek skipperling (*Oarisma poweshieck*), Dakota skipper (*Hesperia dacotae*), and the regal fritillary, which are all uncommon.

Federally listed threatened, endangered, or candidate animal species: One endangered fish species, Topeka shiner (*Notropis topeka),* is known to reside in Pipestone Creek.

Minnesota state-listed animal species found at PIPE: Two birds and one mammal on the state conservation list occur in the park (see Appendix L). The federally listed Topeka shiner is included on the state list, as well.

Tallgrass Prairie National Preserve

The prairie is the dominant vegetation at TAPR.

Established on November 12, 1996, the 10,894 acres park preserves, protects, and interprets a remnant of the once vast tallgrass prairie ecosystem that previously covered over 400,000 square miles of North America. It also represents the transition from open range cattle ranching to enclosed holdings. The park is a public/private partnership in that the majority of the land is privately owned. As established by legislation, the NPS may not own more than 180 acres. The National Park Trust (NPT), a non-profit land conservancy, purchased land associated with TAPR in 1994. The NPT transferred 32 acres to the NPS in 2002. In 2005, The Kansas Park Trust purchased the property from NPT and then sold the property to The Nature Conservancy (TNC). Prior to 2006, the majority of the property was under a 35-year grazing lease. The TNC purchased the long-term grazing lease, allowing for management using fire and grazing. The NPS manages the private property under a cooperative agreement in partnership with the TNC.

Landform, Geology, and Soils. The park lies within the Flint Hills of east central Kansas. The Flint Hills formed following the erosion of a belt of resistant limestone and softer shale and sandstone that includes 40 separate formations. The highest elevations exceed 1,600 feet and the lowest are 1,150 feet in the Cottonwood River Valley (NPS 2000a). The park's soils are derived from limestone, sandstone, and shale. The soils may be relatively deep in the bottoms of the larger stream valleys, but are typically thin on the flanks and tops of the hills with occasional outcrops. The soils are excessively drained, and runoff is rapid with slopes ranging from 30-50% (NPS 2000a). Soil losses due to sheet or rill erosion are typically low in tallgrass prairies, even in burned prairies where surface roughness is adequate to maintain low overland flow velocities.

Aquatic Resources. The park's landscape contains springs, seeps, intermittent and perennial streams, and constructed stock ponds. The major aquatic resources within TAPR are Palmer Creek and Fox Creek. Palmer Creek, a tributary to Fox Creek located in the northern portion of TAPR, flows west to east. Fox Creek is a major tributary to Cottonwood River and bisects TAPR, flowing north to south. The park has some of the least impacted prairie stream habitat remaining in the Midwest. The physical and chemical properties of the park's prairie streams are dynamic, and the fish communities are adapted to living in this harsh and changing environment. Prairie streams are subject to human disturbance, such as land use changes at a watershed scale that can dramatically alter a stream system. In general, streams at TAPR have good biotic integrity and provide suitable habitat for a relatively stable native fish community (Dodd, et al. 2010).

Vegetation. As of 2001, more than 400 species of vascular plants (native and non-native) had been identified at TAPR. The park is dominated by big bluestem, Indian grass, and little bluestem. Prairie is found on nearly level land, as well as on steep upland slopes, and on a wide array of soils. A rich flora is associated with the margins of prairie springs, seeps, and streams. The forested floodplain contains ashes, elms (*Ulmus* spp.), hackberry, bur oak, and black walnut. The bottomland along Fox Creek is either planted in smooth brome grass (hay lease) or restored prairie.

The park implements a varied fire and grazing regime meant to mimic the historic frequency of fire in the Flint Hills. While cattle graze most of the acreage on the park, one pasture is home to a small herd of American bison (*Bison bison*). Both cattle and American bison typically prefer to graze recently burned patches while leaving unburned patches mostly ungrazed. Patch burn grazing on the sites creates a heterogeneous pattern across the park designed to provide habitat for plants and animals that prefer these different fire and grazing rotations.

Federally listed threatened, endangered, or candidate plant species: No federally listed plant species occur in the park.

Kansas state-listed plant species found at TAPR: No documented plants are included on the state lists for conservation needs.

Wildlife and Fish. Bird inventories at TAPR have documented 134 different species over the last decade. Subsequent breeding bird surveys found 91 breeding species, 15 of which are species of continental importance (Peitz 2011b; Peitz et al. 2009). The Flint Hills of Kansas are a stronghold for the greater prairie-chicken (*Tympanuchus cupido*) and the species is found in the park. Thirty-seven fish species (Dodd et al. 2010) and 40 species of mammals have been documented in the park. Large ungulates, such as mule deer (*Odocoileus hemionus* hemionus), white-tailed deer, and pronghorn (*Antilocapra americana*), have been observed within the Flint Hills, but antelope no longer occur in the park and mule deer are uncommon. Cattle are the dominant grazers within the park along with a small herd of American bison, reintroduced in 2009. Over 30 species of reptiles and amphibians have been documented in the park. There is very little data on the invertebrate communities of the park, although over 50 species of butterflies have been documented.

Federally listed threatened, endangered, or candidate animal species: The Topeka Shiner is federally endangered and is a resident at the park.

Kansas state-listed animal species found at TAPR: State-threatened species that have been documented in the park include the Topeka shiner. The park documented Species in Need of Conservation, including five birds and two fish (see Appendix L).

3.2 Cultural Resources

Cultural resources include archeological resources, buildings and structures, cultural landscapes, museum collections, and ethnographic resources. The regulatory and policy framework for evaluating impacts to cultural resources is provided by the Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs pursuant to the NHPA of 1998, NPS Management Policies 2006, DO–12: Conservation Planning, Environmental Impact Analysis, and Decision-making 2001, and DO-28: NPS Cultural Resource Management Guidelines and Policies. In general, any proposed action must be evaluated for the potential to result in a change in the aspects of the location, design, setting, materials, workmanship, feeling and association, use, or other values that contribute to or convey the significance of the property.

Much of the information in the description of cultural resources in the affected environment was gleaned from descriptions in other park documents. Many sources are cited within this document, when original sources could be obtained, but common knowledge and resource managers' information is not cited. Common knowledge is that information which appears in multiple documents, and although it is generally accepted, its original source is not recorded.

3.2.1 Overview

The Secretary of the Interior is responsible for establishing professional standards and providing advice on the preservation of cultural resources listed in or eligible for listing in the NRHP. This includes standards for federal agencies in the evaluation and listing of properties to the NRHP. According to the NPS Management Policies 2006, page 59, the NPS will "*preserve and foster appreciation of the cultural resources in its custody, and will demonstrate its respect for the peoples traditionally associated with those resources, through appropriate programs of research, planning, and stewardship*." Section 106 of the NHPA requires federal agencies to consider the effects of their proposals on historic properties, and to provide state historic preservation officers, tribal historic preservation officers, and, as necessary, the Advisory Council on Historic Preservation a reasonable opportunity to review and comment on these actions. The desired conditions for resources are established in a generalized manner by regulation, rule, and policy, as presented in Table 3.2.0.

Table 3.2.0. Desired conditions for cultural resources

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

Resource	Desired Condition	Source
Archeology	A condition that protects archeological sites in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable in which case mitigation may be required.	NHPA; E.O. 11593; Archeological and Historic Preservation Act; Archeological Resources Protection Act; Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; Programmatic MOA among the NPS, Advisory Council on Historic Preservation, and National Council of State Historic Preservation Officers (1995); NPS Management Policies 2006; DO-28A; NEPA

Cultural landscapes	A condition that promotes responsible preservation practices that protects our nation's irreplaceable legacy of cultural landscapes.	The Secretary of the Interior's Standards for the Treatment of Historic Properties, 36 CFR Part 68
	A condition that will preserve significant physical attributes, biotic systems, and uses when those uses contribute to historical significance.	NPS Management Policies 2006
Ethno-graphic resources	A condition where to the extent practicable allows access to and ceremonial use of Indian sacred sites by Indian religious practitioners is accommodated and adverse effects on the physical integrity of these sacred sites is avoided.	NPS Management Policies 2006; E.O. 13007 on American Indian Sacred Sites, NEPA
	Certain research data is withheld from public disclosure to protect sensitive or confidential information about archeological, historic, or other NPS resources when doing so would be consistent with the Freedom of Information Act (FOIA). In many circumstances, allowing the NPS to withhold information about ethnographic resources.	NPS Management Policies 2006
	American Indians and other individuals and groups linked by ties of kinship or culture to ethnically identifiable human remains are consulted when remains may be disturbed or are encountered on parklands.	NPS Management Policies 2006; American Indian Grave Protection and Repatriation Act
	Other federal agencies, state and local governments, potentially affected American Indian and other communities, interest groups, State Historic Preservation Officer, and the Advisory Council on Historic Preservation are given opportunities to become informed about and comment on anticipated NPS actions at the earliest practicable time.	NHPA; Programmatic MOA with the NPS, Advisory Council on Historic Preservation, and the National Council of State Historic Preservation Officers (1995); E.O. 11593; American Indian Religious Freedom Act; American Indian Graves Protection and Repatriation Act; E.O. 13007 on American Indian Sacred Sites; Presidential Memorandum of April 29, 1994, on Government-to-government Relations with Tribal Governments; NPS Management Policies 2006; NEPA
Historical features	A condition where the qualities that contribute to the eligibility for listing of historic properties on the NRHP are protected in accordance with the Secretary of the Interior's Standards.	NHPA; E.O. 11593; Archeological and Historic Preservation Act; the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation; Programmatic MOA among the NPS, Advisory Council on Historic Preservation, and the National Council of State Historic Preservation Officers (1995); NPS Management Policies; NEPA

It is important to note that cultural resources are often intrinsically intertwined. For example, historical buildings and structures are a contributing features of the cultural landscape and may have an archeological, ethnographic, or museum collection component.

Archeology. Management of archeological sites is subject to *Director's Order #28A,* which summarizes all of the regulations as they apply to parks. According to the NPS Management Polices, 5.3.5.1, archeological resources will be managed in situ, unless the removal of artifacts or physical disturbance is justified. Many of the archeological descriptions came from various reports of surveys and excavations conducted by the MWAC and available at

http://www.nps.gov/mwac/publications/tech.html#20 (accessed May 26, 2011). Archeological data are retained in the Archeological Sites Management Information System (ASMIS), the NPS's database for the basic registration and management of park prehistoric and historic archeological resources. The database, a compilation of the Cultural Sites Inventory documentation notebooks and digital maps, provide the core of archeological data storage for the NPS. Records contain data on site location, description, significance, condition, threats to, and management requirements for known park archeological sites. Proposed work plans may be easily compared to ASMIS data to determine potential impacts to archeological resources.

Cultural Landscapes. Cultural landscapes, as defined by the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes (USDI 1992), are geographic areas, including both the cultural and natural resources with the wildlife and domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic value. There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes. In general, a cultural landscape is a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined both by physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values and traditions.

The planning, treatment, and maintenance of cultural landscapes require a multi-disciplinary approach. Landscapes provide scenic, economic, ecological, social, recreational and educational opportunities that help us understand communities and the nation. In compliance with NHPA § 110, the NPS maintains the Cultural Landscapes Inventory (CLI) as a dynamic, comprehensive inventory of all culturally and historically significant landscapes within the national park system. The CLI records each landscape's location, historical development, existing conditions, and management information. For landscapes found to be potentially eligible for the NRHP, the CLI provides an analysis of landscape characteristics and features, allowing for an evaluation of historic integrity and significance. On an individual park level, the CLI provides park managers with a vast array of information specific to the landscape of their park and easily referenced in the process of determining potential impacts from proposed invasive plant treatments.

Ethnographic Resources. Ethnographic resources are landscapes, objects, plants and animals, or sites and structures that are important to a people's sense of purpose or way of life. Access to these resources for their continued use by traditional people is also protected under NPS policies. Only ethnographic resources and values that are part of the affected environment or accessed through the affected environment will be discussed in this EPMP/EA.

Landscapes. Groups may use a park's landscapes to teach beliefs, traditions, and history to new generations through legends or other stories.

Objects. Objects related to tribes and other groups reside in many park collections. Park collections are not in the affected environment. Some objects may be returned to a site or may be yet unknown and residing in the affected environment.

Plants and Animals. People often have knowledge about and traditional uses for plants and animals from centuries of interaction with the environment.

Sites and Structures. Structures may be integral to a cultural way of life or purpose and may have meanings that tie together the sense of history and modern-day life for those associated with these resources. [27]

Many ethnic backgrounds may have an association with the land and its resources that pre-dates the establishment of a park. Ceremonial sites, migration routes, harvesting areas, and other resources or values may be within park boundaries. By law, executive order, and agency policy, the NPS must respect these peoples and consider the effects of its actions on them. These regulatory guidelines are presented at http://www.nps.gov/ethnography/mandate/index.htm#policy (accessed May 6, 2011).

Historical Features. This grouping contains properties to be preserved. The NRHP categorizes properties as buildings, sites, districts, structures, open space, or objects. The National Register Information System is a growing electronic depository of all properties on the NRHP (http://www.cr.nps.gov/nr/research/).The List of Classified Structures (LCS) is a dynamic NPS database used for evaluating, documenting, and tracking historic buildings and structures owned or of legal interest to the NPS as per NHPA §110. The LCS is an evaluated inventory of all historic and prehistoric structures that have historical, architectural, and/or engineering significance within parks in which the NPS has, or plans to acquire, any legally enforceable interest. The database is easily accessed to determine potential impacts from proposed invasive plant management actions.

Structures are constructed works that serve some form of human activity and are generally immovable. They include buildings and monuments, dams, millraces and canals, nautical vessels, bridges, tunnels and roads, railroad locomotives, rolling stock and track, stockades and fences, defensive works, mounds, ruins of all structural types that still have integrity as structures, and outdoor sculpture. The full LCS for any park may be obtained at http://www.hscl.cr.nps.gov/insidenps/summary.asp (accessed March 7, 2012). A list of the Classified Structures that may be within project areas is presented in Appendix I.

3.2.2 Park Cultural Resource Descriptions

Each park has all categories of cultural resources with potential to be impacted addressed in this section. The parks are listed in the same order as presented in the natural resources section.

[27] Paraphrased from NPS, Park Ethnography Program, http://www.nps.gov/ethnography/parks/resources/index.htm, accessed April 13, 2011.

Cuyahoga Valley National Park

Originally established as a recreation area and given National Park status in 2000, the park purpose includes preserving the historic and scenic values of Cuyahoga Valley and contains more than 60 NRHP districts and sites, some with multiple structures, documented at various times. Some of the following information is extracted from the park's cultural landscape overview (Winstel 2000). The park has a rich cultural legacy, rooted in the preservation, restoration, and rehabilitation of significant features and presenting the landscape as culturally vibrant, a home for wildlife, and a model for sustainable living. Dominant cultural themes in the valley include prehistory, settlement, transportation, agriculture, industry, and recreation. Sustainable farming ventures through NPS partners help preserve the valley's agricultural heritage.

Archeology. Much of the information that follows came from an archeological overview completed by Finney (2002) and from numerous investigations undertaken by the MWAC. Archeological resources are distributed throughout Cuyahoga Valley. To date, over 200 archeological sites have been documented representing human episodes dating as far back as 10,000 years ago and as recent as the historic era of the twentieth-century. Archaic hunting camps, Middle Woodland earthworks, Whittlesey villages, mid-nineteenth century farmsteads, the Ohio and Erie Canal and associated enterprises, are just a few examples of the types of archeological sites distributed throughout the park. A large-scale archeological survey was completed prior to the NPS transforming the Ohio and Erie Canal Towpath into a multiple-use trail, resulting in discovery of three prehistoric and eleven historic archeological sites and documentation of three previously recorded sites associated with the canal.

Additional investigations were completed at areas that would not be involved in direct treatments, but that may be located near treatment areas. In August 1991, an archeological shovel test survey was conducted at the Campus of the Earthlore Environmental Education Center, resulting in the identification of two prehistoric sites and one multi-component site. Archeological testing, conducted in November 1983, surveyed the area of a proposed sewage leach field near park headquarters. Additional reports are available through http://www.nps.gov/mwac/pub.htm.

Cultural Landscapes. Transportation routes are significant to the cultural landscape, starting with American Indians trail networks, later adopted and adapted by early European settlers. Roads and the Ohio & Erie Canal supplanted these trails in the early 1800s. Although sections of the canal no longer carry water, it is still an important landscape feature in parts of the valley. The historic Towpath Trail, associated with the Ohio & Erie Canal, has been converted by the NPS into a multi-purpose trail running the length of the park. The Valley Railway, begun in 1880, also retains historic integrity and the Cuyahoga Valley Scenic Railroad currently runs trains along the historic route.

The history of farming in the valley began with subsistence farming in A.D. 700 and continued through the nineteenth-century golden age of agriculture to the present-day era of large and small-scale farming. Changing farming practices over the years dictated the circulation and structural patterns of farming landscapes. The small, open fields that remain in tillage or fallowed represent the period of agricultural development in the valley. Waterpower and agriculture gave rise to the development of industry, which contributed to the local economy at and around the park, as well as to a broader-based marketplace supplied by the transportation

system. Other local industries were devoted to maintaining the canal and transporting goods. Some structures from this historic period of industry persist in the valley. Despite the nearness of major population centers, large tracts of land remained undeveloped in the Cuyahoga Valley throughout the 1800s and 1900s, providing opportunities for recreation. A local system of parks was developed at this time that coincided with the nineteenth-century transcendentalist movement that advocated for green space that was accessible to urban areas. Federal relief projects of the 1930s, such as the Civilian Conservation Corps, constructed recreational facilities in the area, some of which have been preserved at the park.

The mission of CUVA includes preserving cultural landscapes that provide a setting for the agricultural, industrial, and recreational history of this area. Unique partnerships and treatment plans include the active use of cultural landscapes to preserve active agriculture within an agrarian setting. To date, twelve landscapes at CUVA have been inventoried and documented with consultation, and entered into the CLI. As the inventory-process continues for multiple properties in the park, additional landscapes will be added to the system annually. These landscapes are all related to the major themes identified for the park and include the agricultural and transportation related properties (Roberta Young, written communication, February 22, 2012).

Ethnographic Resources. No single tribe or nation developed permanent settlements within the valley prior to European settlement, but American Indians did use the valley as a transportation route and for small, temporary encampments. People traditionally associated with the region are listed in Appendix J. No traditional use, sacred, or ceremonial sites has been identified at the park by these tribes, which have been invited to consult in this planning process to ensure their resource interests and concerns are considered.

Brandywine Creek Mills Site

Historical Features. In 1996, legislation created the Ohio & Erie Canalway, a 110-mile national heritage area from Cleveland to New Philadelphia that extends the Towpath Trail and Cuyahoga Valley Scenic Railroad. The Canalway physically connects CUVA to local parks and 40 communities. Historic structures in the LCS can be found in Appendix I. Structures in the Brandywine Creek area and the Ulyatt Cistern are within the project area, but would be buffered from direct actions. The LCS for CUVA includes 320 buildings and structures that meet NRHP requirements individually or contribute to a site or district. The park expects to add structures to the inventory as work continues in the park to find properties that meet the guidelines for evaluation. The park has an active geodatabase.

Effigy Mounds National Monument

Presidential Proclamation 2860, October 25, 1949, established EFMO to preserve of Eastern Woodland Indian mounds built during the Woodland Period from about 500 B.C.E. until about 800 B.P. This is a small remnant of the thousands of mounds representing the manifestation of the mound building cultures of the upper Midwest. The four units of the park differ in the concentration of mounds and the type or shape of those mounds.

- North Unit — contains 56 mounds, including four bear effigy mounds
- South Unit — contains 35 mounds, including 17 effigies (12 bears, 5 birds)
- Sny Magill Unit — contains 100 mounds, including five effigies located about 11 miles south of the headquarters along the Mississippi Flood Plain, and it contains the largest extant concentration of Indian mounds in the United States.
- Heritage Addition Unit – contains three mounds, including two bear and one linear mound

The park was listed in the NRHP in 1966. This designation includes the area within the park's original boundary, but not the Heritage Addition[28], which requires inventory and evaluation of the mounds located there. The mounds are considered ceremonial and sacred sites by many Americans, especially the park's 12 affiliated American Indian tribes. Due to the sensitive nature of cultural resources, all cultural sites will be excluded from treatment by this project.

Marching Bear Group mounds and other mounds are outside of treatment area.

Archeology. An archeological overview and assessment (Benn and Stadler 2007) provided much of the following information. This report included summaries and evaluations of previous archeological research, descriptions of known archeological resources, and other information.

The primary archeological resource is prehistoric Indian mounds in a variety of forms including effigy, compound, linear, and conical. The intact burial mounds are of great significance when compared to the thousands that have been lost or degraded due to farming practices and development. Of the 200 original mounds, 191 still exist, and more mounds are being located at this time. Cultural affiliation of the mounds is to the Woodland Tradition of three local tribes. These affiliations have been associated with modern tribes for the purpose of repatriation and cooperative interaction.

Some of the mounds mapped and identified were destroyed, or partially destroyed, by plowing before the park was established. Emphasis is now on preservation and nondestructive mound study. Most of the known mounds are in good condition and are maintained by the park's maintenance staff, using approved park management plans. Mounds that are maintained by the park maintenance staff are not included in this EPMP/EA. The areas around the mounds may be included in treatment.

[28] added by P.L.106-323 in 2000

The LCS has records for 210 mounds and 2 other historic structures – the old military road and a cistern. The Heritage Unit has not been documented by the LCS. The mounds are also listed on the State of Iowa Archaeological Sites Inventory. Two habitation sites exist near and along the boundary of the park; however these two sites extend onto State Department of Natural Resources land or into the Mississippi River. The project area is adjacent to, but does not include portions of these habitations that are within the park. Eighteen rockshelters were identified in a rockshelter survey conducted in the 1980s. These rockshelters were used as either permanent or temporary habitation sites. Complete studies of these areas have not been conducted. Other, as yet undiscovered, habitation sites may also exist within the park. Several natural chert outcrops in the North Unit and the Heritage Addition have also been recently identified as a source for stone tool materials likely used by prehistoric occupants in the area. Documented sites are excluded from the project area for this EPMP/EA.

Cultural Landscapes. Both historic and ethnographic landscapes at EFMO have distinctive features of the human-built environment and natural environment that may be adapted to represent aspects of a way of life for a people or peoples through prehistory and history. The NRHP designation includes the original area of the monument, excluding the Heritage Addition at this time, and the known mounds within it. With the General Management Plan in development, a cultural landscape desired condition has not been defined yet. Those desired conditions will contribute to a cultural landscape treatment plan and implementation. The CLI has grouped the mounds into two major cultural landscapes Sny Magill and Yellow River. Future CLI work may be conducted in the Heritage Unit but has not been scheduled.

Ethnographic Resources. The early mound-building people were predecessors of several current tribes. These nations (see Appendix J) were invited as consultants in the planning process. The park has completed repatriation under NAGPRA with some remains being buried on site. Other than the mounds and the setting associated with the mounds, there are no other documented traditional use, sacred, or ceremonial sites associated with the park.

Historical Features. A number of historic sites are found in the park. A military road built in 1840 by the U. S. Army crosses the southern half of the South Unit. Along the road are still visible remnants of rockwork, dugouts and a cistern. A few historical structures are not on the LCS. Remnants of at least one historic sawmill, the Jefferson Davis Sawmill, also exists at least partially within the park boundary. Other historic sites include a mine, several historic structure foundations or depressions, and various historic roads, some related to logging activities. Remnants of old logging roads from the late 1890s and turn-of-the-century crisscross the park and are in poor condition, being reclaimed by natural succession. The logging roads have no relation to the park's enabling legislation.

Hopewell Culture National Historical Park

Mound City is outside of treatment area.

The NPS owns and manages five Hopewell earthwork sites in the greater Chillicothe area in south-central Ohio. These nationally significant archeological resources provide an insight into the social, ceremonial, political, and economic life of the Hopewell people (200 B.C. – A.D. 500). All five sites are located on terraces above rivers or creeks, and both cultural and natural resources have a history of disturbance, primarily resulting from agriculture.

Archeology. Hopewell mound and earthwork sites are well known for their elaborate burial ceremonialism. Hopewell mounds in the Ohio Valley contain exotic goods from distant locations. The paragraphs below describe the remains of the earthworks at each unit of the park as recorded in the park's Resource Management Plan of 1999 (NPS 1999c). There are remains in the form of fire pits, trash pits, post-hole patterns, ceramic artifacts, lithic remains, and rarely metal objects. There are also historic remains from Euro-American settlement of the area. These remains include building foundations, ceramic fragments, and metal objects.

Mound City Group. Visible Hopewell resources include a 13-acre rectangular earthen 2050-foot enclosure, within which are at least 23 mounds. All the walls and mounds were reconstructed. The Mound City Group was listed on the NRHP in 1978. The mounds themselves are mowed and so are outside of the EPMP/EA project area. The Ohio and Erie Canal, built in the 1830s, ran just 0.25 mile west of Mound City Group. The World War I Camp Sherman period is represented by artifacts from the camp, archival photographs and maps, and subsurface archeological deposits (e.g. latrines, water/sewer lines, and structural foundations).

Hopeton Earthworks Unit. The earthwork remnants on this 292-acre site consist of a square enclosure about 900 feet on a side joined on its north side to a circular enclosure with a diameter of about 1,050 feet. Smaller circular structures also join the square at various points and two linear embankments extend westward toward the river for about 2,400 feet from the northwest corner of the square. Most of the earthworks are difficult for the untrained person to see. The entire unit is a National Historic Landmark (NHL), placed on the NRHP in 1975.

Hopewell Mound Group Unit. The general form is that of a parallelogram 2,800 feet long on the east and west sides and 1,800 feet long on the north and south. Remnants of the east, west, and north walls are visible. Two earthwork features are located within the parallelogram. Although extensively excavated, the site still offers considerable potential for expanding knowledge about the Hopewell culture. It appeared on the NRHP in 1974.

Seip Earthworks Unit. The large earthwork complex contains low embankment walls forming a small circular enclosure, an irregular circular enclosure, and a square enclosure, enclosing about 121 acres. Within the largest enclosure are a large elliptical mound, several small mounds, and several workshop structure outlines found through excavations. The site is listed on the NRHP. The central third of the unit is owned and managed by the Ohio Historical Society.

High Bank Works Unit. The unit was recorded in 1848 with the documented features including a circular enclosure and an octagonal enclosure, each measuring just over 1,000 feet in diameter. On the octagon interior, eight small mounds correspond to the eight intersecting points of the outer walls. Two more small circular enclosures with a single gateway were noted, connected to

the larger forms by two embankments extending southwest for almost 2,000 feet. Cultivation, erosion, and flooding have reduced many of the surface features, but the walls are relatively intact and portions of the octagon are visible. Many subsurface resources remain. This unit offers outstanding potential for research. The area is listed in the NRHP.

Cultural Landscapes. The park does not have a CLR, but some landscape treatment has been defined through consultation with archeologists and historical landscape architects assigned to assist the park. Cultural Landscape Inventories (NPS 1999a, 1999b) have been completed, using the NRHP information. Very little information is available upon which to base a description of how the landscape may have appeared during its prehistoric period of significance, making vegetative treatment decisions difficult. Yet patterns of land use and relationships are still present as character defining features on the landscape. All parklands and potential parklands have been farmed, logged, or otherwise changed within the past 50 years, and the park contains no pristine landscapes, dating back to the period of significance. Secondary cultural contexts involve the construction and influence of the Ohio and Erie Canal between 1830 and 1913, and the construction and occupation of Camp Sherman between 1917 and 1920. The Ohio and Erie Canal landscape is represented by stones from a nearby canal lock.

Ethnographic Resources. An Ethnographic Overview and Assessment does not indicate any current use of the parklands by federally recognized tribes. Additionally, no federally recognized American Indian group has claimed a traditional affiliation or association with HOCU. However, given the prehistoric and historical American Indian use and resources in the area, park management engages several nations in consultation during the planning processes. Tribes the park consults are listed in Appendix J. The park is not listed as an ethnographic site on the NRHP.

Historical Features. The only documented historic structures in the park are associated with the earthworks. The LCS currently has 36 records for HOCU. Twenty-six of the records are associated with Mound City. Seven are associated with Hopeton. Hopewell, Seip, and High Banks each have one LCS record at this time because the structures were batch listed and recorded as a group or unit rather than individually. The LCS gives the following historic structures as being present at the Mound City Unit:

- Twenty-five mounds
- Eight borrow pits
- One earth wall

The 34 structures at Mound City represent reconstructions of the original earthworks using information from archeological excavations, historic maps and other documents. The surveys include structures associated with agriculture and habitation over the past 200 years. The Classified Structures includes enclosures and walls along with the mounds.

Lincoln Boyhood National Memorial

An NHL designated in 1960, the roughly rectangular-shaped property encompasses the western 80 acres of the original quarter section owned by Thomas Lincoln, including several cultural and interpretive elements. At some time during the mid-1800s, several buildings were erected on the current LIBO property as part of Lincoln City. Interest in the LIBO property as a historical landmark, specifically the gravesite of Nancy Hanks Lincoln, also occurred around this time. When the site was incorporated into the NPS system in 1962, the recreational development portion of the park remained part of the Lincoln State Park. The site's development is an important part of the park's history as a designed landscape. The park commemorates Abraham Lincoln through numerous landscape features on the site where he lived from age seven to 21 years of age, and brings to light the influence his mother had on his life accomplishments.

Archeology. An overview document (Mauck and McKelway 1996) provided much of the following information. Additional information was available from the MWAC.

Two episodes of excavations were done in preparation for the park's establishment and both occurred near the knoll associated with the original Thomas Lincoln cabin site. The 1967 excavations (Larrabee 1967) determined that the Memorial Knoll had been subjected to extensive cultivation and landscaping and concluded that the disturbance, attributed to the early development period of the 1930s, likely erased evidence of the Lincoln period. In 1968, archeologists searched for undisturbed archeological deposits in an attempt to provide information about the pre-1930 setting. They encountered numerous features in the area of the Living Historical Farm's garden plot, which were interpreted to date to the pre-1929 Lincoln City period of the National Memorial. Additional features encountered were associated with late historic structures and none of the recovered artifacts is from early-nineteenth-century occupation (Larrabee and Kardas 1968). The MWAC conducted an intensive systematic shovel-test survey from 1997-1999, which covered the entire 200 acres of LIBO (Frost and Stadler 2000). They recorded prehistoric sites, most of which are low-density lithic scatters, and historic sites consisting of refuse dumps associated with residences from the historic town of Lincoln City, Indiana. Many of these are outside the project area. The cemetery site is outside of the proposed project area.

Cultural Landscapes. Much of the following information was obtained from the park's Cultural Landscape Report (McEnaney 2001). During the mid-1920s, Frederick Law Olmsted, Jr. was hired to develop a formal landscape plan for the park. Implementation of the Olmsted plan occurred from the late 1920s through the early 1940s and included contributions of other landscape architects as well. The plan included a formally landscaped walkway, park building, and tree plantings on the property. Olmsted's plan was meant to draw the visitor's focus towards the gravesite and a peaceful forest setting. The NPS completed construction of a living history farm in 1968 that will require evaluation for the NRHP in 2018. The farm is located near the cabin site memorial and within the historic Lincoln-property, and is linked to the formalized setting by a walking trail, used for interpretation purposes.

The park is significant as both a commemorative landscape and historic site. This is exemplified in the original site plans that intended the forest around the cemetery to be restored as a sanctuary and buffer from adjacent areas. The forest represents a pioneer forest, which includes mature canopy. The control of invasive species in the forest improves integrity of the designed landscape and establishes an attractive setting for the designed components (McEnaney 2001).

These prescriptions are a part of the cultural landscape treatment plan for the site. Much of the developed landscape is omitted from this EPMP/EA and will not be treated under this plan. The CLI was completed using data from the CLR (McEnaney 2001).

Ethnographic Resources. No ethnographic resources or tribal affiliations have been identified for LIBO.

Historical Features. The park is significant as a designed commemorative landscape that acknowledges the absence of any above ground features that date to the Lincoln residence on the farm, many of the historic structures tend to focus on the park development. Features associated with the significance of the park's development include numerous culverts, and stone or brick pillars and marker combinations that fall within or adjacent to EPMP project areas. The Trail of Twelve Stones connects the interpretive home site of Abraham Lincoln's youth with the pioneer cemetery where his mother, Nancy Hanks Lincoln, is buried. The stones and trail are entered on the LCS and fall within the proposed project area. The cemetery, significant to both the cultural landscape and archeology, is also on the LCS. In total, the park has 44 buildings and or structures on the LCS that document both large and small-scale features that contribute to the site's significance. Those that reside within the EPMP project area at this time are in Appendix I. The Lincoln Trace is listed on the LCS, as "ineligible managed as a resource." Such a designation means the park has made some level of commitment to preserve the feature and treat it as historic even though it is not individually eligible for the NRHP.

Trail of Twelve Stones

Arkansas Post National Memorial

According to the LCS, completed in 2012, Arkansas Post served for almost two hundred years as a strategic outpost for three nations seeking control of America's interior, first as a trading post and then as a military stronghold, a frontier settlement, and a territorial capital. Today, the park consists of two noncontiguous units. The Memorial Unit on a peninsula above the Arkansas River was the site of the first European settlement in the Lower Mississippi River Valley. Over the past few hundred years, ARPO has been a strategic military post, the site of a Revolutionary War battle and a Civil War battle, a river port, and a commercial center. It was the site of the first territorial capital of Arkansas. The Osotouy Unit, regarded as the spiritual and cultural homeland of the Quapaw tribe, was the former home of Woodland and Mississippian cultures. Most of the information on the Memorial Unit is taken from the CLR for the park (NPS 2005). The Memorial Unit was designated an NHL, October 9, 1960 (NPS 1998), and the Osotouy Unit (originally the Menard-Hodges Site; NPS 1987) was designated on April 11, 1989 (NPS 1989).

Archeology. Archeological resources from a number of periods, including the Spanish colonial era, the nineteenth century town development, the Civil War, agrarian periods, and the Arkansas State Park period are known to persist in the Memorial Unit. Archeological investigations and historical research have identified historic building sites and other historic resources, particularly for the Colonial town site on the lower end of the peninsula (NPS 1998). The historical town lies within the turf area that is outside of this EPMP project area.

Fort Hindman of the Civil War period is currently in a navigation pool, east of the peninsula and outside the area for the EPMP project. A line of trenches associated with the fort ran 720 yards in a westerly direction from the fort and terminated at Post Bayou. Today, the trenches appear intermittently as low mounds for about 100-150 yards along an east-west line. The trenches have been partially cleared of brush. A historic road used during the battle in 1863 is still visible in the northern portion of the Memorial Unit. Much of the road that parallels the entrance road is overgrown with native grasses.

Mound A in the Osotouy Unit was overgrown prior to addition to the park.

The Osotouy Unit, which would largely be within the project area, contains mounds, including some burials, and a plaza. According to the NRHP nomination (NPS 1989), investigations resulted in a site map that included the main mound with prominent wing-like extensions, and smaller flat-topped mounds. The entire area is considered sensitive with a rich source of data expected from the site. Additionally, it appears that burials occurred within the area of the unit, during times later than the mound-building era.

Cultural Landscapes. The Memorial Unit setting presents a pleasant, park-like appearance with open, grassy areas alternating with clusters of hardwoods and pines (NPS 1998). The landscape is a composite of land and water, but it does not maintain any integrity relating specifically to any of the historically significant periods. The cultural landscape is comprised of several identifiable component landscapes, some historic and some not. The forested northern portion of the park was identified as a natural area and wildlife habitat. Sites of the

eighteenth- and nineteenth-century Post of Arkansas and the Civil War rifle pits have been preserved and interpreted as historic areas. The areas on the northern and eastern sides of the Memorial's lake and other scattered tracts have been identified and treated as general outdoor recreation areas.

Remnants of domestic landscape vegetation dating from the late nineteenth and early twentieth-centuries and associated with the dispersed rural house sites of that period survive in the central section of the Memorial Unit. These remnant vegetative features are mixed within or displaced by opportunistic native plants and invasive vegetation. The Osotouy Unit was not included in the 2005 CLR (NPS 2005), but a cultural landscape report is underway for this unit. The CLI for the Memorial Unit will be completed using data from the CLR. The CLI for the Osotouy Unit will be completed after archeological investigation is complete.

Ethnographic Resources. All recorded plants for the Memorial Unit were documented in the CLR (NPS 2005) for their traditional uses by American Indians. The CLR clearly references locations that must be considered in management decisions for the Memorial Unit. No comprehensive surveys or studies have been completed for the Osotouy Unit. Only one tribe, the Quapaw Tribe of Indians of Oklahoma, is affiliated with ARPO and has been included in consultation during planning.

Historical Features. In the Memorial Unit, the Notrebe cistern and two nineteenth-century wells are the only surviving non-military structures that predate the NPS period. In addition, there are the earthworks developed by Confederate forces during the Civil War remain extant in the landscape. The NPS placed cannons near the earthworks to help interpret the Civil War history of the site. The road is one of the few surviving features from the frontier settlement of Arkansas Post. It is considered a contributing structure to the NHL.

Confederate Earthworks

The LCS contains 15 records for the park. All classified structures in the EPMP project area are listed in Appendix I. Several features either not listed on the LCS or are outside of the EPMP project area, including twentieth-century agricultural features, such as a cattle-dipping vat, concrete piers in the vat vicinity, and metal fence fragments. Several remnants of homes, a cast iron well pump, and structural remnants on the former Hughes property are in the Memorial Unit. A cut stone property boundary marker, which dates from the 1930s, also survives in the northern portion of the site.

Buffalo National River

Buffalo National River contains over 650 identified archeological sites, over 250 historic structures, four NRHP historic districts (listed in 1987 and 1988), and a fifth district that is eligible as for the NRHP. Periods of significance for the park run from the prehistoric (ca. 12,100 B.P.) to A.D. 1955. European settlement, beginning in the 1820s, changed much of the forest into farms.

The Terrestrial Habitat Management Plan and Environmental Assessment states, "*Terrestrial habitat management at Buffalo National River represents a unique opportunity to mesh the objectives of cultural resource management, natural resource management, and public use in a single plan.*" The description and subsequent analysis of impacts to cultural resources within that plan is applicable to the invasive plant management plan.

Example of a rock shelter

Archeology. A variety of surface and subsurface archeological sites and historic properties exist in BUFF, including bluff shelters, caves, open sites, mining prospects, and historic farmsteads. A comprehensive survey has not been completed for all areas associated with this EPMP. People of the Paleo-Indian Culture are believed to have settled in this area about 12,000 years ago, but evidence of their occupation is sparse. The Dalton Period is better represented with numerous sites containing the projectile point characteristic of this cultural period. Archaic and Woodland cultures also took advantage of the wide river terraces to live and farm along the river. Bluff overhangs were extensively used by both prehistoric and historic populations for shelter. The largest and best-known examples in the park are Cob Cave on the upper portion of the river and Indian Rockhouse on the lower river.

Cultural Landscapes. Pastoral settings reflect the historical agricultural landscapes around the Buffalo River. They will be a consideration in future cultural landscape treatment plans. As of 2012, six CLIs have been completed for BUFF. Several objectives are seen as significant relative to invasive plant management:

- Provide and maintain aesthetic visual diversity with a mosaic pattern of plant communities and successional stages.
- Restore and manage old-field plant communities, and early successional stages using native flora or non-invasive, non-native grasses and forbs when necessary, to provide multi-season habitat for a diversity of wildlife.
- Maintain historic land use patterns and pastoral settings through agricultural special use permits and leases.
- Manage and restore forests, canebrakes, thickets, savannas, and glades for floristic and habitat diversity.
- Conserve natural animal and plant communities and processes within the park.

Re-established native grass field

- Implement measures to eliminate or control invasive exotic species within the park

Ethnographic Resources. The park has not formally documented sacred sites or traditional uses, but consults with affiliated tribes of the area in planning (see Appendix J).

Historical Features. The LCS has recorded 348 buildings and structures associated with sites and districts within the park. Historic properties include NRHP historic districts and individual sites that have as their features houses, outbuildings, cisterns, cemeteries, roads, agricultural fields, mining features (mills, shafts, adits, etc.), railroad grades, ferry landings, bridges, and walls. A unique area within BUFF is the Boxley Valley Historic District, which is managed by the Boxley Valley Land Use Plan/Cultural Landscape Report, 1985.

George Washington Carver National Monument

The park memorializes the life of George Washington Carver and preserves the setting of the Moses Carver Farm where George spent his formative years. Carver spent his childhood years exploring the woods, fields, and watercourses that make up the landscape, represented today by the 210 acres of the original 240 acres Moses Carver farm. According to the park's CLI (NPS 2010), interpretation at the park presents features of the park in a commemorative nature, relative to its period of installation. It is acknowledged that structural elements of the landscape had changed a great deal since Carver's boyhood years. Research showed that only the Moses Carver Family Cemetery actually dated to the boyhood period. An associated structure, the Moses Carver Late Period Dwelling, which George is known to have visited later in life, is also extant. With few historic structures and little documentation to work with, the NPS focused on the vegetative surroundings that would have been present during Carver's boyhood period, given how influential the environment, both natural and agricultural, was to him. To these ends, the native flora and some fauna that he encountered as a boy have been encouraged to re-establish in the area. Much of the cultural resource information was derived from the Cultural Landscape Inventory 2010. The site was listed on the NRHP in 1966.

Archeology. On a flat grassy knoll above the spring on the Carver Branch is the site of the cabin in which George Washington Carver was born. In 1953, archeological investigations at this location encountered deposits consistent with the period associated with the cabin. Today, a partially reconstructed cabin marks the area. The Moses Carver House and an associated archeological site, representing the early twentieth-century, are on the west side of Willams Branch. The Williams's cabin site and Gilmore cabin are two additional areas where relatives of the Carver family lived. The Carver Family Cemetery occupies about one tenth of an acre in a roughly rectangular shape located southwest of the park's visitor center. There are about 35 marked and unmarked graves on the site. Prehistoric sites are also represented across the park's landscape, in addition to other historic manifestations. Two stone masonry structures are located in the northeast and southeast boundary corners of the park. Turf is managed immediately around the structures, buffering them from EPMP actions.

Cultural Landscapes. The commemorative landscape documented by the CLI includes the Carver Family Cemetery, the Birthplace Cabin site, the Moses Carver House, the Carver Nature Trail, Williams Pond, two natural springs, the circulation system, and Visitor Center. Other features that remain intact with integrity include natural systems, small-scale features, spatial organization, topography, and vegetation. The cultural landscape derives its importance from the light-handed commemorative development of the site, which focuses on aesthetic values from the period 1943 - 2007. In 2010, the State Historic Preservation Office determined the park's 240-acre cultural landscape is a contributing feature to the NRHP listing.

Moses Carver House, surrounded by mowed landscape..

Ethnographic Resources. The park has not documented ethnographic resources within its boundaries. Even so, the park confers with several tribes, as listed in Appendix J.

Historical Features. The LCS documents nine structures in the park, all of which are listed in Appendix I. The Moses Carver House was built in 1881 to replace two log cabins that preceded it. The house and interpretive garden is buffered from invasive plant actions by turf surrounding the house.

With the exception of the cemetery, no above ground, historical features remain from the period when George Washington Carver lived at the property. The 4-foot high dry-laid stonewall, protecting the cemetery from livestock, was removed by subsequent landowners, and was later reconstructed by the NPS in the mid-1950s. Although treatment may occur in the vicinity, structures are buffered from treatment by managed turf.

Williams Pond Dam and Springhouse Foundation are ineligible for the NRHP, but managed as cultural resources. The Williams Pond Dam is a non-contributing element and the foundation is ineligible for the NRHP. These features are within the EPMP project area.

Non-contributing statuary includes a bust of George Washington Carver, the Boy Carver Statue, and a bronze dedication plaque set in a stone boulder. The statuary are buffered from invasive plant actions by their locations within the landscape.

Non-contributing wayside exhibits are located along the Carver Trail, and include granite stones with Carver quotations along the contemplative trail and the exterior of the visitor center. These exhibits are in turf, but may be close to or on the way to potential treatment areas.

One of many Quote Stones on the Contemplative Loop Trail around the Williams Pond.

Hot Springs National Park

Stone retaining wall being covered in ivy (*Hedera helix*), an invasive plant (NPS 2010a).

The principle resources of HOSP are the thermal springs and therapeutic bathhouses within the approximately 5,450 acres, contiguous with the City of Hot Springs. Bathhouse Row and the Fordyce-Ricks House Historic District were listed on the NRHP in 2003. Bathhouse Row, listed as an NHL in 1987, is a group of eight bathhouses built between 1911 and 1923. Their origins and development related to the spring waters, long valued as a unique and healthy drinking water source for local and commercial consumption, and for the recreational and therapeutic value of thermal water baths.

Archeology. The MWAC began a five-year parkwide inventory in 2008. To date, NPS archeology crews have documented prehistoric encampments, novaculite quarries, historic roads, and dumps. Among the sites visited in 2009 were two abandoned cemeteries, where most of those buried in the cemeteries lie in unmarked graves. Historic and pre-historic archeology has been discovered and additional sites are expected in the forests throughout the park. The MWAC has conducted archeological testing in the Bathouse Row area, but this is outside of the EPMP project area.

Cultural Landscapes. The following information is taken primarily from the CLR (NPS 2010a). The majority of the vegetation, thermal waters, cold-water springs, bathhouses and associated cultural features, foot trails, prehistoric and historic novaculite quarries, and general physiography are on NPS land (4876.77 acres). The remaining 672.69 acres are within the park boundary, but privately owned. The city of Hot Springs is adjacent to the park. Cultural landscapes include several significant historic landscapes, such as the Reservation Front, Hot Springs and West Mountains, Whittington Park, and Gulpha Gorge (Figure 3.4.6). The Reservation Front is excluded from the affected environment. Portions of the park do not include above ground cultural landscape resources. These include the west end of West Mountain, Music Mountain, Sugarloaf Mountain, Bull Bayou, and several square miles of terrain north of Highway 7 in the northeast section of the park. Two CLIs have been completed for the park.

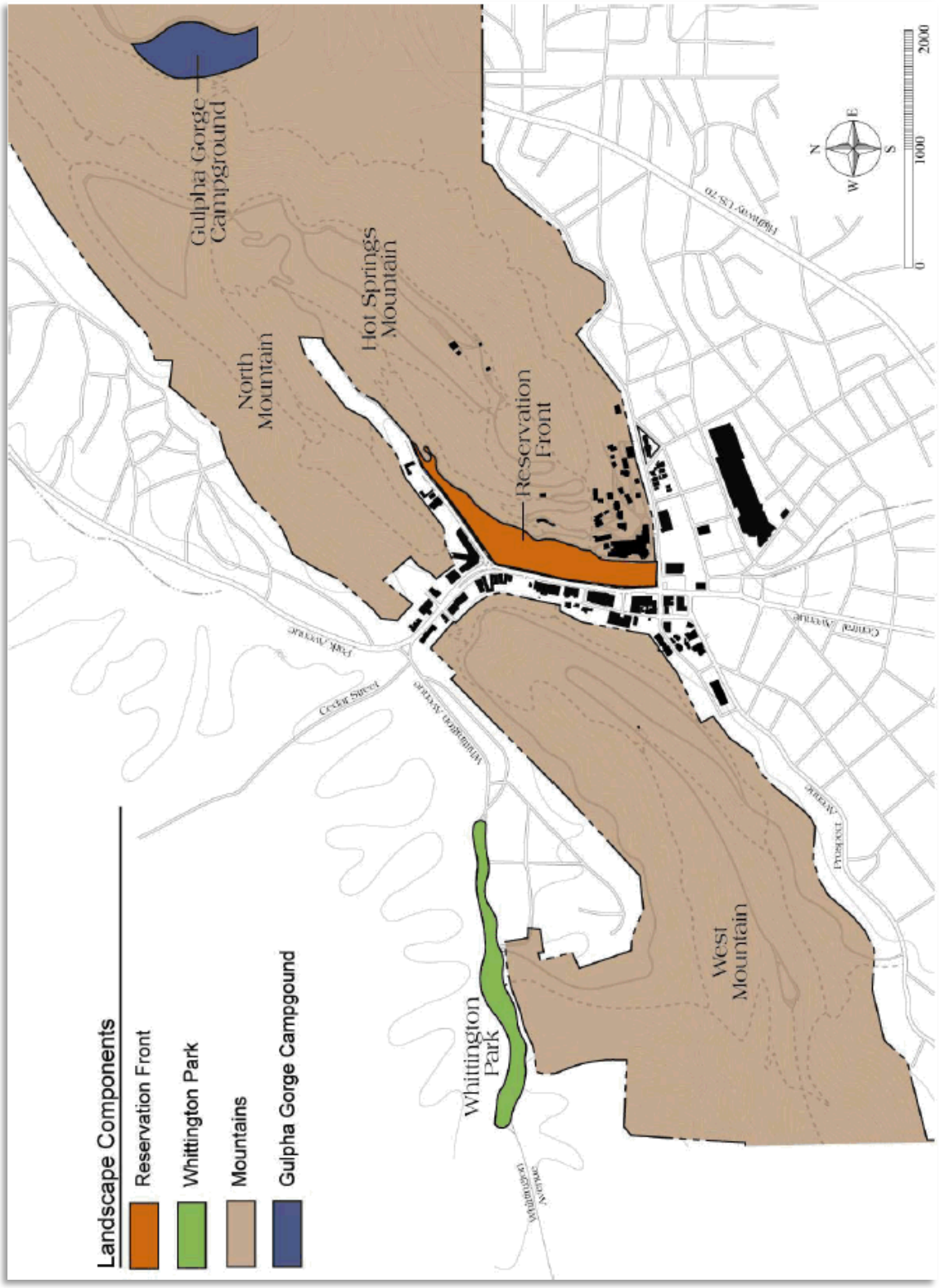
Ethnographic Resources. Several tribes, listed in Appendix J, are associated with the site and consulted during planning, but no sacred sites have been identified.

Historical Features. The LCS documents 63 buildings and structures within the park and those within the EPMP project area are listed in Appendix I. The Bathhouse Row consists of eight bathhouse buildings that were constructed between the years of 1892 and 1923. This area and the Grand Promenade were designated as an NHL District in 1987, constituting one of the park's primary resources. The urban setting falls outside the EPMP project area. However, contributing structures within the project area are buffered by mowed lawn or ornamental landscape. The Reservation Front district and Whittington Park district are excluded from this EPMP project area (Figure 3.4.6).

West Mountain Summit parking area, an example of a structure buffered by structured landscape or manicured turf

Figure 3.4.6. Five distinct cultural landscape areas at HOSP

Taken from the Cultural Landscape Report, NPS 2010a.



Ozark National Scenic Riverways

The park was established in 1964 as the first in the NPS specifically designated to preserve the scenic river experience. There are numerous archeological and cultural resources throughout the park. Historic properties are widely scattered across the park with those meeting the criteria having been determined eligible for the NRHP. Other properties are still being evaluated. Areas with concentrated historic properties have been identified and placed in a fire management unit called the Historic FMU. This FMU receives special management considerations and mitigations to help protect these valuable resources.

Archeology. The largest concentration of data sources since the park's establishment is curated at the MWAC. This center has sponsored or conducted archeological research at OZAR since 1971. Much of the information that follows is taken from MWAC reports and Finney (2006).

There are 468 archeological sites recorded in OZAR. The physical record indicates that humans at least passed through the Current River Valley beginning as early as 13,450 years B.P. This early use is indicated by the presence of early Paleo-Indian Clovis (3300 B.P.) projectile points at Alley Spring and Two Rivers, and Woodland Culture at Akers Ferry. Later occupations of the Paleo-Indian period, such as Folsom, are poorly represented in the park, but at least one late Paleo-Indian Scottsbluff point was found at the Alley Mill site. Use of the area seems to increase significantly at the transition to the Archaic Period as represented by the significant number of sites (20) dating to the Dalton period that have been found in the park. Occupation generally continues to increase through the Archaic (ca. 9950 to 2450 B.P.), Woodland (ca. 2450 to 1250 B.P.), and the Mississippian Period (ca. 950 to 350 B.P.). Following this there is a decline in population during the protohistoric period.

Euro-American occupation at the park began in the early nineteenth century. Evidence for many farmsteads/cabins and mills have been found in the park. A substantial quantity of prehistoric and historic artifacts has been collected from undisturbed contexts in the park, however, much of the park has yet to be inventoried for archeological sites. Archeological investigations were carried out at two multi-component archeological sites near Akers Ferry in Shannon County, Missouri, in September 1991. Subsurface testing revealed that prehistorical features exist below the plow zone. Archeological testing at the Gooseneck site and at the Owls Bend site produced substantial information about the Emergent Mississippian occupation of the Upper Current River Valley that culminated in the development of the Mississippian complex. The many rock cairns in the park are difficult to date, and may indicate burial sites or some other type of feature.

Cultural Landscapes. Some of the cultural landscapes of OZAR include the following major identifying themes: agricultural farmsteads (e.g., Chilton-William Farm Complex and Partney Farm), recreation and conservation landscapes (e.g., Big Spring Historic District and Alley Springs State Park Historic District), and an educational theme with historical school buildings (e.g., Lower Park School Site). Properties on the NRHP may be cross-listed as cultural landscapes. The park has 14 identified cultural landscapes, all of which have been determined eligible for the NRHP. Farmsteads and open fields are significant contributing factors to the cultural landscape as cited in the parks' FMP 2004 and General Management Plan 1984.

Ethnographic Resources. Although OZAR consults with affiliated tribes during planning (see Appendix J), ethnographic resources in the park have not been identified.

Historical Features. According to the 2012 LCS, 249 buildings and structures in the park are listed, eligible, or managed as resources. A variety of structures are listed, such as mills, stores, cemeteries, foundations ruins, barns, cabins, remnants of community buildings, and roads. A listing of LCS properties known to be within the EPMP project area is in Appendix I. Many historic sites relate to the settlement of the Ozark frontier. Invasive species have been notably documented along many of the listed roads. Currently there are 20 LCS and CLI properties listed on the NRHP.

Chilton-Williams Complex: Lesh/Williams House, an example of the landscape buffer around most Classified Structures

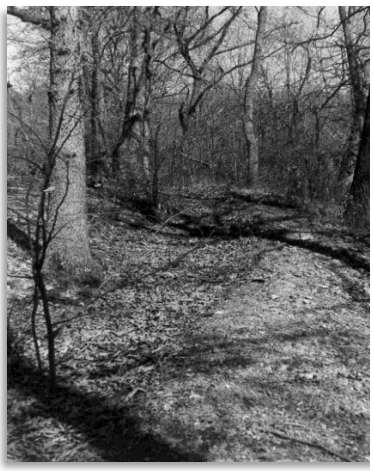
Pea Ridge National Military Park

The park was listed on the NRHP in 1966 with updates in 1984 that documented contributing resources at that time, including standing structures, non-standing structures, and three roadways. There are numerous areas within the battlefield area containing known cultural objects. In addition, there is the reconstruction of the Elkhorn Tavern, which played a significant role during and after the battle. The threat of prescribed fire to unknown cultural resources was determined negligible, as these resources average a minimum of 3 to 5 inches beneath the surface of the ground (NPS 2005d).

Archeology. Numerous sites in the area date human use and occupation to at least 10,000 Y.B.P. American Indian occupation continued until the early nineteenth-century when Euro-American settlement began to occur in earnest. Field investigations conducted in 2001, 2002, and 2003 by the MWAC and the University of Arkansas' Department of Anthropology have yielded abundant evidence of prehistoric and historic occupation of the site. Evidence of the battle is abundant in the area of Clemons' Field and around Elkhorn Tavern. Patterned deposition of small arms and larger ordnance is particularly abundant in these areas. Broken bits of firearms, accouterments, and camp and personal items are also present. Additional archeology was completed in 2008 (Carlson-Drexler, et al. 2008).

Cultural Landscapes. The CLI for PERI was completed in 2008. The following information is taken from the resource descriptions in the FMP (NPS 2005d). The park's 4,300 acres encompass about 90% of the actual battlefield. At the time of the battle, the area was a thriving agricultural setting. The landscape today reflects some of the features of the historic landscape as it appeared in March of 1862. Further analysis will be completed as part of a CLR. Open fields, lines of split-rail fences, and the Elkhorn Tavern convey some sense of Pea Ridge as the combatants saw it. Major landscape features include the following:

- *The Elkhorn Tavern.* The current structure is a 1963 NPS reconstruction based on the earliest known photo of the postwar building ca. 1870.
- *The Union Army Earthworks.* The earthworks are the only original structures in the park that date from the time of the battle.
- *Historical Roads.* The Telegraph Road was built to facilitate transportation and communication between St. Louis and Springfield, Missouri, and Fort Smith, Arkansas. It became part of the "Trail of Tears." Other historical road traces within the park boundaries include the Ford Road, the Leetown Road, the Winton Springs Road, and the Huntsville Road.
- *Split-rail Fences.* Ten miles of reconstructed split rail fence delineate some of the agricultural fields present at the time of the battle.
- *Pratt's Store Foundation.* It is possible that the foundation at this location is the original foundation of the store.
- *The West Overlook.* This overlook provides visitors with a broad panorama of the region in which this campaign took place.



Union Trenches could be susceptible to damage from invasive plants and treatments. Mitigation would be used to protect the earthworks.

- *The East Overlook.* This position provides visitors with the best overall view of the battlefield.
- *The Commemorative Markers.* Union and Confederate veterans of the Battle of Pea Ridge placed these commemorative markers near the Elkhorn Tavern.

Other landscape features at the park include stonewalls along parts of the tour road and some interpretive waysides that were installed after 1962. Open fields are maintained in a historic appearance by haying under special use permit and/or prescribed fire. The park's cultural landscape is potentially eligible for inclusion on the NRHP. A historic vegetation map was completed in 2005. Natural resources of the park were separated into two distinct areas that coincide with the GMP's Management Zones, Battlefield and Arkansas Highlands, which are managed in accordance with an approved cultural landscape treatment plan for vegetation potential in a natural resource context.

Ethnographic Resources. The park includes ethnographic resources related to cultures and peoples traditionally associated with the local landscape, in particular, certain American Indian nations. Troops from a number of tribes, including the Cherokee, Choctaw, Chickasaw, Creek, and possibly the Delaware served with the Confederate Army at the Battle of Pea Ridge. Members of the Cherokee, Choctaw, Chickasaw, and Creek tribes passed through what is now the park on the Telegraph Road, during their forced removal from the southeast United States to Indian Territory, Oklahoma, known as the Trail of Tears. These associations may not constitute an ethnographic resource identified in the park, but park management consults with the tribes (see Appendix J) when making management decisions, because of their position as stakeholders in the region.

Historical Features. The park, listed on the NRHP in 1966, documents 13 buildings/structures on the LCS. These are related to the 1862 battle and are listed in Appendix I, including

- Foundations
- Union Army earthworks
- Commemorative markers
- Battlefield sites
- Cemeteries
- Roads and trails

The feature identified as most susceptible to damage during invasive plant actions would be the Union trenches, which are low trenches with earth ramparts that are not readily discernible to the untrained eye, due to re-growth of trees and shrubs on site. The trenches are hundreds of feet long but only a few feet wide.

Wilson's Creek National Battlefield

Cultural resources at Wilson's Creek include historic structures, buildings, and cultural landscapes that are integral to interpretation of the first Civil War battle west of the Mississippi River. The park, listed on the NRHP in 1976, encompasses 1,750 acres, which includes 75% of the historic battleground.

Archeology. An MWAC study (Scott, et al. 2008) and an overview (Scott 2000) provided the following information. There are 50-recorded archeological sites covering over 8,000 years of documented human use and occupation of the parkland. The assessment notes that the main archeological resource of the park, the physical evidence of the 1861 Battle of Wilson's Creek, is not fully recorded, documented, or studied. The approximately 1,750 acres of rolling hills and Ozark uplands contain archeological evidence for continuous use of the area. A substantial amount of archeological investigation has been performed because of development and management decisions, requiring compliance with the NHPA §106. Little is known about the archeological potential of the greater park landscape (NPS 2004). The park undertook a survey of archeological sites in four proposed areas to be affected by removal of invasive vegetation (i.e., Osage orange and eastern red cedar trees) by heavy machinery. The major objective of the survey was to determine the location and number of archeological sites to be affected by the proposed tree removal activity, while increasing the database pertaining to settlement patterns in the Wilson Creek Valley.

The Wire Road trace is a pedestrian interpretive route and a horseback riding trail. Trails can be associated with introduction of invasive plants in adjoining natural areas.

Cultural Landscapes. Cultural resources and natural resources are intertwined at this historic battlefield. The cultural landscape of WICR is comprised of large rural tracts, including both fields and forest of varied topography. The CLR (NPS 2004b) defines the cultural landscape treatment and guides management decisions about the landscape's physical attributes, biotic systems, and use relative to historical significance. The CLR offers the following recommendations that may relate to invasive plant management:

- Rehabilitate existing vegetation communities focusing on native species enhancement of existing prairie restoration areas and young woods to approximate historic savanna conditions.
- Restore riparian areas to healthy plant communities.
- Once nearly treeless, the glades should be classified as significant natural features to be protected.
- Rehabilitate and restore native landscapes within the park to eliminate run-off and enhance infiltration of precipitation into the park's groundwater resources.
- Employ BPs for thinning and clearing woodlands.
- Maintain and enhance the health and diversity of vegetation in sensitive or remnant communities particularly the limestone glades and Manley woods.

- Establish an aggressive control plan that incorporates prescribed fire as necessary for invasive species.

Ethnographic Resources. According to the CLR, the earliest evidence for human occupation dates to a transitional period called the Dalton complex, ca. 10,000–9,000 B.P. The park has identified American Indian tribes as being descended from people that occupied the area (see Appendix J). Although no sacred places, traditional uses, ethnographic landscapes, or burials are documented within the park, these tribes are included in consultation during planning at the park.

Historical Features. The LCS documents 30 buildings/structures that are entered or eligible for the NRHP or managed as resources (NPS 1995b). Primary park historic structures include:

- The Ray House (built in 1852 or 1853, and occupied until 1966), the oldest extant structure in the park, and the Spring House, which existed at the time of the battle.
- The General Lyon Marker is an inscribed granite marker 3'6" in height by 2'1" wide, set on a concrete base in 1928 near the spot at Bloody Hill, where General Lyon was killed.
- The Telegraph Road traverses the battlefield from the east boundary near the John A. Ray House to the western border.
- Gibson Mill was a massive rock foundation and wood frame construction.
- The Short Spring Box surrounds the spring that drains into Wilson's Creek, located southeast of Short House Site.
- Additional structures include headstones in two family cemeteries, sites of a historical house, barn, and outbuildings, the Edward's cabin, and stonewalls.

Many of the LCS records for the park are associated with farms or homesteads. Many of these are managed as turf areas, outside of the direct management actions of the EPMP. Several cemetery headstones are also on the LCS and located in mowed turf and so outside of this project's treatment area, but near potential treatment areas. Markers related the battle have cleared areas immediately around them, either gravel or turf, but may be near treatment sites.

Fieldstone walls are not buffered from actions proposed in this EPMP. The walls contain no mortar and can be intermittent, ending in stone rubble or as a tapered structure. Ruins are also in areas that are not mowed and may be included in the EPMP project area. Telegraph road, also on the LCS, is a gravel trace with woods and fields bordering it. The vegetation along the road will be treated as needed.

McElhaney House, an example of the turf buffer around a structure

Herbert Hoover National Historic Site

The prairie is part of the cultural landscape and located next to cultural resources, but contains no documented historic resources.

This park was established to commemorate the life of Herbert Hoover by preserving cultural resources associated with his childhood period at this location and the development of the park. The Birthplace Cottage was designated an NHL in 1965. The entire park was listed on the NRHP in 1978. The areas proposed for actions in this EPMP project do not have individual historical integrity, but are contributing elements of the cultural landscape. A large portion of the park is devoted to historic buildings and artifacts associated with Herbert Hoover's life in West Branch that are outside of the project area. Other cultural resources include the Miles Farm, Thompson Farm, and Gravesite.

The park's GMP has designated management zones based on the types of management actions and other activities that are appropriate in each zone. The EPMP project area encompasses the Natural Zone and the Open Space Zone. The prairie, part of the Natural Zone, and Open Space Zone served as agricultural row crop fields for approximately 100 and 150 years, respectively. The stream that transects the park passed through what had been portions of the town of West Branch and its banks host old dumpsites and a historical retaining wall.

Archeology. Finney completed a park overview in 2005 from which much the following information comes. A complete archeological survey has not been completed. Localized surveys have been done, usually in association with a restoration or construction project. Investigations have been made by researchers from the MWAC and the Office of the State Archaeologist at The University of Iowa, Iowa City.

At present there are 17 archeological sites registered in the Iowa Site Record and ASMIS. The majority of the sites occur in the HEHO historic core area, outside of the treatment areas proposed in this EPMP. All of these 17 sites represent Euro-American occupations. At present, there are no documented American Indian related sites in HEHO. There are no known surficial archeological artifacts within the prairie. The park historian suggests that subterranean resources are unlikely between the deep plow line (two feet below surface) and the soil surface because of more than 100 years of agricultural activities on the land. Several trash dumps have been located along the stream corridor and so would potentially lie within the treatment areas.

Cultural Landscapes. Much of the following is taken from the CLR (NPS 1995) and CLI (2006c). **T**he entire historic site has been documented as a as a cultural landscape with the open fields significant and contributing to the setting, feeling, and association with the period of significance (1876 – 1965). The prairie does not have historic integrity to the period of significance. The prairie and farm fields do contribute to the Fundamental Resources and Values established for the draft Resource Stewardship Strategy, specifically contributing to a Serene and Simple Setting. Similarly, although the stream has changed significantly since Hoover's childhood in West Branch, it too contributes to the setting, feeling, and association, and is part of the natural resources on site.

Most of the Commemorative, Orientation, Special Use, Maintenance, and Recreation zones, as defined in the GMP, will not be included in the proposed EPMP project area. Historic resources

and visitor-use facilities are located here. Exotic plant management falls under approved turf management plans in these areas. Prairie plantings and wooded areas contiguous with the prairie that are not in manicured lawn areas are part of the proposed project site. Several features that are integral to the cultural landscape are included in the proposed treatment areas.

- *Axial relationship of Birthplace and Gravesite*. The vista between the Birthplace Cottage and Gravesite passes through the stream riparian.
- *Water Features.* The creek is one of the most enduring and visible elements of this cultural landscape.
- *Rural/Agricultural Setting.* A large area consists of relatively flat riparian areas bordering Hoover Creek, and reconstructed prairie to the south. It also includes the Thompson Farm and Miles Farm settings of fields or prairies surrounding the clusters, but the farmyards are not included in this project.
- *Land Use Patterns.* The park is a commemorative and memorial site with maintained open space.
- *Vegetation.* Prairie and native vegetation has been described in the Prairie Management Plan (NPS 2003b).
- *Circulation Patterns.* Pathways and trails that pass through natural features, such as the prairie or the stream riparian area, will be included in the proposed area.

Native prairie was recorded to have persisted near West Branch during the time Herbert Hoover lived here (Bearss 1971). Therefore, open prairie and farm fields are important to a discussion of Hoover's childhood in Iowa.

Ethnographic Resources. The park has no documented affiliated tribes and no prehistoric archeology has been discovered. Two groups of Friends (Quaker), Friends Church and Friends Meeting, have been invited to contribute to decision-making, because of their connection to the Friends Meetinghouse and the interpretation of Herbert Hoover's faith.

Historical Features. The LCS documents 57 buildings/structures listed as eligible for the NRHP or managed as a resource. Cultural resources located adjacent to EPMP project areas, include the Miles Farm, Thompson Farm, and Hoover Gravesite. The only historic structure that is potentially within the treatment area is the Hoover Creek Retaining Wall, HS-50, which is a contributing feature in the NRHP nomination. Mitigations and BPs will ensure protection of this feature by providing an ample buffer for treatments that have a potential to destabilize the structure or chemically damage the components.

Hoover Creek historical retaining wall

Homestead National Monument of America

Daniel Freeman claimed the land in 1863 where HOME is now located. The park purpose is to interpret the history of the Homestead Act and its effect on citizen's lives. The park totals 195 acres, which includes 163 acres of the original Daniel Freeman homestead and the Freeman schoolhouse. The park was listed on the NRHP in 1976. Much of the following cultural information was extracted from the park's vegetation management plan (NPS 2004e), LCS, and CLR (NPS 2000).

Archeology. Archeological investigations began at the park in the late 1940s and have continued through the present. All fee-title land within the park has been examined on at least one occasion by professional archeological teams from the NPS or other agencies working under contract. Investigations were implemented largely in response to a need for a park-wide inventory of archeological resources. Much of that information was used in an overview document (Bozell 2005) and served as the source of information that follows.

The land comprising HOME has been used by humans for approximately 2,000 years. The first inhabitants were Indian tribes engaged in simple agriculture and hunting in the area. During the eighteenth and nineteenth centuries, Euro-Americans began to travel west, and traders and trappers were active in the area. In 1857, the area was surveyed. In 1863, Daniel Freeman became the first person to file a claim under the Homestead Act.

Past studies identified seven archeological sites associated with both American Indian and Euro-American settlement. Within the prairie are the remains of a freight road. There are also several Freeman family home sites. Daniel and Agnes Freeman are buried in a plot along the east boundary of the park in an area that overlooks their claim. These nationally significant features need to be protected and taken into account when planning vegetation management actions. Most shallow deposits are well identified, but deeply buried resources require further investigation. Deeply buried resources are outside the project area.

Cultural Landscapes. Two CLIs have been completed for the park – one for the entire park the other for a component landscape called the Freeman School. The original park boundary was the same land boundary used by Daniel Freeman when he filed his homestead claim on this 160-acre tract of land. Additional property was acquired and is now the location of the Heritage Center, a park visitor facility. When the NPS acquired the Freeman homestead in 1936, the riparian woodland south of the historic freight road was intensively grazed and harvested. In 1939, in an effort to prevent increased erosion, it was decided to restore the former cultivated area of the Freeman farm to tallgrass prairie and to plant over 10,000 oak and hackberry seedlings. These vegetation communities have historical significance of their own. The park restored the hackberry dominated southern half to represent the woodlands before the 1860s.

Homestead Heritage Center, as seen from prairie, is an island of development within the natural landscape.

Daniel Freeman planted an Osage orange hedgerow to delineate the south property line. Osage orange, exotic in this location, represents a significant feature of the cultural landscape. The Freeman School grounds contain an unplowed prairie unit that is approximately 0.75 acres in size. This unit is managed the same way as the Tallgrass Prairie Unit. The pioneer triangle unit is a 2.8-acre portion of the east forty that is north of the State Highway 4. The triangle is hayed yearly. The Friends of Homestead currently

own 40 acres of land south of the middle and west 40s. This parcel was restored to tallgrass prairie in 2009.

Several goals were set for the cultural landscape within a 2005 Cultural Landscape Report:

- Enhance visitor understanding of the cultural landscape.
- Ensure the continued health of historic trees.
- Preserve the integrity of the nation's second oldest restored tallgrass prairie and promote its research to answer management questions.

Ethnographic Resources. The NPS has not documented any current use of the park by federally recognized tribes. No federally recognized American Indian group has claimed a traditional affiliation or association with HOME. The park is not listed as an ethnographic site on the NRHP. However, historical American Indian groups are believed to have used the area and the park recognizes these tribes as consultants in the decision-making process.

Historical Features. The LCS documents 10 buildings/structures listed on or eligible for the NRHP or managed as a resource. Appendix I contains a list of those that are within the EPMP project area. The Freeman School, built in 1872, is the best example of a one-room school in Nebraska and is a tangible symbol of the roots of American public education. In addition to the brick schoolhouse, there is an attendant storage shed as well as two privies that are over 50 years old. All structures will be buffered during treatment operations. A Daughters of the American Revolution monument and 1962 time capsule is located in the prairie. This is buffered by a 12 inch mowed strip, but would be further buffered with no-spray buffer and motorized equipment would provide ample clearance to protect the monument.

Pipestone National Monument

The Congress set aside approximately 116 acres in 1937 for three purposes: (1) to administer and protect the pipestone quarries, reserving the quarrying of pipestone for Indians of all tribes (an ethnographic resource), (2) to protect cultural and natural resources within the park boundaries, and (3) to provide for the enjoyment and benefit of all people. A second act was passed on June 18, 1956 that authorized the addition of up to 250 acres from the Pipestone School Reserve. Values to be protected include the geologic resources, the prehistoric and historic resources, vegetation, and wildlife found within the park's boundaries.

The park contains important cultural resources of the Middle Woodland Period, circa. A.D. 500–700, through the Late Prehistoric Period, ending about A.D. 1700 and continues its relevance as an important part of American Indian culture. The park was listed on the NRHP in 1966.

Archeology. Much of the information on archeology was taken from the archeological inventory and overview (Scott et al. 2006). The park encompasses an archeological district, the boundary of which coincides with that of the park. The entire park is officially recorded in the files of the Office of the Minnesota State Archaeologist. It is composed of 44 sites where archeological features have been reported at various times over the past 120 years.

The archeological sites are comprised of stone quarries, mounds, circular stone alignments that are also known as tipi rings, petroglyphs, a historical cemetery associated with the Pipestone Indian School, and campsites involving Catlinite workshop areas. There is a long history of investigation of the prehistoric and historic archeological resources of the park, dating from 1882. Archeologists from the MWAC have conducted several surveys over the years.

Cultural Landscapes. An ethnographic landscape is a type of cultural landscape with unique qualities relating to an associated group. The landscape of the park supports the ethnographic values of the site and its importance elevates the landscape to a Fundamental Resource. Particular features are critical ethnographic resources within the cultural/ethnographic landscape: the quarries, the Three Maidens, Winnewissa Falls, the Oracle, Old Stone Face / Leaping Rock, and numerous petroglyphs. The ethnographic landscape also includes the natural resources of the park that contribute to the sense of place and scene. The CLI for the park is complete.

Ethnographic Resources. An Ethnographic Landscape Report (Fitzgerald 2007) has been completed for the park and serves as the CLR. Ordinarily, ethnographic resources are identified with particular tribes, peoples, or groups traditionally associated with what is now parkland. Because the Catlinite pipestone quarries were open to all tribes at all times, no single tribe claims the area as solely theirs. Instead, individuals within many tribes assigned traditional significance to the site and claim its resources and values as part of their cultural system. The park has determined the most closely affiliated tribes (listed in Appendix J) and has consulted these tribes in park planning. Since 1991, the park has served as the location of two annual Sun Dances. Some other ceremonies include individual vision quests, sweat lodges, and many informal ceremonies.

The entire park is an ethnographic resource, as well as an ethnographic landscape. Therefore, the entire set of natural and cultural resources, except the modern structures, will be treated as a subset of the ethnographic resources. Along with ethnographic resources, ethnographic values are a part of the park's importance. Ethnographic values are intangible resources that include the sense of place, spiritual feelings, sacredness, and other very personal experiences.

Historical Features. The LCS documents 11 buildings/structures listed on or eligible for the NRHP or managed as a resource. Those within the EPMP project area are included in Appendix I. The park was listed on the NRHP on October 15, 1966. The archeological features are also considered historical features. The historical resources of a more recent period, nominated in 2003 and deemed eligible by the State Historic Preservation Office for listing on the NRHP, are supportive of, but not fundamental to, the park. They are not part of the ethnographic resources, and are relatively recent additions to the cultural landscape. The Circle Trail was extended and redesigned during Mission 66 development. The Circle Trail and South Quarry Line Trail are three-foot wide paved paths. Civilian Conservation Corps created two Sioux quartzite and concrete barrel arch footbridges within the project area.

CCC footbridge through natural area, but maintained as a cultural asset.

Tallgrass Prairie National Preserve

The park, formerly the Z Bar/Spring Hill Ranch, was designated an NHL in 1997, representing the transition from the open range to the enclosed holdings of the large cattle companies of the 1880's. The entire 10,894 acres of the preserve are designated as part of the NHL. Multiple overlapping cultural resources at TAPR receive protection and preservation in the enabling legislation. As a designated NHL, all cultural resources that contribute to the landmark significance and theme are eligible for the NRHP.

Archeology. Archeological resources, the physical remains of past cultures and archeological sites, are known to exist within the proposed project area (Jones 1999). Thirteen prehistoric and historic sites are documented for TAPR. The sites are scattered across TAPR and the site types include lithic scatters, a quarry/workshop site, cairns, early farmsteads, the Spring Hill Ranch headquarters area, Deer Park Place, a historic dumpsite, and the Lower Fox Creek School area. The archeological resources extent and exact locations are not all documented. Field investigations conducted in 1998 addressed the small number of previously documented, but mostly unrecorded sites, but these addressed only about 150 acres (less than 2% of the park). An archeological overview and assessment was completed in 1999 (Jones 1999) which documented reconnaissance survey results. Twelve archeological sites were documented, including the following:

- The remains of an historic farmstead which dates to between 1870 and 1938;
- A large prehistoric quarry and lithic workshop;
- The remains a farmstead evidenced by depressions and dry-laid masonry;
- A large prehistoric lithic quarry and workshop, dated to between A.D. 1-950 with potential for intact subsurface deposits;
- A small prehistoric lithic workshop.

Isolated chipped stone implements have been found at several locations. The potential is high for the identification of sizeable numbers of prehistoric and historic sites and features within the area of TAPR, based on the density of sites documented in Chase and adjoining Morris counties.

Cultural Landscapes. The CLR (Bahr Vermeer Haecker Architects 2004) for the park was completed in 2004. The park also has two completed CLIs. The ranch lands, as well as prehistoric and historic structures and features, are part of a cultural landscape that contributes to the significance as an NHL. The CLR describes the contributing elements of the built environment, which convey the significance of the landscape (Table 3.2.1). Managed view sheds, historic stone fencing, and patterns of spatial organization (pasture delineation, road patterning etc.) are deemed significant in the CLR and are addressed in treatment recommendations.

Table 3.2.1. Character defining features of the cultural landscape, TAPR

Historical feature	List or description
General	The historical alignment of railroad spur, connecting cattle yard to Atchison, Topeka & Santa Fe Railroad; Prairie views, both into and out of the park
Historic Spring Hill / Z Bar Ranch Headquarters	Cluster arrangement at the ranch headquarters; nineteenth-century residence; barn; shed / chicken house; carriage house; spring house; privy; ice house / cistern; stone corral complex; south corral; nineteenth-century pond site; terrace system adjacent to residence; ranch fences; curvilinear cedar plantation west of residence; black walnut, elms, and oaks; views to Fox Creek, Flint Hills, & Lower Fox Creek School; these also contribute to the historical features / structures and archeology
Lower Fox Creek School	School house; remnant stone steps east of school; also part of the historical features/structures
Deer Park Environs	Stone poultry house; arched stone bridge; historical road alignments; St. Anthony Cemetery; these contribute to historical features / structures and archeology
Former Stockyard Site and Rail Spur	Stockyard archeological site; historical road and rail alignments
Pastures and Cow Meadow	West Branch Pasture; Gas House Pasture; Windmill Pasture; Red House Pasture; Crusher Hill Pasture; West Traps Pasture; Brome Pasture; East Traps Pasture; Two Section Pasture

Ethnographic Resources. Several American Indian tribes (listed in Appendix J) have been recognized as having ethnographic association with TAPR, but no sacred sites have been identified.

Historical Features. The LCS documents 24 buildings/structures listed on or eligible for the NRHP or managed as a resource. The structures and features document the evolution of farming, ranching, and rural life on the property from the mid-nineteenth to the mid-twentieth centuries. Twelve structures on the LCS are in the EPMP project area, but many NRHP eligible structures are also in the project area (Appendix I). Eight buildings and four structures have been identified as contributing to the property's national significance. The majority of these are concentrated at the Spring Hill Ranch Headquarters, Deer Park Place, and Lower Fox Creek School in areas that are maintained landscape outside the treatment areas proposed in this EPMP project. Historic structures currently house park operations and visitor services. Historic structures also occur within the proposed project area in the form of dry-laid stone fences that delineate original pasture plots.

3.3 Visitor Use and Experience

The Organic Act of 1916 created the NPS to conserve park resources and "*provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for future generations.*" According to NPS Management Policies 2006, page 90, the NPS will advance enjoyment by "*providing memorable educational and recreational experiences that will (1) help the public understand the meaning and relevance of park resources, and (2) foster development of a sense of stewardship.*" The overlying principle is that park staff will help visitors have a safe, meaningful, and satisfying park experience. What constitutes a desired condition for visitor experience differs among the parks, but they all share some generalized desired conditions (Table 3.3.1).

Table 3.3.1 Desired conditions for visitor experience.

Current laws and policies require the following conditions for visitor experience.

Desired Condition	Source
A condition where visitor and employee safety and health are protected;	NPS Management Policies 2006; NEPA
Visitors understand and appreciate park values and resources and have the information necessary to adapt to park environments. Visitors are provided with opportunities to enjoy the parks in ways that leave park resources unimpaired for future generations;	NPS Organic Act; NPS Management Policies 2006
Regulated recreational uses are promoted and basic visitor needs are met in keeping with park purposes;	NPS Organic Act; Title 36 of the Code of Federal Regulations; NPS Management Policies 2006
NPS facilities, programs, and services are accessible to and usable by all people, including those with disabilities.	Americans with Disabilities Act; Architectural Barriers Act; Rehabilitation Act; NPS Management Policies 2006

Vistas and soundscapes will be described as appropriate in this section. Sounds and sights that visitors encounter affect their recreational and/or educational experience. The type of park unit and its specific features often help shape those expectations. Generally, expectations include

- Those associated with nature, such as the wind rustling through autumn leaves, birds singing, or the sparkle and bubble of a clear stream.
- Those reflecting our cultural heritage, such as cannons firing, native drumming, or music.
- Those connected to people visiting their parks, such as children laughing, park interpretive talks, and cars or motorboat engines.
- Special sights and sounds associated with specially designated areas, such as Wilderness or Wild and Scenic Rivers

However, not all activities will be appropriate or allowable in all parks; a determination of appropriateness must be made based on park-specific planning. Director's Order 47 states that soundscape preservation and noise management activities will be subject to the policies contained in the NPS Management Policies 2006. Section 4.9, page 56, of these policies states, "*The National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks. . . . The Service will restore to the natural condition wherever possible those park soundscapes that have become degraded by unnatural sounds (noise), and will*

protect natural soundscapes from unacceptable impacts." It continues to say, "*Using appropriate management planning, superintendents will identify what levels and types of unnatural sound constitute acceptable impacts on park natural soundscapes.*"

Unless otherwise indicated, the following concise descriptions of visitor experience are compiled from the park submissions to the Heartland Inventory and Monitoring Network Vital Signs Monitoring Plan (DeBacker et al. 2005), which originated in the parks' enabling legislation and planning documents.

Cuyahoga Valley National Park

The park was established in 1974 to *"preserve and protect the natural and recreational values of the Cuyahoga River and adjacent lands."* This includes the preservation of the historic and scenic values of the valley in a manner that will provide for the recreation and education needs of visitors. Although CUVA was designated a National Park in 2000, there is an emphasis on recreation that carries from the park's original designation as a National Recreation Area. Proximity to major urban centers may influence the expectation of the visitor experience by reducing the emphasis on unspoiled nature and increasing the emphasis on diverse recreational opportunities that include human interaction with nature.

Effigy Mounds National Monument

The park was established by Presidential Proclamation 2860, on October 25, 1949, "*to preserve and commemorate the Eastern Woodland culture and their prehistoric mounds because of the variety of their forms, which include animal effigy, bird effigy, conical and linear types.*" A visit offers opportunities to contemplate the meanings of the mounds, the peoples who built them and the relationships to modern descendants. The 2,526 acres, situated in a natural setting, are located within one of the most picturesque locations in Iowa along the "Great River Road" of the Mississippi River, a National Scenic Byway. The opportunities for contemplation and the picturesque setting may suggest that visitors expect contact with nature, extraordinary views, and a quiet environment, but with the realization that the Mississippi River is a major travel way for commerce, boats, railways, and highways.

Hopewell Culture National Historical Park

The park was established as Mound City Group National Monument on March 2, 1923 because "*the Mound City Group of prehistoric mounds is an object of great historic and scientific interest and should be permanently preserved and protected from all depredation and from all changes that will to any extent mar or jeopardize their historic value.*" The park invites visitors to learn about these sacred spaces and to reflect upon the lives of the mound builders. This suggests opportunities for serenity that would be enhanced by relative quiet and attractive space, harmonizing with nature. Disturbed land is being restored to native grassland designed to encourage grassland birds for visitors to enjoy.

Lincoln Boyhood National Memorial

The park was established by an Act of Congress on February 19, 1962 to *"preserve the site associated with the boyhood and family of Abraham Lincoln."* The setting memorializes President Lincoln through stately developed areas. The historical farm presents another impression with its recreated pioneer homestead, including a cabin, outbuildings, split rail

fences, farm animals, vegetable and herb gardens, and field crops. The living history experience transports the visitor to a sense of the 1820 era setting. The affected environment includes the farm area, and the woodlands and natural space between the modern memorial area and the farm. The natural areas lend a sense of sanctuary and serenity to the site. The forests are intended to provide an aesthetically appealing setting for commemoration (McEnaney 2001).

Arkansas Post National Memorial

The park was federally designated in 1960 to "*preserve and commemorate the site of the first European settlement of the lower Mississippi Valley."* Arkansas Post served for almost two hundred years as a strategic outpost for three nations seeking control of America's interior: France, Spain, and the United States. Established first as a trading post and used successively as a military stronghold, a frontier settlement, and a territorial capital, Arkansas Post was a frontier institution that played an important part in the history of Arkansas. The Memorial Unit contains developed areas that are excluded from this proposal, as well as natural areas that suggest a historical connection to nature and the river. The park emphasizes its quality plant and animal habitat, and the wildlife viewing. This creates the expectation of natural sounds and views with little intrusion from modern machinery in the natural areas, secluded from the modern developed areas. The Osotouy Unit contains American Indian mounds and a historic cemetery. Visitors would likely expect few intrusions onto the natural sounds and serene views at this unit.

Buffalo National River

Congress established the Buffalo River as the first National Scenic River in the United States in 1972 "*for the purposes of conserving and interpreting an area containing unique scenic and scientific features, and preserving as a free flowing stream an important segment of the Buffalo River in Arkansas for the benefit and enjoyment of present and future generations*." As a scenic waterway, visitors would expect the sights and sounds of nature to predominate. Some recreational boating on the river would result in temporary engine sounds. Expectations in the designated Wilderness areas would be for little intrusion from sounds not associated with nature. The park's Terrestrial Habitat Management Plan (NPS 2006e) acknowledges the importance of viewing agricultural scenes (old fields), enjoyment of forest environment and wildlife, and hunting of game, all of which are recreational activities and opportunities associated with healthy habitat and limited tolerance for invasive plants, but with some tolerance for human disturbance.

George Washington Carver National Monument

The park was established by an act of Congress on July 14, 1943 "*to memorialize the birthplace and childhood of Dr. George Washington Carver and to preserve the setting of the Moses Carver farm.*" The park manages natural and cultural resources to memorialize Carver's life in a dignified and inspirational setting. As a memorial, the park promotes opportunities for contemplation, allowing the public to spend time reflecting upon their lives and experiences and those of George Washington Carver. The historical sense of place is limited to certain areas within the park. Generally, the visitor would not expect pristine natural areas within this park, and would have tolerance for minor intrusions of modern sights and sounds. However, sights and sounds, especially along the Carver Trail, are important to the visitor experience. Education is typically a key aspect of a park visit.

Hot Springs National Park

The park was first set aside as the Federal Hot Springs Reservation on April 20, 1832 "*to protect the hot springs flowing from the southwestern slope of Hot Springs Mountain.*" Hot Springs Reservation became Hot Springs National Park by a Congressional name change on March 4, 1921. The park's enabling legislation mandates the thermal waters be preserved and provided to the public in an unending and unaltered supply. This may be the only park in the system required by law to give away its natural resource. The park is located in an urban area and subject to the sights and sounds of traffic and people. The portions of the park that are in what had been residential areas are quieter, but less visited, and they are the primary areas affected by the proposed actions. In recent years, the park has been developing the reverted residential areas to natural areas with an attempt to incorporate natural area values, such as natural sounds and night sky viewing. There will always by some influence from the urban setting.

Ozark National Scenic Riverways

The park was established in 1964 to "*conserve and interpret unique scenic and other natural values and objects of historic interest, including the preservation of the Current River and the Jacks Fork River as free-flowing streams, preservation of springs and caves, management of wildlife, and provision for use and enjoyment of the outdoor recreation resources.*" It was the first park in the NPS specifically designated to preserve the scenic river experience. As such, sights and sounds are important to the visitor experience. Currently, the rivers can be congested with visitors in canoes and motor boats during certain times. Engine noise is less a factor than the sounds of people enjoying the river. Temporary intrusions of sound and sights associated with human activities would likely be accepted by visitors.

Pea Ridge National Military Park

The park was established in 1956 to "*preserve and commemorate the March, 1862 civil war battle that saved Missouri for the Union and allowed Union forces to gain control of the Missouri and Mississippi Rivers.*" The park's mission statement is "*to preserve the cultural and natural resources therein; to commemorate, interpret and foster the appreciation of associated historical events; and to promote resources stewardship through education.*" As a commemorative site, the visitor expectation is for a sense of place while viewing the battlefield. Sights and sounds should provide opportunity to contemplate the action of battle and the associated meanings. The loop road brings modern convenience and sound close to the visitor. Mowers are regularly used on the grassy areas of the battlefield, and modern background sounds and sights are common.

Wilson's Creek National Battlefield

The park was established by an Act of Congress on April 22, 1960 to "*preserve and commemorate the Battle of Wilson's Creek; the first major Civil War battle west of the Mississippi River."* It is also where General Nathaniel Lyon died, the first Union General killed in the Civil War. As a commemorative site, the visitor expects a sense of place. Sights and sounds should provide opportunity to contemplate the battle and the associated meanings. The loop road brings modern convenience and sound close to the visitor. Routine maintenance of the site also temporarily brings the sounds and sights of modern equipment to the visitors, but much of the battlefield has infrequent maintenance activity.

Herbert Hoover National Historic Site

The park is located in east-central Iowa within the city of West Branch. It was established in August 12, 1965 to "*preserve in public ownership historically significant properties associated with the life of the 31st United States President, Herbert Hoover*." This commemorative site creates a simple and serene setting with a late nineteenth-century sense of place and time. The setting is between a small rural town and an Interstate, compromising the soundscape. The natural areas are intended to buffer the outside distractions, rather than present a sense of a pristine environment. The city and interstate are visible from many points within the natural area.

Homestead National Monument of America

The park was established in March 1936 to "*commemorate the Homestead Act of 1862 and its effects upon the settlement of the West as well as advancements in agricultural technology.*" The sense of place is enhanced from the open space, natural vistas, and natural sounds. Temporary modern sounds enter the landscape, but should not predominate. Some visual intrusion by workers would also be in keeping with the sense of a working homestead.

Pipestone National Monument

The park was established by an Act of Congress on August 25, 1937. Approximately 116 acres were set aside for three purposes, one of which is to provide for the enjoyment and benefit of all people. Values to be protected include sounds from the quarry and those associated with the running water and open landscape. Sights include a sense of undeveloped landscape interrupted by working quarries. The sense of place supports the visitor experience. Therefore, sights and sound influence the visitor experience. Footpaths lead visitors through the quarries and natural areas. This is also an ethnographic landscape, where a sense of place is important.

Tallgrass Prairie National Preserve

The park is a designated NHL, representing the transition from the open range to the enclosed holdings of the large cattle companies of the 1880's. Its stated purpose is to preserve, protect, and interpret a rare tallgrass prairie ecosystem on the Spring Hill Ranch in the Flint Hills. This ecosystem is a remnant of prairie that once covered 400,000 square miles of North America. Visitors likely expect open views of pasture and prairie with low tolerance for modern sounds, but tolerance for sights and sounds associated with activities in the pastures.

3.4 Other Resources or Values

The National Park Service Organic Act of 1916 created today's park service within the U.S. Department of the Interior. The Organic Act charges the NPS with a dual mandate to promote and regulate the use of the national parks "*by such means and measures as conform to the fundamental purpose to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment for the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*" Within the confines of this mandate, the Organic Act otherwise gives the NPS broad authority to manage the parks, directing the Secretary of the Interior to "*make and publish such rules and regulations as he may deem necessary or proper for the use and management of the parks, monuments, and reservations under the jurisdiction of the National Park Service.*"

According to the NPS Management Policies 2006, section 4.3, page 41, "*The Park Service recognizes that special designations apply to parts or all of some parks to highlight the additional management considerations that those designated areas warrant. These designations include research natural area, experimental research area, wilderness area, national wild and scenic river, national natural landmark, biosphere reserve, and world heritage listing. These designations do not reduce the Service's authority for managing the parks, although in some cases they may create additional management requirements or considerations.*" The following special designations occur in one of the parks included in this EPMP/EA.

3.4.1 Wild and Scenic Rivers

Buffalo River of BUFF, Current River and Jacks Fork River of OZAR, and Yellow River in EFMO are classified as National Wild and Scenic Rivers (see Appendix N for descriptions). The designated segment of Buffalo River also includes a 15.8-mile headwaters segment of the river and flows through the Upper Buffalo Wilderness Unit. Designated rivers are subject to management guidelines to maintain certain desired conditions. These are outlined in Table 3.4.1.

Table 3.4.1. Desired conditions for Wild and Scenic Rivers

Current laws and policies require that these conditions be achieved for wild and scenic rivers, or prospective wild and scenic rivers.

Desired Condition	Source
A condition where selected rivers of the Nation, which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, are preserved in free-flowing condition. These rivers and their surrounding environments are protected for the benefit and enjoyment of present and future generations.	Wild and Scenic Rivers Act
Adverse effects on the values that qualify a river for the national wild and scenic rivers system are avoided.	NPS Management Policies 2006

The National Wild and Scenic Rivers Act (16 U.S.C. 1271-1287) [29] says that uses compatible with management goals are allowed on designated rivers. While section 7 forbids federal agencies from developing designated rivers in a manner that damages outstanding characteristics

[29] Act is described at http://www.rivers.gov/wsract.html, accessed August 21, 2012.

or free flow, section 10 requires administering agencies to enhance these rivers. Under a 1979 presidential directive, and related Council on Environmental Quality (CEQ) procedures, all federal agencies must seek to avoid or mitigate actions that would adversely affect designated rivers.

The NPS Management Policies 2006, section 2.3.1.9, page 25 states that, "*General management plans and other plans potentially affecting river resources will propose no actions that could adversely affect the values that qualify a river for the National Wild and Scenic Rivers System.*" Page 41, Section 4.3.4 also discusses management of Wild and Scenic Rivers and instructs parks to comply with the Wild and Scenic Rivers Act.

3.4.2 Wilderness Act

One park has wilderness area designated within its boundaries. The Buffalo National River Wilderness consists of three separate units totaling 36,000 acres. Because of this designation, BUFF must follow certain guidelines in the management of those areas and lands immediately adjacent to designated wilderness to maintain certain desired conditions. Wilderness values include opportunity for solitude, natural soundscapes, and vistas overlooking primitive lands, as outlined in Table 3.4.2.

Table 3.4.2. Desired conditions for designated Wilderness

Current laws and policies require that desired conditions be achieved for designated wilderness areas or for those lands that possess wilderness characteristics that may qualify for designation.

Desired Condition	Source
A condition where no commercial enterprise and no permanent roads are allowed within any wilderness areas, except as necessary to meet minimum requirements for the administration of the area (including measures required in emergencies involving the health and safety of persons within the area), where there are no temporary roads, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area;	Wilderness Act
Wilderness is unimpaired for future use and enjoyment as wilderness	NPS Management Policies 2006

The Wilderness Act of 1964[30] generally prohibits activities such as timber harvesting, as well as permanent roads, structures, and facilities, in wilderness areas. The purpose of DO-41 is to guide NPS efforts in meeting the letter and spirit of the Wilderness Act. It should be applied to management actions carried out within the framework of a park's management plans, including its wilderness management plan, and natural and cultural resource plans.

[30] Act may be found at http://www.wilderness.net/index.cfm?fuse=nwps&sec=legisact, accessed August 20,2012.

4

Consequences

Impact Topics

- Meet objectives
- Water resources, including water quality, wetland, karst hydrology
- Geological resources, including soils and karst features
- Vegetation
- Wildlife and fish
- Threatened and Endangered species
- Archeology resources
- Cultural landscapes
- Ethnographic resources
- Visitor experience (including park operations, health, and safety)

The National Environmental Policy Act requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided for the alternatives considered. National park system units are directed to assess the extent of impacts on park resources as defined by the context (type and extent), duration, and intensity of the effect, based on an understanding and analysis by resource professionals and specialists. This chapter identifies the impacts to the physical, biological, and human aspects of the environment that could be affected by the alternatives.

4.0 Methodology

The interdisciplinary planning team created a process for impact assessment, based upon the directives of the DO-12 Handbook, Section 4.5(g) (NPS 2001b). The impact discussion is not a reiteration of the proposal, but rather a discussion of resulting effects, should the proposal and alternatives be implemented. Methodologies were identified to measure the change in park resources that would occur with the implementation of invasive plant management alternatives. Both program success and potential for risks were considered in the analysis.

4.0.1 Program Goals and Objectives

Attainment of program goals and objectives defines success. An alternative that fails to meet program goals and objectives will result in an unwise use of program funds. Therefore, the alternatives are assessed for the feasibility in fulfilling the purpose of the program. Two designations will be used in this assessment:

- Attainment – the alternative can meet the objectives and so attain the goals of the program
- Nonattainment – the alternative is unlikely to meet some or all of the objectives and so will not attain the goals of the program

When possible, a likelihood of attainment will be provided in a qualitative term, such as probable, likely, or unlikely, particularly when the question of attainment is not absolute. The objectives for this program are reviewed under major headings in Table 4.0.1.

Table 4.0.1 Guidance on determining achievement of program goals and objectives

Attain / maintain desired conditions	Attain or maintain desired conditions for landscapes; support approved park CLR treatment plans enhancing historic context, setting, feeling, and association of cultural resources to the defined period of significance (also enhances visitor experience and supports interpretation programs). Invasive plant management should support natural and cultural resource desired conditions that the NPS aspires to achieve and maintain over time, and the conditions necessary for visitors to understand, enjoy, and appreciate those resources. These conditions are identified through the park planning process. Some desired conditions may apply parkwide, but delineation of management zones illustrates intended differences in resource conditions, visitor experiences, and management activities in various areas of the parks. The analysis will evaluate: Would the alternative implement activities and projects needed to attain/maintain the desired conditions? Would desired conditions be attained in a reasonable length of time (before damage is done to resources or before levels of invasion increase the costs treatment or necessitate a reduction in expectations of the level of success feasible [e.g., shift from an objective of eradication to only being able to control or contain])? Would adequate financial resources, staff time, equipment, and materials, be allocated to achieve the level of treatment that facilitates maintaining desired conditions?
Restore sustainable communities and develop sustainable program	Restore native plant communities, where appropriate, to reduce the need for ongoing invasive plant treatment, thus, contributing to a sustainable program. An invasive plant management program should be economically and ecologically sustainable. Restoration of landscape leads to natural processes taking over to maintain desired conditions with subsequent reduction in the need for management actions. There may be a need to restore plant communities through revegetating treated areas, to restore local hydrology, or to improve soil conditions.

The analysis will evaluate:

- Would landscape achieve a level of restoration that allows natural processes to establish and to reduce the need for continued intensive management?
- Would strategies and fiscal resources be adequate to achieve objectives in a reasonable timeframe (quickly enough to avoid further threat to resources or increased cost of actions)?

Prevent unacceptable threat

Prevent unacceptable levels of invasive plant cover and threat, using environmentally sound, cost-effective management strategies that pose the least possible risk to people, park resources, and the environment, and support early detection and treatment.

The invasive plant management plan was established to address prevention of unacceptable levels of invasive plant cover and threat. The methods must be grounded in the best available science and expert judgment. There should be an established process for deciding the course of action appropriate to manage threats and resources. The plan must support a strategy of early detection and treatment within the parks, in accordance with the external scoping recommendation. Early detection can reduce the level of action required to reduce invasive plant intrusions, or can prevent the plants from ever reaching levels that would result in damage to resources or a high degree of difficulty in eradicating, controlling, or containing the plants.

The analysis will evaluate:

- Does the alternative promote continued monitoring, early detection, and suitable treatment?
- Does the alternative result in the selection of the best management actions or Optimum Tool for individual situations, based on good science and adaptive management principles?

Ensure planning and compliance

Develop an invasive plant management plan and compliance documentation that provides the necessary environmental assessment for invasive plant management strategies at the parks.

An invasive plant management program should ensure that a strategic plan is in place that will allow the NPS to attain each park's short-term objectives and long-term goals (desired conditions), while fully considering the environmental costs and benefits of the proposed actions before making any decision to undertake actions. This is a dynamic activity, requiring adaptive management. It also should analyze environmental impacts of potential treatments, to broaden the scope of acceptable actions available to parks and the EPMT. It must also have clear pathways for selecting the best management actions for the invasive plant problem.

The analysis will evaluate:

- Does the alternative provide a comprehensive and strategic approach to invasive plant management that can attain desired conditions in each park and minimize adverse impacts?
- Does it consider if the strategy oversees collection of information needed to evaluate program effectiveness and guide the necessary improvements to the program?
- Does the strategic planning support tactical planning with little additional compliance?
- Does the plan have a pathway for decision-making and completing compliance documentation?

Use best management practices

Keep resource managers up-to-date with state-of-the-art treatment options and procedures (best practices or BPs) and mitigation measures, so that parks can select options that represent best management practices for their needs.

The NPS seeks to apply the most current means and technologies available to comply with mandatory environmental regulations, but the NPS also seeks to maintain a superior level of environmental performance, consistent with its conservation ethics. Those choices, decisions, actions, and ethics must achieve desired conditions, protect qualities and functions of air, water, soil, and other aspects of the natural environment, and preserve the human environment. These management practices allow use and enjoyment of park resources by the current generation, while ensuring that future generations will have the same opportunities.

The analysis will evaluate:

- Would the alternative keep invasive plant managers up-to-date with BPs and mitigation measures so that best management practices are implemented?
- Would the invasive plant managers recognize and focus efforts on the most critical resource threats and on invasions that can be realistically addressed?
- Would the alternative promote the integration of the park managers' understanding of the resources and the EPMT coordinator's expertise in invasive plant management to ensure the implementation of best management practices?
- Would the alternative implement a procedure that applies BPs and mitigations?

4.0.2 Topics for Analysis

This section lists topics identified in Chapter 1 to be analyzed in detail in this Chapter 4.

- Water Resources (water quality, wetland, karst hydrology)
- Geology and Soils
- Vegetation
- Wildlife and Fish
- Threatened / Endangered Species
- Archeology
- Cultural Landscapes
- Ethnographic Resources
- Visitor Use and Experience

4.0.3 Categories of Impact

Thresholds were established for each impact topic to help understand the severity and magnitude of changes in resource conditions, both adverse and beneficial, of the various management alternatives (NPS 2006). Whereas issues describe the impact relationship between actions and resources, impact analysis predicts the magnitude of that relationship.

An environmental impact, relating to a topic, is expressed as the change in condition of the resources or environment under examination that can be attributed to the proposed action. Impacts are analyzed by considering the action relative to the resource baseline condition and the resulting effect. Impacts must be quantified as much as possible and interpreted in terms of their type, extent, duration, and intensity. For the purpose of this analysis, we will use the following terminology:

Type

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

And

- Direct impacts - impacts occurring from the direct use by or influence of invasive plant management; or
- Indirect impacts - impacts occurring from invasive plant management that indirectly alter a resource or condition; it may also be a secondary effect of the initial action.

Extent

- Site specific – impacts apply to the immediate site of direct treatment and would not include surrounding landscape; or

- Local – impacts apply to the immediate site, but also extend to areas where the action was not directly applied. For the purposes of this document, localized effects would be measured in acres or linear feet and would be contained within the park boundary; or
- Regional – impacts would affect the park and extend to adjacent land and communities.

Duration

- Short-term impacts – Those impacts occurring from invasive plant management in the immediate future usually 1 to 6 months, or one growing season); or
- Long-term impacts – Those impacts occurring from invasive plant management and lasting for the next 10 years.

Intensity

- Negligible
- Minor
- Moderate
- Major

Because definitions of intensity (negligible, minor, moderate, or major) vary by impact topic, intensity definitions are provided separately for each topic analyzed in this document (Table 4.0.3.).

For purposes of impact analysis, the baseline is the continuation of management prior to the EPMT funding as projected over the next 10 years (the No Action Alternative). In the absence of quantitative data, best professional judgment was used to determine impacts. In general, the thresholds for impacts used come from existing literature, policies and mandates, federal and state standards, and consultation with subject matter experts and appropriate agencies.

Table 4.0.3. Impact intensity definitions for resources under consideration in environmental assessment.

Resources	Negligible	Minor	Moderate	Major	Impairment	Standard
Water, wetlands, and karst hydrology	Changes to water quality and processes of wetlands, streams, or karst would be minimally affected, or changes would not be detectable using standard testing procedures for the target constituent.	Adverse: changes to water quality and processes of wetlands, streams, or karst would be measurable, although the changes would not bring levels above water quality standards. No water quality or hydrology mitigation measures would be necessary. Beneficial: results maintain or improve overall resource conditions and natural processes.	Adverse: changes to water quality and processes of wetlands, streams, or karst would be measurable and may exceed water quality standards, but would not result in significant alteration in biota present. Necessary water quality or hydrology mitigation measures would likely succeed. Beneficial: results improve resource conditions and natural processes.	Adverse: changes to water quality and processes of wetlands, streams, or karst would be readily measurable and would have substantial consequences, and would be noticed outside of the park. Mitigation measures would be necessary and their success would not be guaranteed. Beneficial: results move towards attainment of desired conditions for resources and natural processes.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	State and federal water quality standards. Changes in fish and invertebrate community as determined by the Vital Signs program. Conditions in caves can be monitored by water and air quality and through changes in biota.
Geological resources and soils	An action that could result in a change to a natural physical resource, but change could be so small that it would not cause any measurable or perceptible consequence. Cave air quality changes would not be detectable using standard testing procedures for the target constituent. Any effects to soil processes would self-rectify in a short period. No mitigation measures would be necessary.	Adverse: Changes could result in a change to a natural physical resource, but change would be small, site-specific, and of little consequence. Cave air quality changes would be measurable, although they would not bring levels above standards or degrade cave habitat. No water quality or hydrology mitigation measures would be necessary. Effects to soil processes would self-rectify in a year. If mitigation were needed to offset adverse impacts, it would be simple to implement and likely successful. Beneficial: resulting overall resource conditions retain or improve natural processes.	Adverse: Changes would result in change to a natural physical resource, and change would be measurable and of consequence. Cave air quality changes would be measurable and may exceed standards, but would not result in significant alterations in biota present. Necessary mitigation measures would likely succeed. Effect to soil processes and character would be apparent. Mitigation measures would probably be necessary to offset adverse impacts and would likely succeed. Beneficial: resulting overall resource conditions improve natural processes.	Adverse: Changes would result in a noticeable change to a natural physical resource would be measurable with severe repercussions for resources in the system. Cave air quality changes would be readily measurable and would have substantial consequences, and would be noticed outside of the park. Mitigation measures would be necessary and their success would not be guaranteed. The effect on soil processes would be readily apparent. Mitigation measures would be needed, extensive, but their success could not be guaranteed. Beneficial: resulting overall resource conditions restore natural processes.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	NPS Management Policies 2006; no numeric values are set for constituents. Health of soil processes may be determined through the quality of vegetation community composition at the site.
Vegetation	No native vegetation populations would be affected, but some individual native plants could be affected because of the action. No mitigation measures would be necessary.	Adverse: Changes could affect some individual native plants and a relatively minor portion of that species' population within the park. Mitigation to offset adverse impacts could be required and would be effective. Beneficial: results maintain or improve overall vegetation community conditions and natural processes.	Adverse: Changes would affect individual native plants and a sizeable proportion of a local population would be suppressed or killed. Mitigation to offset adverse impacts could be extensive, but would likely be successful. Beneficial: results improve vegetation community conditions and natural processes.	Adverse: Changes would have a considerable effect on native plant populations, threatening the persistence of a local population of the species. Mitigation measures to offset the adverse impacts would be required, extensive, and success would not be guaranteed. Beneficial: results move towards attainment of desired conditions for vegetation community and natural processes.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	Desired conditions and/or thresholds for management action are identified for plant communities, using measures such as plant diversity.
Wildlife and fish	Any effects to wildlife would be at or below the level of detection with consequences being on the individual level. No mitigation measures would be necessary.	Adverse: Changes would be detectable on the individual level, but of little consequence to the species' population. Mitigation measures, if needed to offset adverse impacts, would be simple and successful. Beneficial: results maintain or improve overall habitat conditions and population structure.	Adverse: Changes would be readily detectable with consequences at the population level, but within the parks populations only. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful. Beneficial: results improve habitat conditions and population structure.	Adverse: Changes would be obvious and would have substantial consequences to wildlife populations in the region. Extensive mitigation measures would be needed to offset any adverse impacts and their success would not be guaranteed. Beneficial: results move towards attainment of desired conditions for habitat and population structure.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	Observed impacts to individual animals. Changes in population size, fecundity, and recruitment as determined by the Vital Signs program and park monitoring.

Threatened and Endangered species	No federally or state-listed species would be affected in a way considered a taking, or effect would be limited to an individual of a listed species or a small proportion of critical habitat, but the change would be so small that it would not be measurable or perceptible consequence. Negligible effect would equate with a "no effect" determination by USFWS.	Adverse: Changes could affect an individual(s) of a listed species or its critical habitat, but the change would be small and would not constitute a taking. Minor effect would equate with a "may affect" determination by USFWS and would be accompanied by a statement of "likely…" or "not likely to adversely affect" species. Beneficial: results maintain or improve overall habitat conditions and population.	Adverse: An individual or population of a listed species or its critical habitat would be noticeably affected. The consequence would be to the individual, population, or habitat. Moderate effect equates with "may affect" determination by USFWS and would be accompanied by a statement of "likely…" or "not likely to adversely affect" species. State species of concern could also be affected. Beneficial: results improve habitat conditions and population.	Adverse: An individual or population of a listed species or its critical habitat would be noticeably affected with a vital consequence to the individual, population, or habitat that would be a taking. Major effect would equate with a "may effect" determination by USFWS and would be accompanied by a statement of "likely to adversely affect" species or critical habitat. State species of concern could also be affected. Beneficial: results move towards attainment of desired conditions for habitat and population.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents. The extirpation of the species from the park would constitute impairment.	USFWS determination of effect.

Impact Topic	Negligible	Minor	Moderate	Major	Impairment	Standard
Archeology and historic resources	Impact is at the lowest levels of detection – detectable, with no perceptible consequences, and neither adverse nor beneficial consequences. The determination of effect for NHPA §106 would be no adverse effect. No mitigation measures would be necessary.	Adverse: disturbance of a site results in little, if any, loss of integrity. The determination of effect for NHPA §106 would be no adverse effect. Beneficial: maintenance and preservation of a site. For purposes of NHPA §106, the determination would be no adverse effect.	Adverse: disturbance of a site would diminish the significance or integrity of the site. The determination of effect for NHPA §106 would be adverse effect. Beneficial: stabilization of a site. For the purposes of NHPA §106, the determination of effect would be no adverse effect.	Adverse: disturbance of a site results in loss of significance and integrity of the site. The determination of effect for NHPA §106 would be adverse effect. Beneficial: active intervention to preserve the site. For purposes of NHPA §106, the determination of effect would be no adverse effect.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	Secretary of the Interior's Standards for Treatment of Historic Properties / Guidelines for the Treatment of Cultural Landscapes (36 CFR Part 68, 12 July 1995 Federal Register [Vol. 60, No. 133]); National Historic Preservation Act of 1966, sections 101(f) (g), and (h), and section 110; DO – 28; DO – 28A in development
Cultural landscapes	Impact is at the lowest levels of detection – barely measurable, with no perceptible consequences, and neither adverse nor beneficial consequences. The determination of effect for NHPA §106 would be no adverse effect.	Adverse: disturbance of a site results in little, if any, loss of integrity. The determination of effect for NHPA §106 would be no adverse effect. Beneficial: maintenance and preservation of a site(s). The NHPA §106, determination would be no adverse effect.	Adverse: disturbance of a site would diminish the significance or integrity of the site. The determination of effect for NHPA §106 would be adverse effect. Beneficial: stabilization of a site(s). The NHPA §106, the determination of effect would be no adverse effect.	Adverse: disturbance of a site results in loss of significance and integrity of the site. The determination of effect for NHPA §106 would be adverse effect. Beneficial: active intervention to preserve the site. For purposes of NHPA §106, the determination of effect would be no adverse effect.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	Secretary of the Interior's Standards for Treatment of Historic Properties / Guidelines for the Treatment of Cultural Landscapes (36 CFR Part 68, 12 July 1995 Federal Register [Vol. 60, No. 133]); DO – 28; Completed CLI, condition assessment may be used
Ethnographic resources	Any changes in use or experience would be below or at the level of detection. Traditional peoples would not likely be aware of the effects associated with the alternative. There would be no effect to individual plants or populations of plants.	Adverse: changes in use or experience would be detectable, although the changes would be slight and likely short-term. Traditional peoples would be aware of the effects associated with the alternative, but the effects would be slight. Disturbance could cause small impacts to individual plants. Populations of plants would not be effected. Impacts would be site specific and short-term.	Adverse: changes in use or experience would be apparent and likely short-term. Traditional peoples would be aware of the effects associated with the alternative and would likely be able to express an opinion about the changes. Disturbance could cause large impacts to individual plants and small impacts to populations of plants. Impacts would be site specific and short-term.	Adverse: changes in use or experience would be readily apparent and would have important long-term consequences. Traditional peoples would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes. Disturbance could result in large impacts to individual plants and to populations of plants. Impacts would be site-specific and long-term.	A major, adverse impact to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	DO – 28; DO – 28A – in development

Impact Topic	Negligible	Minor	Moderate	Major	Impairment	Standard
Visitor use and experience	Any changes in visitor use or experience would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative. Impacts are neither adverse nor beneficial.	Changes in visitor use or experience would be detectable, although the changes would be slight. The visitor would be aware of effects associated with the alternative. Adverse: Noise generated by management activities may predominate during daylight hours, but noise is at low levels and rarely exceeds ambient sound beyond 500 feet. Visual intrusion maybe detected, slightly exceeding the intrusion caused by routine maintenance. Temporary aesthetic changes, such as dead vegetation, are noticeable, but not predominant and disappear with recovery. Beneficial: Aesthetics are improved and landscape integrity is improved for interpretive purposes. Landscape sustainability results in future reduction in management actions.	Changes in visitor use or experience would be apparent. The visitor would be aware of the effects and would likely express an opinion about the changes. Adverse: Noise generated by management activities predominates during daylight hours, but is at medium or low levels beyond 500 feet during half of the daylight hours. Visual intrusion exceeds that of routine maintenance and makes an impression on visitors. Temporary aesthetic changes require a growing season to recover and may require restoration measures. Beneficial: Aesthetics are improved and landscape integrity is significantly improved for interpretive purposes, once area is restored. Landscape sustainability results in reduction in intensity of future management actions.	Changes in visitor use or experience would be readily apparent and would have important consequences. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes. Adverse: Noise generated by management activities predominates during daylight hours, and is at greater than medium levels beyond 500 feet during a majority of the daylight hours. Rectifying aesthetic changes requires active and relatively intensive measures. Beneficial: Aesthetics are improved and landscape integrity is reestablished for interpretive purposes, once area is restored. Landscape sustainability results in only routine management actions.	A major, adverse impact to a value that is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of park; (2) key to interpretation of the natural or cultural purpose of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	Park goals as expressed in GMP and Long-range Interpretive Plan, and other authorities setting standards.
Cumulative impacts	Combined impact is at the lowest levels of detection – barely measurable, with no perceptible consequences, and neither adverse nor beneficial consequences. Impacts are neither synergistic nor cumulative with fire treatment.	Combined impacts have detectable results in monitoring targeted at detecting impacts. Adverse: Impacts detract from attainment of desired condition. Beneficial: Impacts contribute to maintenance of desired conditions. Impacts may work synergistically with prescribed fire.	Combined impacts have measurable results in monitoring Vital Signs or other routine indicators during same growing season, indicating a potential change in resource conditions. Adverse: Impacts detract from maintenance or attainment of desired condition. Beneficial: Impacts contribute to maintenance or attainment of desired conditions, and may work synergistically together.	Expert observer would recognize apparent signs of combined impacts and Vital Signs or other routine indicator monitoring results would show a change in status and trends in resource conditions. Adverse: Impacts detract from maintenance or attainment of desired condition. Beneficial: Impacts contribute to maintenance or attainment of desired conditions, and may work synergistically together.	Combined impacts cause major or irreparable harm to a resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation or proclamation of park; (2) key to the natural or cultural integrity or interpretation of the park; or (3) identified as a goal in the park's general management plan or other relevant NPS planning documents.	Secretary of the Interior's Standards for Treatment of Historic Properties / Guidelines for the Treatment of Cultural Landscapes (36 CFR Part 68, 12 July 1995 Federal Register [Vol. 60, No. 133]); National Historic Preservation Act of 1966, sections 101(f) (g), and (h), and section 110; DO – 28; DO – 28A in development; Park goals as expressed in GMP and Long-range Interpretive Plan, and other authorities setting standards.

4.1 Impact Analysis

Environmental consequences are explained in full within the following text. Summaries of those consequences are presented in tables towards the end of the chapter. Each resource and topic is addressed relative to effects of invasive plant management on the park resources and human environment. The achievement of program objectives is considered first in the analysis and treated as a topic of in its own right. Attainment of desired conditions for each resource or value affected under an impact topic is also covered within that respective topic.

Because pesticide use is often controversial and the impacts of pesticides are varied, Table 4.1.1 provides basic information on the pesticides likely to be used in Alternative 2. Characteristics of the pesticides in the soil, air, and water, as well as toxicity to living organisms, are summarized and should be referenced by the reader as the analysis progresses through topics. A similar list does not exist for the No Action Alternative pesticides, because there are many pesticides that have been used over the years.

Common to all alternatives, cultural methods (as defined in Chapter 2) would have similar negligible impacts across all alternatives. Those cultural method actions carried out as part of the EPMP are generally not significant physical changes to the environment (e.g., education or increase native plant cover). There are types of equipment (e.g., seed drill to plant a treatment area) that may be used within cultural method that may impact resources, but the effects would be from the selection of equipment and not the decision to use a cultural method (e.g., increase native plant cover). Therefore, discussion of cultural methods will not be specific in the analysis, but rather cultural methods under each alternative will be guided by the limitations of that alternative (e.g. no use of heavy equipment) and the use of that equipment will be analyzed.

4.1.1 Program Goals and Objectives

All alternatives are evaluated, as described in Table 4.0.1, to determine their effectiveness and feasibility in attaining the goals of the EPMT program.

Alternative 1 – No Action Alternative

Attain/maintain desired conditions.

Funding for invasive plant management projects has been sporadic for parks, relying on competitive sources or park base funding. The probability of attaining or maintaining desired conditions varies with each park and is dependent on funding availability, as well as obtaining technical expertise, developing strategies, and completing compliance. The likelihood of all 15 parks achieving the necessary levels of funding, expertise, strategic development, and compliance completion to execute activities and projects needed to attain desired conditions in a reasonable period is very low.

Therefore, the No Action Alternative does not support across-the-board success in attaining and maintaining desired conditions.

Must be sustainable.

Reliable funding is fundamental to carrying treatment through to the point where restoration efforts result in desired conditions and a biologically sustainable system. Additionally, the

independent approach to invasive plant management results in duplication of activities that collaboration among parks could avoid.

Use of CEs as the compliance instrument somewhat restricts parks to the types of treatment that can be implemented, thus restricting the execution of activities and projects needed to achieve desired conditions. Under DO-12, the only invasive plant management activities that are covered under a CE involve removal of individual members of a non-threatened/endangered species or populations of invasive plants that pose an imminent danger to park visitors or an immediate threat to park resources. Such restrictions do not allow treatment of large infestations. The use of CEs eliminates early detection and treatment, since only invasive plants presenting a current threat to resources may be treated under a CE. Early detection and treatment are critical to sustainability, where the intention is to remedy invasive plant problems before they affect population changes that alter natural processes.

Therefore, the No Action Alternative is not sustainable because of the uncertainty of funds to complete connected actions or sequential actions, and the lack of impact analysis that results in a limited approach to management that may not achieve or maintain sustainability.

Prevent unacceptable levels of invasive plant threat

Current invasive plant management efforts include a few parks with invasive plant strategies and other parks reacting to invasions that pose an immediate threat to park resources or a current danger to park visitors. Park managers must address a wide range of management issues and many lack specialized knowledge in IPM. Great care and expertise must be used to select effective tools that qualify for implementation under existing compliance documents or CEs. Without a thorough impact analysis, the tools selected must remain conservative and may prevent the use of the most cost effective and most environmentally sound tools (Optimum Tool). As mentioned, existing compliance documents do not support early detection and treatment in most parks, limiting options in this alternative.

Therefore, available tools may be inadequate to accomplish this objective in the No Action Alternative.

Ensure planning and compliance.

Many parks do not have a comprehensive and strategic approach to invasive plant management, based on a decision-tree to determine the best approach to attain/maintain desired conditions. This results in reactive management that may be less cost effective and environmentally sound than a proactive strategic approach. A strategic plan provides the basis for adaptive management, where monitoring and feedback can inform tactical planning. Without a strategic plan with a decision structure designed to protect resources and the human environment, tactical planning (work plans) will require greater NEPA compliance for each park, than if a strategic programmatic plan were in place. The NHPA §106 process, offers streamlined avenues for removal of non-historic, exotic species when the species threatens cultural landscapes, archeological sites, or historic or pre-historic structures, but these avenues do not apply to ecological threats that do not impact cultural resources. Therefore, the No Action Alternative does not achieve the objective of ensuring planning and compliance that promote an effective invasive plant management program.

Use best management practices.

Resource managers are asked to accomplish a broad range of management tasks within their parks. Most of the managers are not botanists or invasive plant management experts. This necessitates a particular effort on the managers' part to seek information and techniques to update their science-based practices. Selecting the most critical resource threats that can be improve, based on the judgment of a dedicated specialist. A non-collaborative approach to management does not benefit from expertise available in a programmatic approach. This alternative does not present a standard list of BPs or mitigations that may be applied at the parks, nor is there a standardized decision-tree to select the Optimum Tool.

Therefore, some parks will be unable to implement best management practices, and this Alternative does not recommend specific BPs, making this objective unachievable across all parks.

Alternative 2: IPM, Preferred Alternative

Attain/maintain desired conditions.

Integrated Pest Management is an ecological discipline that considers the use of all methods for immediate and long-term management. The IPM goal is to manage pests and the environment to balance costs, benefits, public health, and environmental quality. It utilizes a high quantity and quality of technical information about the pest and its interaction with the environment or site, and it takes advantage of all appropriate pest management tools, including pesticides (McCrea and DiSalvo 2001). Prioritization in IPM accounts for threat level, or the manner in which the presence of the invasive plant impedes attainment or maintenance of desired conditions. This Alternative provides the broadest suite of tools available from which the Optimum Tool will be selected to attain or maintain desired conditions in a reasonable timeframe.

Additionally, the programmatic organization of this alternative will allow a long-term commitment of funding to an ongoing problem. The funding for tactical planning under the guidance of the EPMT coordinator and park managers and implementation by trained personnel will ensure maximum long-term benefits to resources.

Therefore, this objective is met through the program's ability to provide continuous funding and support for experts to implement the Optimum Tool from a broad suite of available treatments using the IPM decision-making methods that will attain/maintain desired conditions.

Must be sustainable.

Funding availability is a consideration in an effective IPM program that attains and maintains desired conditions, particularly when connected actions are required. Alternative 2 maximizes cooperation between parks, thus reducing costs to each park and achieving economy of scale with secure funding. No action will be undertaken unless a holistic approach and follow-up is assured. Pests usually are understood to be symptoms of underlying problems that need to be solved in the IPM decision process. By correcting the underlying problem, objectives would be reached in a reasonable timeframe and the pest control may be sustained (McCrea and DiSalvo 2001). Continued monitoring, and early detection and treatment are instrumental in this sustainable program.

Therefore, because desired conditions are attainable under this alternative, the sustainability or maintenance of those conditions can be expected as well, given the continuous funding and effective use of funding to sustain a long-term IPM program in Alternative 2.

Prevent unacceptable levels of invasive plant threat.

The IPM program is built around the use of the Optimum Tool, selected through a decision-tree. A logical decision-making process determines an environmentally sound and cost effective management solution for the specific pest situation. Early detection and treatment is part of the strategy in Alternative 2 and may be effective for some invasive species infestations. Early detection allows treatment of a potential threat, as determined by an expert, knowledgeable in the invasive plant's biology, while the populations are small enough to be eradicated. Monitoring is ongoing in this alternative, allowing for evaluation of effectiveness in reaching program goals and in Adaptive Management.

Therefore, early detection and treatment, as well as effective treatment of existing infestations, using a logical decision-making process will result in prevention of unacceptable threats to resources.

Ensure planning and compliance.

The decision-making process detailed in this alternative is strategic, systematic, and comprehensive, providing guidance to tactical planning. It accounts for long-term goals and short-term objectives. It has monitoring and Adaptive Management built into it. The decision-tree utilizes information from monitoring and evaluation to select treatments. The spatial database summarizing current conditions, including sensitive resource areas, and past actions make evaluation easy. The alternative has also set down a practice that ensures the completion of all compliance, both NEPA and pesticide/biocontrol related compliance. Particular care is taken to ensure that work plans written from this alternative receive review for NHPA §106 compliance to ensure the greatest possible protection of cultural resources and values. The NHPA §106 process does offer streamlined avenues for removal of non-historic, exotic species when the species threatens cultural landscapes, archeological sites, or historic or pre-historic structures, and it allows for replacement of invasive infestations with similar non-invasive plants. The work plans provide all necessary information and streamlined compliance under the 2008 programmatic agreement may be possible.

Therefore, Alternative 2 will ensure planning, long-term strategic and short-term tactical, with appropriate compliance documentation for each.

Use best management practices.

Mitigations and BPs have been discussed at length in description of this alternative. Best practices apply appropriate technologies available to not only comply with mandatory environmental regulations, but also maintain a superior level of environmental performance. Alternative 2 provides for education and certification of operators applying treatments and provides for a coordinator to ensure that all BPs are used. In order to use BPs, all technologies and treatment techniques must be available to the manager, so that the Optimum Tool, itself a "best practice," may be applied. The park and EPMT work together to select locations, target species, and Optimum Tools. The decision-tree ensures that the most critical resource threats are addressed and treated, when treatment is feasible.

Therefore, Alternative 2 uses best management practices by using a well-defined set of BPs and mitigations, and by keeping all technologies available to the manager.

Alternative 3: No Chemical, Biological, or Heavy Equipment

Attain/maintain desired conditions.

Eliminating use of chemical, biological, and heavy equipment treatments would reduce the likelihood of attaining desired conditions within a reasonable period, particularly for extreme infestations. Several invasive species are most effectively treated with one of these prohibited tools, particularly the use of chemicals or biological agents. Financial resources would be available to use connected actions to attain desired conditions in time.

Therefore, Alternative 3 differs from Alternative 2 in that restoring plant communities and processes may take longer for Alternative 3 than Alternative 2, but Alternative 3 would likely attain/maintain desired conditions in some situations.

Must be sustainable.

This alternative is similar to Alternative 2 in economic and functional sustainability. Long-term funding is available in both Alternative 2 and 3. Connected actions may be required to attain desired conditions, requiring a longer timeframe before reaching a sustainable level. Early detection and treatment are available in Alternative 3, and this treatment method would be geared towards eradicating small numbers of plants once desired conditions are attained and maintenance of conditions is required.

Therefore, sustainability through funding is similar for Alternative 2 and 3, and Alternative 3 meets the objective of sustainability, but will require more time achieving sustainability than would Alternative 2.

Ensure planning and compliance.

Planning and compliance will be assured in this Alternative 3, as it is in Alternative 2. Lacking the full suite of treatments available in Alternative 2, this alternative requires less annual compliance work, relative to the use of pesticides and biocontrols, but compliance is needed to complete management actions in areas protected under the NHPA and other regulations, as in Alternative 2. The planning and compliance obtained through implementation of Alternative 3 could be superior to that of the No Action Alternative in that the planning process is strategic, the process is well defined, and the information for tactical planning compliance is available in the annual work plan, as in Alternative 2.

Therefore, Alternative 3 achieves the objective of ensuring planning and compliance.

Use best management practices.

Training and available expertise in the implementation of mitigations and BPs in Alternative 3 is similar to that of Alternative 2, and significantly broader-based than that of the No Action Alternative. Best Practices include implementing the Optimum Tool, which may not be available to this alternative. By restricting the techniques available, the optimal tool must come from those available, and the park and EPMT would work together to select this tool with the decision-tree. The most critical resource threats would be addressed, as in Alternative 2.

Therefore, Alternative 3, uses best management practices for the allowed techniques, but does not always employ the Optimum Tool.

Summary

Alternative 2 is the most likely to attain or maintain desired conditions. Alternative 2 would effectively control invasive plants more quickly than would Alternative 3, and thus achieve sustainability. The No Action Alternative does not attain desired conditions across all parks and is not economically or biologically sustainable. Alternative 2 and Alternative 3 prevent unacceptable levels of invasive plant threat, but high threat levels are required for several parks to be allowed to take action under the No Action Alternative. The planning process in Alternative 2 and Alternative 3 is strategic, and ensures compliance and subsequent analysis of work plans. A standard for mitigations and BPs is applied to Alternative 2 and Alternative 3, but no standard list of BPs exists for the No Action Alternative, and mitigations are not allowed under a CE. The Optimum Tool may not be available under Alternative 3.

4.1.2 Water, Wetlands, and Karst Hydrology

In the NPS Management Policies 2006, section 4.6, pages 50 through 52, water resource management, including the protection of surface waters and ground water, water quality, and hydrologic processes is addressed. The policies also provide guidance for protection of floodplains and wetlands. Reference to floodplain protection addresses development not proposed in these alternatives. Reference to wetland protection addresses a "no net loss of wetlands" policy, and to preserving and enhancing the natural and beneficial values of wetlands.

Karst hydrology is addressed in this section because of its relationship to water quality and water movement. Water in shallow karst is considered surficial, because of its close contact with surface water. Karst geology (caves, fractured bedrock) is addressed in the geology section of this analysis. Cave-dwelling animals are discussed in the wildlife and fish section. Similarly, soils are mentioned in this section with respect to their hydrological properties. Impacts to soils are addressed in the geology and soils section.

The issues that are covered in this analysis topic are:

- Various treatments may have direct and indirect effects of water quality; pesticides may affect drinking water quality.
- Pesticides may affect riparian and aquatic systems (surface and ground water).
- Degradation of wetlands (as defined in Clean Water Act).
- Fate of pesticides, especially in areas with ground water near soil surface.
- Degradation of water quality in karst landscapes.
- Movement of pesticides in karst landscapes.

None of the alternatives would lead to development or actions that could adversely affect floodplain resources, wetland or floodplain function, flood risks, or the "no net loss" policy. Generally, improvements to native vegetation communities on native soils, including hydric soils, would improve floodplain and wetland functions and values. Those alternatives that allow the use of pesticides would follow label mitigations and would consider the potential for impacts to water resources and karst systems, such as those shown in Table 4.1.1.

Table 4.1.1. Environmental fate and effects of pesticides

Sources: Forest Service 2006; Weed Science Society of America 2002, http://wssa.net/, accessed October 27, 2010.; Weed Control Methods Handbook (Tu, et al. 2001); Washington State Department of Transportation 2005); U.S. E.P.A. approved Specimen Labels; Cornell University Cooperative Extension, http://ipmguidelines.org/Turfgrass/content/CH01/default.asp, accessed October 27, 2010; Hartzler, Bob. Department of Agronomy, Iowa State University, http://www.weeds.iastate.edu/mgmt/, accessed October 27, 2010 unless otherwise indicated.

Active Ingredient	Persistence in Soil	Residual Soil Activity	Volatilization and Potential By-products from Burning	Solubility	Potential for Leaching	Surface Waters	Toxicity
2,4-d (Aqua-Kleen, Barrage, Weedone, Esteron brand 99)	At its highest application rate, 2,4-D persists for 30 days.	May remain active for one to six weeks in soil.	Oil-soluble amine forms are least volatile. The burning of vegetation treated with 2,4-D has not generated detectable amounts of 2,4-D by products in the field.	Low solubility in water.	Over time, will bind to organic matter in soil. 2,4-D ranges from mobile to highly mobile in sand, silt, clay loam, and sandy loam. However, potential for ground water contamination is low due to rapid degradation in soils and rapid uptake by plants.	2,4-D residues dissipate rapidly, especially in moving water. Do not apply directly to water or wetlands, except as specified for certain uses.	**Soil microorganisms** - no effect at recommended field application rates. At higher levels, can suppress soil fungi and nitrogen-fixing algae. **Plants** - highly toxic to many non-target plants. **Aquatic animals** - 2,4-D ranges from practically nontoxic to highly toxic to fish and aquatic invertebrates. 2,4-D ester formulations are most toxic. 2,4-D amine salts are generally non-toxic to fish. **Terrestrial animals** - 2,4-D butyl ester is practically non-toxic to birds. Ester formulations are least toxic to insects. Mammals have moderate sensitivity to 2,4-D exposure.
Aminopyralid (Milestone)	Likely to be non-persistent and relatively immobile in the field. Half-lives of 32 and 20 days were determined. Photolyzed moderately slowly on a soil surface. The half-life was 72 days.	Under aerobic conditions, degradation in five different soils resulted in the production of CO2 and non-extractable residues. Aminopyralid is weakly sorbed to soil.	Non-volatile; vapor exposure is very low[31]	Water soluble	Is relatively immobile in soil, with most of the chemical remaining within the upper 12" of the soil profile.	In aquatic systems, the primary route of degradation is photolysis with a laboratory half-life of 0.6 days.	**Soil organisms** –practically non-toxic to earthworms. **Plants** – moderate spectrum broad leaf herbicide toxic to some non-target plants. **Aquatic animals** - practically non-toxic to fish and aquatic invertebrates; slightly toxic to eastern oyster, algae, and aquatic vascular plants. Not expected to bioaccumulate in fish tissue. **Terrestrial animals** - formulated product (Milestone) exhibits low toxicity, giving it toxicity category IV [Caution]. Use on campgrounds and recreation areas has potential short-term post-application incidental oral exposures for infants and children via hand-to-mouth transfer. Practically non-toxic to birds and rats. There are no acute or chronic risks to non-target endangered or non-endangered fish, birds, wild mammals, terrestrial and aquatic invertebrates, algae or aquatic plants.
Fluroxpyr (Vista)	Typical half-life in soil is 36 days.[32]	Dissipation by hydrolysis and microbial degradation reduced persistence and limited downward transport (i.e., leaching) in the submitted field studies.	Moderate volatility and potential for loss to the atmosphere.	Highly soluble	High mobility is countered by the rapid microbial degradation, and tendency to be only in upper 6 inches of soil.	Hydrolysis at pH 9 is 3.2 days, but stable at and below pH 7. Aerobic aquatic metabolism in 14 day. Do not apply directly to water, or to areas where surface water is present	**Soil microorganisms** - slightly to practically non-toxic to soil microorganisms and degraded by microorganisms **Plants** - toxic to many plants and injurious in very small amounts. **Aquatic animals** – practically non-toxic to aquatic invertebrates and slightly toxic to fish. **Terrestrial animals** – practically non-toxic to mallard duck and northern bobwhite; slightly toxic to small mammals; practically non-toxic to honey bees.

[31] Strachan et al. 2010.
[32] Washington State Department of Transportation 2006.

Active Ingredient	Persistence in Soil	Residual Soil Activity	Volatilization and Potential By-products from Burning	Solubility	Potential for Leaching	Surface Waters	Toxicity
Glyphosate Products (Roundup Pro, Roundup Ultra, Rodeo, GlyPro, Accord, Glyphomax, Touchdown)	Half-life can range from 3 to 130 days. Microbial degradation breaks down glyphosate. Surfactant in Roundup has a half-life of less than 1 week.	High adsorption on most soils, particularly with high organic content. Generally not active in soil. Not usually absorbed from soil by plants. Susceptible to microbial degradation and potentially photodegredation.	Does not volatilize in the field Major products from burning treated vegetation are not known to be a health threat at levels found in a vegetation fire.[33]	Dissolves in water easily	Potential for leaching is low Roundup formulation is adsorbed by soil particles Half-life for glyphosate in water ranges from 35 to 65 days. The surfactant half-life ranges from 3 to 4 weeks	Very low concentrations have been observed in surface water following heavy rains up to 3 weeks after application, presumably attached to soil particles in erosion run-off.[34]; adsorption to suspended and bottom sediments with half-life of 12 days to 10 weeks	**Soil microorganisms** - has stimulatory effect on some organisms **Plants** – non-selective; contact can injure or kill non-target plants **Aquatic animals** – glyphosate may be slightly toxic to fish, and practically non-toxic to aquatic invertebrates. It does not bioaccumulate in fish. Accord and Rodeo formulations (without X-77 Spreader®) are nearly nontoxic to freshwater fish and aquatic invertebrates. Roundup is moderately to slightly toxic to freshwater fish, amphibians, and aquatic invertebrate, because the surfactant (modified tallow amine) interferes with cutaneous respiration. **Terrestrial animals** - Glyphosate is nearly nontoxic to birds and mammals with low bioaccumulation. It is nearly non-toxic to bees.
Imazapic (Plateau, Cadre, Plateau Eco-Paks)	Half-life ranges from 120-140 days. Binds weakly to moderately with most soil types. Adsorption increases with decreased soil pH and increased clay and organic content.	Moderately persistent	Does not volatilize from the soil surface and photolytic breakdown on soils is negligible.	Soluble, but Not degraded in water	Not found to move laterally in surface water. Breaks down rapidly in aqueous solution (half-life:1-2 days). Limited horizontal mobility (6 to 12" in loam; up to 18" sandy soils)	Rapidly degraded by sunlight in aqueous solution, but not registered for use in aquatic systems	**Soil microorganisms** - no information is available. **Plants** – non-selective; contact can injure or kill non-target plants. **Aquatic animals** – moderately toxic to fish. **Terrestrial animals** – low toxicity to birds and mammals. Does not bioaccumulate in animals. Is rapidly excreted in urine and feces.
Imazapyr (Arsenal, Habitat)	Can be broken down by exposure to sunlight. Microbial degradation contributes to breakdown.	Can remain active in soil for 6 months to 2 years	Does not evaporate easily	Soluble in water	Low potential for leaching to ground water Breaks down rapidly in water	Can move to streams; most movement was found in runoff from storms. Streamside buffer zone can significantly reduce movement into stream. Half-life in water of about 4 days.	**Soil microorganisms** - has very little effect on soil microorganisms. **Plants** - non-toxic to conifers, but is toxic to many other non-target plants. **Aquatic animals** - formulations are low in toxicity to invertebrates and practically non-toxic to fish. Is not expected to build up in aquatic animals. **Terrestrial animals** - practically non-toxic to mammals and birds; low toxicity to bees. Imazapyr is rapidly excreted by animals.
Sethoxydin	Readily degraded through microbial metabolism and photolysis, and possibly by hydrolysis	Some degradation products are toxic to plants. Average half-life in soils is four to five days, but half-lives can range from hours to 25 days	Does not readily volatilize when applied in the field.	Water-soluble and does not bind strongly with soils.	Can be highly mobile.	No reports refer to water contamination or off-site movement.	**Soil microorganisms** – little noticeable effect on populations **Plants** – kills grasses, but little or no impact on broadleaf herbs or woody plants **Aquatic animals** – low toxicity **Terrestrial animals** – low toxicity to birds and mammals.
Triclopyr (Garlon products)	Microorganisms degrade triclopyr rapidly; average half-life in soil is 46 days.	Active in soil and absorbed by plant roots. Traces have been found at soil depths of 45 cm 477 days after application Binds to clay and organic matter in soil	Volatilization of ester formulations can be high; low volatilization in salt formulation. No information available on byproducts from burning treated vegetation.	Moderate to low; formulations behave very differently	Depends on soil type, acidity, and rainfall conditions. Should not be a problem under normal conditions. May leach from light soils if rainfall is very heavy	Sunlight rapidly breaks it down in water. Half-life in water is less than 24 hours. Do not apply on or immediately next to waters used for domestic purposes.	**Soil microorganisms** - slightly to practically non-toxic to soil microorganisms. **Plants** - toxic to many plants and injurious in small amounts. **Aquatic animals** - low in toxicity to fish; slightly toxic to practically non-toxic to aquatic invertebrates. Ester form (Garlon 4) is more toxic than non-ester forms, but normally breaks down rapidly to a less toxic form. Triclopyr does not bioaccumulate in fish. **Terrestrial animals** - slightly toxic to mammals. In mammals, most triclopyr is excreted, chemically unchanged. Triclopyr formulations have very low toxicity to birds; non-toxic to bees.

[33] Northern Great Plains Invasive plant Management Plan and Environmental Assessment (NPS 2005e).
[34] Additional information from Cornell University Cooperative Extension, Pesticide Information Profile. 1994. http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html Accessed October 27, 2010.

Restoration of native vegetation associated with invasive plant management would have a beneficial effect of promoting the reestablishment of native vegetation, which could help reduce erosion and sedimentation in surface waters at those parks employing invasive plant management. Changes in water quality, such as reduction of total suspended solids [TSS] in surface waters, may be measurable and long-term, but would be relatively local. **The impacts of cultural methods, such as prevention and reseeding, on water resources would be directly beneficial, site-specific or local, long-term, and moderate.**

Alternative 1: No Action

Management practices to protect surface water and ground water resources vary from park to park. Currently, parks must obtain approval from the Regional or National IPM Coordinator before using pesticides. This process helps ensure that appropriate pesticides are used in the appropriate areas, such that they will not enter surface or ground water. For example, a Regional IPM Coordinator will not approve the use of pesticides that does not have an aquatic label in areas located in or adjacent to water. Parks are also required to use pesticides in accordance with labels. Parks with approved fire management plans continue to use prescribed fire as a management tool in accordance with existing prescribed fire management plans and project-specific prescribed fire plans.

The overall success of invasive plant management programs varies from park to park. Therefore, beneficial effects to aquatic resources, including wetlands and floodplains also vary among parks. Invasive plant management may help some parks achieve the desired conditions for surface waters by improving vegetation communities that in turn restore natural floodplain, riparian, and wetland values. Parks that currently have invasive plant management plans are more likely to attain goals because they have access to a variety of management tools. Parks that do not have invasive plant management plans are limited in the actions that they may take, resulting in negligible to minor beneficial effects. Therefore, **beneficial impacts are direct, negligible to minor, short- to long-term, and site-specific to local.**

Potential adverse environmental impacts from each treatment are described below:

- Physical disturbance to some areas can lead to minor erosion and sedimentation unless mitigated. Ground disturbing activities may cause direct impacts to wetland plant communities that contribute to wetland values unless explicitly defined mitigations are applied. Impacts would be adverse, short-term and site-specific. A USACE 404 permit would not be required since no activities that involve dredging or filling of waters of the U.S. are proposed. The impacts of manual and mechanical disturbance on water resources are **directly and indirectly adverse, minor, short-term, and site-specific or local.**
- Occasionally, UTVs or heavy equipment may cross intermittent drainages to access invasive plant populations. Stream crossings can increase localized sedimentation in standing or shallow flowing water at the crossings. Physical changes to water quality resulting from stream crossings are below water quality criteria, and would be within the range of natural variability. Physical disturbance to water resources may be relatively higher under this alternative than the other alternatives, because mitigations for stream crossings are not defined in the No Action Alternative. The impacts of UTVs and equipment on water resources are **directly adverse, negligible to minor, short-term, and local.**

- Although the intention is to apply treatments in accordance with all regulations and policies, it requires trained personnel to recognize situations that fall outside of the limitations of regulation and policy. Pesticides available for use in the vicinity of surface waters have a low toxicity and persistence. The potential for pesticides to impact ground water varies from park to park based on soil types, depth to ground water, and access to karst hydrology. Substitute treatment types or pesticide selections and application rates are considered for areas with high leaching potential or proximity to karst, surface water, or ground water. Pesticide application is not likely to result in detectable changes in chemical water quality that exceeds desired water quality criteria. Pesticide treatments are used on wetlands and floodplains only at those parks that currently have the necessary clearances to use them. At those parks that use pesticides, non-target wetland plants subjected to pesticide drift can experience no effect, reduced vigor, or death depending on the sensitivity of the plant species to the specific pesticide and the dose the plant received. Infrequent impacts to individual plants generally have negligible to minor effects on plant populations or wetland, floodplain, or riparian values. The impacts of pesticide use on water resources are **indirectly and directly adverse, negligible to minor, short-term, and local.**

A karst environment increases the potential for impacts to water resources and values. The impacts of invasive plant management on water resources, wetlands, and karst hydrology are **directly and indirectly adverse, site-specific to local, short-term, and negligible to minor.** This alternative does not result in impairment to water resources.

Alternative 2: IPM

Removal of invasive plants that affect wetlands, floodplains, and riparian areas would help return some surface waters to natural conditions, improve vegetation along riverbanks, and improve natural processes affected by native vegetation in wetlands, floodplains, and riparian areas. Integrated Pest Management would help parks achieve the desired condition of perpetuating surface water and karst ground water quality, restoring natural floodplain, wetland, and riparian values. Restoration activities, such as reseeding with slip-seeders or drills, would have a beneficial effect of promoting the reestablishment of native vegetation, which would help reduce erosion and sedimentation in surface. Changes in water quality, such as reduction of TSS in surface waters, may be measurable and long-term, and could be detected downstream. The impacts of invasive plant management on hydrology and water resources, including those in a karst system, would be **indirectly beneficial, moderate, short- and long-term, and site-specific and local.**

A number of BPs would be implemented to minimize potential impacts to water resources and karst under this alternative. There may be some temporary increase in suspended solids from surface disturbing activities. There may also be changes in water quality from the application of pesticides. In general, potential impacts to water resources and karst systems would be negligible because of the mitigations and BPs. Potential impacts from using the Optimum Tool are described below:

- Minor physical disturbance from defoliation or ground disturbing activities may result in indirect effects, such as increased sedimentation to surface waters, or temporary disturbance to wetland and floodplain vegetation. Change in sedimentation would likely be non-detectable, or if detected, would be slight, site-specific, and short-term. A USACE

404 permit would not be required for mechanical treatment because these activities would not involve dredging or filling waters of the U.S. The impacts of manual and mechanical treatments on Aquatic resources, including wetlands and floodplains, in a karst environment would be **directly and indirectly adverse, negligible, short-term, and site-specific.**

- Equipment may cross intermittent drainages to access invasive plant populations. This disturbance may be greater in Alternative 2 than in Alternative 3, but may be less than for the No Action Alternative because of mitigations and BPs. Stream crossings could potentially increase localized sedimentation in standing or shallow flowing water at the crossing. Mitigations place limitations on conditions where equipment would be permitted to travel or work. Physical changes to water quality resulting from stream crossings or proximity to water would likely be below water quality standards and criteria, and would be within the range of natural variability. The impacts of equipment on hydrology and water resources, including wetlands and floodplains, and in karst systems would be **directly and indirectly adverse, negligible, short-term, and site-specific.**
- A number of BPs are designed to consider other alternatives to pesticide use, and then only use pesticides where prudent and feasible. Changes in surface water quality from the use of pesticides are not expected to be detectable. Pesticides may pose a negligible risk to ground water from leaching. Coarse to medium-textured soils are less likely to retain pesticides, but can permit pesticides to enter ground water. Medium and fine-textured soils with high organic matter content have a potential to retain pesticides, and in doing so can compromise soil health, while protecting ground water. Soils will be taken into account when determining the Optimum Tool and, when selected, pesticide type. When water resources are present near the surface, or soils are shallow over permeable substrate, BPs make ground water contamination unlikely. The BPs state that weather conditions will be monitored on the day of application and chemical application will not be done when storms may transport of pesticides to surface or ground water. The potential for directly spilling pesticides into surface waters is unlikely. Pesticides are transferred in controlled settings away from surface water resources, as stated in the BPs. All pesticides are contained in spill-proof containers and are handled in accordance with label specifications. The impacts of pesticide use on hydrology and water resources, including wetlands and floodplains, and in karst systems would be **directly adverse, negligible, short-term, and site-specific because of the low levels.**

A USACE 404 permit would not be required for any activities associated with this alternative. The overall impact of this alternative on water resources and karst systems is **directly adverse, negligible, short-term, and site-specific.** This alternative would not result in impairment to Aquatic resources, including wetlands and floodplains.

Alternative 3: No Chemical, Biological, or Heavy Equipment

The benefits of invasive plant management would still exist, but the success in controlling invasive plants may be diminished by the lack of tools to achieve the desired results effectively. This may limit benefits to only minor improvement in conditions in water resources. Therefore, impacts from Alternative 3 on hydrology and water resources, including wetlands and floodplains, and karst systems would be **directly and indirectly beneficial, minor, short-term,**

and site-specific to local. This alternative would not result in impairment to hydrology and water resources, including wetlands and floodplains, and the karst system.

A USACE 404 permit would not be required for any activities associated with this alternative. The risk to hydrology and water resources, including wetlands and floodplains, and karst systems posed by chemicals, biocontrols, and heavy equipment would be eliminated from this alternative. Some disturbance from manual and light equipment remains, similar to Alternative 2, and making it **directly and indirectly adverse, negligible, short-term, and site-specific.**

Summary

Invasive plant management would help parks achieve the desired conditions and restore natural hydrological processes in some areas. Restoration of native vegetation and management of invasive plants in all alternatives would have beneficial effects on water quality, particularly in a karst landscape where ground water is poorly filtered. Mitigation is not formally stipulated in the No Action Alternative, which could potentially result in impacts to the physical properties of water and the values of wetlands, floodplains, and riparian areas. Alternatives 2 and 3 have strict BPs and mitigations that would minimize impacts to resources with Alternative 3 being the most conservative approach. Benefits of Alternative 2 exceed those of the other alternatives. Therefore, benefits may outweigh negligible adverse impacts under Alternatives 2. Alternative 3 is least likely to produce adverse effects and least likely to produce a high level of benefit. No impairment to resources will result from any of the alternatives.

4.1.3 Geological Resources, Including Soils and Karst Features

Section 4.8 of the NPS Management Policies 2006, pages 53 through 56, addresses geologic resource management including geologic features and processes. This policy states that the NPS will maintain, preserve, and protect geologic resources as integral components of park natural systems. Additionally, Page 56, Section 4.8 addresses soil resource management including soil features and processes. This policy states that the NPS will maintain, preserve, and protect soil resources as integral components of park natural systems. Measures to protect these resources vary from park to park.

The Federal Cave Resources Protection Act of 1988 (16 U.S.C. 4301 – 4309) and subsequent regulation, 43 CFR Section 37.11(d), states that NPS policy is "*… that all caves are afforded protection and will be managed in compliance with approved resource management plans*." Additionally, NPS Management Policies 2006, section 4.8.2.2, page 55, guides the principles for cave management. This aspect of the karst landscape will be considered in this section.

Restoration of native vegetation communities on their native soils may contribute to maintaining or improving the soil matrix. The impacts would be **indirectly beneficial, negligible to moderate, long-term, and site specific.** The moderate effects would result from the most successful restorations.

The principal concerns expressed in scoping were:

- Fate of pesticide within soil column and effects on soil properties
- UTVs applying pesticides may leave scars or tracks on vegetation and soil.
- Treatment methods that remove vegetation could increase erosion and sediment runoff
- Treatments have the potential to affect soil properties, topsoil, and soil microorganisms.

Those alternatives that allow the use of pesticides would follow label mitigations and would consider the potential for impacts to geology, soils, and caves, such as those shown in Table 4.1.1. Potential impacts from treatments that are the same for all alternatives are summarized below:

- Manual and light mechanical treatments that do not disturb the soil surface would not have any measurable or perceptible effect on cave and karst, geological resources, or soils. Any manual and mechanical methods would be highly selective for individual plants to minimize the potential for unnecessary impacts to soils. The impacts of manual and light mechanical treatments on these resources would be **directly or indirectly adverse, negligible, short-term, and site-specific for all alternatives.**

Alternative 1: No Action

Restoration of native vegetation communities on their native soils can contribute to maintaining or improving the soil matrix. The success of restoration in this alternative varies among parks. The impacts are **indirectly beneficial, site specific, long-term, and negligible to minor, depending on the success of restoration efforts.**

Potential impacts from treatments are summarized below:

- Manual and light mechanical treatments that result in surface disturbance can physically impact landforms (karst), geology resources, and soils. Erosion is a key concern in any surface disturbance, but digging or grubbing can also disturb friable geological features near the surface. Digging or grubbing can disturb topsoil, but does not disrupt natural processes or microorganisms more than disturbance from other sources. In general, potential impacts to these resources are minimal. Therefore, surface disturbance impacts on karst landforms, geological resources, and soils are **directly adverse, negligible, short-term, and site-specific.**
- Using UTVs or heavy equipment can damage shallow karst features in the landscape. The calcareous rock associated with porous karst can fracture when subjected to physical stresses, but this is probably rare. Slip seeders that disturb the surface of soil are regarded as a preferred soil conservation technique for planting, and they have no detectable impact on underlying geology, soil processes, or microorganisms. In some instances, UTVs are used for the application of pesticides. Heavy equipment and UTVs can cause short-term, direct impacts to soil from traffic en route to invasive plant populations or during treatment. Effects can include compaction of soil and disturbance to upper soil profiles, which can be short- or long-term in duration. Tracks that are visible to recreationists can attract unauthorized recreational traffic, as an indirect result of the initial authorized actions. Some of these effects can be remediated by the long-term benefits to the soil from restoring native vegetation on native soils. Parks with sensitive resources typically have management practices in place to protect these resources. The concern in this alternative is in the lack of mitigations and BPs that are systematically applied to all parks to ensure the best protection of landforms, soil, and geological resources. Therefore, heavy equipment impacts can be **directly and indirectly adverse, minor, short- to long-term, and local.**
- Pesticides do not have any direct measurable effect on landforms and geological resources, when used according to label instructions. Parks with karst features and

sensitive geological resources have various safeguards to protect those resources established by park management. Some pesticides have moderate potential to persist in soils and potentially alter soil functions and microorganisms, but this is rare under the NPS safeguards. The impacts of pesticide use on cave resources and karst under this alternative are the same as for all geologic resources and soils, and likely are **directly adverse, minor, short- and long- term, and site-specific.**

Overall impacts are similar to, but may be greater than, those for Alternative 2, because of the lack of standardized mitigations and BPs. The No Action Alternative does not inhibit the achievement of the desired conditions for naturally functioning karst, soil, and geologic processes. Invasive plant management may have overall long-term beneficial effects on soils from rehabilitating native plant communities. The impacts of the No Action Alternative on these resources are **directly and indirectly adverse, negligible and minor, short- and long-term, and site-specific to local.** The No Action Alternative does not result in impairment to landforms, geological resources, or soils.

Alternative 2: IPM

Restoration of native vegetation communities on their native soils may contribute to maintaining or improving the soil matrix, restoring soil processes, and improving microorganism composition. Because this alternative is the most likely of the three to attain project objectives, **the beneficial impacts will be indirectly beneficial, moderate, long-term, and site-specific.**

A number of BPs would be implemented to minimize potential impacts to resources under this alternative. In general, potential impacts to geological resources, soils, and karst systems would be negligible because of the mitigations and BPs. Potential impacts from Optimum Tool treatments are summarized below:

- Manual and light mechanical treatments that result in surface disturbance would negligibly impact landforms, geology resources, and soils. In general, potential impacts to these resources would be very small. This alternative provides mitigations and BPs that would eliminate threats. Therefore, surface disturbance impacts on landforms, geological resources, and soils would be **directly adverse, negligible, short-term, and site-specific.**
- A small potential for UTVs or heavy equipment to damage shallow karst features in the landscape and soils would exist. The principle difference in impacts to landforms, geological resources, and soils between the No Action Alternative and Alternative 2 is the reliance on well-defined mitigations and BPs and the Optimum Tool selection criteria to lessen or eliminate potentially adverse impacts to resources in Alternative 2. Surface-disturbing activities, such as tilling or use of heavy equipment, would be avoided within sensitive sites, such as caves, erodible areas, and springs. Heavy equipment use would be relatively infrequent and not repetitive over the long-term. Compaction would be dispersed over the entire area and remediated by the plant community's beneficial effects on soil properties and function. Unnecessary cross-country travel would be avoided. Therefore, heavy equipment use and soil disturbance activities under the mitigations and BPs in Alternative 2 would result in impacts to landforms, geological resources, and soils that would be **directly adverse, negligible, short-term, and site-specific.**

- Pesticides would be applied according to application rates specified on the product label and would be the appropriate formulation for the geologic conditions on site. At these rates, chemicals would not be expected to alter the nature of these resources. With the implementation of the mitigations and BPs, the effect of pesticides on cave and karst resources would be negligible. Selection of the Optimum Tool takes into account soil and pesticide properties to minimize the potential for the build-up of pesticides in soils. The impacts of pesticides on landforms, geologic resources, and soils would be **directly adverse, negligible, short-term, and site-specific.**
- Biocontrol treatments would not have any measurable or perceptible effect on landforms, geological resources, or soil resources. The impacts of biological treatments on these resources would be **neither adverse nor beneficial, but could be negligible.**

Alternative 2, IPM, would not inhibit the achievement of the desired conditions for karst, soil, and geologic processes maintenance in as natural a condition as possible. The impacts of IPM on landforms, geologic resources, and soils would be **directly adverse, negligible, short-term and site-specific**. This alternative would not result in impairment to landforms, geologic resources, or soil.

Alternative 3: No Chemical, Biological, or Heavy Equipment

Restoration of native vegetation communities on their native soils may contribute to maintaining or improving the soil matrix, function, and microorganism composition. This alternative was not found to be as effective as Alternative 2 in attaining the goals and objectives of the program. The impacts would be **indirectly beneficial, negligible, long-term, and site specific.**

The only adverse impacts to landforms, geological resources, and soils are **directly adverse, negligible, short-term, and site-specific** and are common to all alternatives. The instituting of all applicable mitigations as described for Alternative 3 would be similar in impacts for Manual/Mechanical Light Equipment in Alternative 2. The level of protection may exceed the No Action Alternative because of the prohibition of some treatments, use of the Optimum Tool selection process, and the instituting of mitigations that are not explicitly a part of the No Action Alternative. This alternative would not result in impairment to the resource.

Summary

Invasive plant management would help parks achieve the desired conditions for geological resources. Invasive plant management would not inhibit the achievement of the desired conditions for karst, cave, or geologic processes, but may enhance the soil function and matrix in the long-term. Alternatives 2 and 3 have well defined mitigations and BPs that are lacking from the No Action Alternative. Therefore, Alternatives 2 and 3 would have less adverse impact on the environment than would the No Action Alternative. **None of the alternatives will result in impairment.**

4.1.4 Vegetation Communities

There are no federal laws governing vegetation conditions in general; however, the NPS has developed policies and guidance on vegetation management. The NPS Management Policies 2006, section 4.4, page 42, address biological resource management, including general

vegetation management. This policy states that the NPS will maintain, as parts of the natural ecosystems of parks, all native plants.

Reseeding could have a beneficial effect of promoting the reestablishment of native vegetation at any of the parks and under each of the alternatives. Reseeding with heavy equipment may have impacts associated with intrusion of equipment and ground disturbance that are considered in those topics. The impacts of cultural methods, such as reseeding, on vegetation resources would be **directly beneficial, moderate, long-term, and site-specific.**

Those alternatives that allow the use of pesticides would follow label mitigations and would consider the potential for impacts to vegetation, such as those shown in Table 4.1.1. The principal issues of concern from scoping were:

- Various treatments, including the use of pesticides, may affect non-target plant species, including state species of concern and plants with traditional or medicinal uses.
- Workers will leave a "footprint" with their presence at the site, or accessing the site, resulting in some degradation to the area.
- Secondary infestation of treated areas by opportunistic species.
- Opportunity to introduce native plant species in restorations.
- Effects in wetland and riparian vegetation.

Alternative 1: No Action

Vegetation community restoration is beneficial to the vegetation community. The intensity and duration of this benefit depends on the degree of restoration towards self-sustaining community achieved. Invasive plant management helps parks to achieve the desired conditions in native plant communities. The overall success of invasive plant management programs varies from park to park. Beneficial effects to native plant communities also vary between parks. Parks that currently have invasive plant management plans achieve moderate success because they have access to a variety of management tools. Parks that do not have invasive plant management plans have negligible or minor success in controlling invasive plants. The No Action Alternative results in **directly beneficial, negligible to moderate, short- to long-term, and local.**

Management practices to limit potential impacts to vegetation vary from park to park. However, parks generally have management practices to minimize potential impacts to sensitive, desirable vegetation. Potential impacts to vegetation resources are summarized below:

- Ground disturbing activities cause minor physical disturbance to individual native plants. Intrusion into natural areas by personnel conducting invasive plant management causes short-term, direct impacts to vegetation from a "foot print" left from treatment and accessing target plants. Individual plants are affected, resulting in no effect, reduced vigor, or death depending on the circumstances. These impacts are adverse, short-term, and negligible to moderate to individual plants. Infrequent impacts to individual plants generally do not affect plant populations, plant communities, or ecological processes. The impacts of ground disturbance and intrusion from manual / mechanical light equipment treatment on vegetation communities, including wetland, floodplain, and riparian vegetation, are **directly adverse, negligible, short-term, and site-specific**.

- Equipment traffic en route to invasive plant populations can compress individual plants. The use of slip-seeders and drills can damage plants in the planting row, but this should be overshadowed by the increase in plant density from the seeding actions. These impacts are adverse, short-term, and moderate for individual plants. Infrequent impacts to individual plants generally do not affect plant populations, plant communities, or ecological processes, making impacts negligible. Soil compaction can result in indirect effects to plant roots. The impacts of heavy equipment on vegetation community including wetland, floodplain, and riparian vegetation, would be **directly and indirectly adverse, negligible, short-term, and site-specific**.
- Only those pesticides that currently have the necessary compliance and clearances are used. Overall, use of pesticide controls has infrequent adverse, minor, short-term impacts on individual plants due to drift during the course of treating targeted species. Infrequent impacts to individual plants generally have negligible to minor impacts on plant populations, plant communities, or ecological processes. Extraordinary reduction in biomass has resulted in opportunistic species infesting the site when restoration of the area was not immediate. The impacts of pesticide use on vegetation resources, including wetland, floodplain, and riparian vegetation, are **directly and indirectly adverse, negligible to minor, short- and long- term, and site-specific**.

The adverse impacts of the No Action Alternative on vegetation resources are **direct and indirect, negligible to minor, short- and long-term, and site-specific and local.** This alternative does not result in impairment to vegetation resources.

Alternative 2: IPM

Alternative 2 would help parks achieve the desired conditions to maintain native plant communities most rapidly with the least impact to the environment. The alternative would be economically sustainable, in that funding would be on-going, allowing maintenance activities until the area stabilizes. Ecological sustainability is one of the prioritizing criteria in this alternative. By controlling invasive plants using IPM, native plant communities at all 15 parks would be rehabilitated, thus benefiting native plant species and the habitat they provide. This would also remove a source of invasive intrusion and broaden the scope of impact. Therefore, impacts would be **directly beneficial, major, long-term, and local.**

The Optimum Tool would be selected, taking into account site-specific conditions and needs. All appropriate mitigations and BPs would be applied when implementing the Optimum Tool, reducing or eliminating the adverse impacts associated with treatment. The anticipated adverse impacts from implementation of Alternative 2 are:

- Ground disturbing activities may cause minor physical disturbance to individual native plants. Personnel conducting invasive plant management must access target plants, causing short-term, direct impacts to plants from foot traffic en route to invasive plant populations or while applying treatment to target plants. Mitigations and BPs address these concerns, reduce the threat to individual plants, and eliminate the threat for populations. The impacts of ground disturbance and collateral damage, from manual / light equipment treatment would be **directly adverse, negligible, short-term, and site-specific**.

- Equipment traffic en route to invasive plant populations may compress individual plants, resulting in no effect, reduced vigor, or death depending on the circumstances. The use of slip-seeders and drills can damage plants in the planting row, but this should be overshadowed by the increase in plant density and diversity from the seeding actions. These impacts are lessened by employing mitigations and BPs, would be adverse, short-term, and minor for individual plants and negligible for plant populations, plant communities, or ecological processes. The impacts of heavy equipment on vegetation communities would be **directly adverse, negligible, short-term, and site specific**.
- Non-target plants subjected to pesticide drift could experience no effect, reduced vigor, or death depending on the sensitivity of the plant species to the specific pesticide and the dose received. Overall, use of pesticides would have adverse, short-term, minor impacts on individual plants, because drift or non-target treatment during the course of spraying targeted species would be infrequent. Infrequent impacts to individual plants, particularly with the application of mitigations and BPs, have negligible effects on plant populations, plant communities, or ecological processes. The impacts of pesticide use on vegetation community would be **directly adverse, negligible, short-term, and site-specific.**
- Because biocontrols are specific to individual species of invasive plant, there would be negligible impacts to non-target plant species. No specific measures would be implemented to contain biocontrols, but none is needed, because biocontrols are host-specific, attacking one plant species (the target invasive plant). The National IPM Specialist would also further review and approve the release of any proposed biocontrols, which would help to confirm that the use of these agents would be appropriate. Therefore, there are no direct adverse impacts. Treatments of large infestations will open areas to colonization by opportunistic plant species. The BPs for any extensive treatment calls for restoration of areas where vegetation was removed during target species treatment. This reduces indirect impacts to negligible. The impacts of biological treatments on vegetation community resources would be **indirect adverse effects, negligible, short-term, and site specific**.

The overall impacts of this alternative on vegetation resources are low because of the strict Optimum Tool selection process and the mitigations and BPs in place. They would be **indirectly and directly adverse, negligible, short-term, and site-specific**. This alternative would not result in impairment to vegetation resources.

Alternative 3: No Chemical, Biological, or Heavy Equipment

Alternative 3 will not have the beneficial impacts of biocontrol that carries no adverse impacts in Alternative 2. It would be unlikely to attain the objectives of the program, which are based on the vegetation community desired conditions, in a timely fashion, and is cost prohibitive in some cases. Therefore, **direct beneficial impacts are minor, long-term, and local.**

The adverse impacts reflect those of Alternative 2 for the treatment types available in this alternative. There may be a need to repeat treatments with greater frequency or over a longer period to achieve results with the limited suite of treatments allowed, thereby increasing the potential for impacts to non-targeted vegetation. The overall impacts of this alternative on vegetation resources would be **directly adverse, minor, short- and long-term, and site-specific**. This alternative would not result in impairment to vegetation resources.

Summary

Invasive plant management would help parks achieve the desired conditions to maintain native vegetation communities as part of the natural ecosystems of the parks. Impacts to vegetation resources from Alternative 3 would be similar to or less than those for the No Action Alternative because of the mitigations employed in Alternative 3. Despite the mitigations that apply to Alternative 2, the removal of chemical, biological, and heavy equipment treatments lends a slight reduction in direct impacts in Alternative 3. Unfortunately, Alternative 3 will not attain program goals without repeated treatment over the long-term. This subjects the vegetation communities to repeated treatment that could result in cumulative impacts to resources over time. Alternative 2 would help parks achieve the desired conditions to maintain vegetation communities more effectively than Alternatives 1 and 3 could. The adverse impacts would be outweighed by the long-term benefits to vegetation communities resulting from use of the Optimum Tool and all stated mitigations and BPs. None of the alternatives would result in resource impairment.

4.1.5 Wildlife and Fish

The Migratory Bird Treaty Act (16 U.S.C. 703-71L) and the Eagle Protection Act (16 U.S.C. I.S.C. 668a-668b) protect sensitive wildlife species that could occur in the proposed project area. The NPS has also developed policies and guidance on wildlife management. Page 42, Section 4.4 of the NPS Management Policies 2006 addresses biological resource management, including general wildlife and fish management. This policy states that the NPS will maintain all native animals as parts of the natural ecosystems of parks. Management practices to limit potential impacts to wildlife and fish vary from park to park. However, parks generally have management practices that are designed to minimize potential impacts to wildlife, fish, and their habitat, especially during sensitive periods of the year such as during breeding, nesting, and spawning seasons.

Cultural methods, such as native-plant restoration, could promote the reestablishment of wildlife habitat at parks and have no known adverse impacts. The impacts of cultural methods on wildlife resources would be **indirectly beneficial, moderate, long-term, and site-specific** for all alternatives and would not cause impairment of wildlife and fish resources. Use of equipment to complete cultural methods (slip seeder, tiller, etc.) is considered in the analysis of equipment use.

Those alternatives that allow the use of pesticides would follow label mitigations and would consider the potential for impacts to wildlife and fish, such as those shown in Table 4.1.1. The principal issues of concern from scoping were:

- Direct or indirect exposure of wildlife and fish to toxic substances; pesticides and biocontrol may inadvertently affect wildlife species that use the Parks through direct or indirect contact
- Degradation of wildlife habitat
- Degradation of cave habitats and cave biota
- Motorized equipment could disrupt wildlife

Alternative 1: No Action

Controlling invasive plants and promoting healthy native plant communities rehabilitates wildlife habitat. It also improves the conditions and processes of wetlands, floodplains, and riparian areas

that can impact aquatic wildlife and fish. The success of invasive plant management programs varies from park to park. Overall, moderate beneficial effects to wildlife habitat occur at parks that have existing invasive plant management plans. These beneficial effects are detectable in some areas over the long-term, and benefit some fish and wildlife populations using these areas over the long-term. Parks that do not have invasive plant management plans have relatively negligible to minor success and successes may be unsustainable. Therefore, the overall success of the No Action Alternative would impact wildlife and fish in a manner **indirectly beneficial, negligible to moderate, short- to long-term, and local.**

Potential impacts of various treatments on wildlife are described below:

- Intrusion into parks by personnel conducting invasive plant management causes short-term, negligible harassment to wildlife and fish species. Some flight response occurs during these activities, but this produces negligible short-term adverse impacts in the form of unnecessary energy expenditures. Overall effects of infrequent intrusion is probably slight and of little consequence to wildlife and fish populations. Physical disturbance can have site-specific adverse direct impacts on ground nesting birds or burrowing animals or indirect impacts from affecting food sources. Management practices at some parks reduce these effects. The impacts of physical disturbance on fish and wildlife are **indirectly and directly adverse, negligible to minor, short-term, and site-specific**.
- Heavy equipment disturbance can have site-specific adverse impacts directly on ground nesting birds or burrowing animals or indirectly on their food sources. These activities also result in short-term, indirect effects to fish, such as increased sedimentation in surface waters. Management practices at some parks limit these effects. Actions of heavy mechanical treatments that disturb individual animals are not likely to have a significant impact on populations. The impacts of physical disturbance on fish and wildlife are **indirectly and directly adverse, negligible to minor, short-term, and site-specific**.
- It is unlikely that adult wildlife species receive direct exposure to pesticides during application. It is also unlikely that wildlife or fish are overexposed over time, because the pesticides are used according to label specifications. Wildlife species flee the area or escape to a below ground burrow/den upon the arrival of personnel conducting invasive plant management. Juvenile wildlife are not as mobile as adults are and can be directly affected by pesticide application. Use of pesticides registered for use in or near water does not pose a long-term risk to aquatic communities or other standing water environments. If pesticides enter karst waters, cave biota, some potentially unique and cave-dependent, can be affected. The ecology and vulnerability of such organisms are not well understood. The potential for water quality changes, addressed in the section on water resources and karst, relates to impacts on cave biota, suggesting the potential for up to minor, indirect impacts. Impacts beyond decline in habitat conditions through the degradation of water quality have not been detected. The impacts of pesticides on wildlife and fish are **indirectly and directly adverse, negligible to minor, short-term, and site-specific.**

The impacts of invasive plant management on wildlife and fish, including cave biota, are **directly and indirectly adverse**, **negligible to minor, short-term, and site specific.** This alternative does not result in impairment to wildlife and fish resources.

Alternative 2: IPM

By controlling invasive plants and promoting healthy native plant communities, wildlife and fish habitat would be rehabilitated or improved at all 15 parks. Indirect benefits include restoration of terrestrial ecosystem structure, surface water hydrology, water quality, and riparian habitat. Beneficial effects would be detectable in some areas once native plant communities are rehabilitated. The additional biomass created by the introduction of biocontrols may benefit mammal and bird species that prey on terrestrial insects. The **indirect beneficial, moderate, long-term, local** impacts of habitat rehabilitation would offset the following potential adverse impacts.

- Intrusion into parks by personnel conducting invasive plant management would cause short-term, negligible harassment to wildlife and fish species. There may be some escape flight response during these activities, but this would produce unnecessary energy expenditures. Physical disturbance to native plants from ground disturbing activity or foot traffic could have site-specific adverse impacts on ground nesting birds or burrowing animals or their food source. Overall effects would be slight and of little consequence to wildlife and fish populations. Mitigations in this alternative and the BPs would reduce or eliminate this impact and would eliminate direct impacts on fish and wildlife. The impacts of intrusion on fish and wildlife would be infrequently **indirectly adverse, negligible, short-term, and site-specific**.
- Physical disturbance to native plants from ground disturbing activity or equipment could have site-specific adverse impacts on food sources. No direct impacts would be expected because of mitigations and BPs. These activities could also result in indirect effects to fish, such as increased sedimentation in surface waters. Mitigations and BPs that would be applied to all parks would reduce or eliminate the impacts to wildlife and fish and their habitats. Actions of both light and heavy mechanical and manual treatments that disturb individual animals will likely not have a significant impact on populations. The impacts of physical disturbance on fish and wildlife would be **indirectly adverse, negligible, short-term, and site-specific**.
- It is unlikely that wildlife species would receive direct exposure to pesticides during application. It is unlikely that wildlife or fish would be overexposed over time when pesticides are used according to label specifications, mitigations, and BPs. Potential impacts discussed in the No Action Alternative apply to this alternative. Applying the appropriate mitigations and BPs that are explicitly a part of this alternative would reduce impacts and eliminate direct impacts. The impacts of pesticides on wildlife and fish would be **indirectly adverse, negligible, short-term, and site-specific.**
- Biological controls have not been specified in this alternative, but are not excluded from future use. Biocontrols are extremely regulated and heavily tested for safe use in the environment. The NPS has additional regulations and controls that assess the use of biocontrols in specific circumstances. Additionally, this alternative includes mitigations and BPs that further protect the environment. Therefore, it is unlikely that inadvertent direct impacts would occur with the use of biocontrols. Biocontrols may be used in large or dense stands of invasive plants. Effectively treating large stands can result in the need to restore vegetation on the treatment area. Unlike mowing or other plant removal treatments, biocontrols usually leave standing plant material that would provide minimal cover for wildlife. Generally, dense stands of invasive plants do not provide prime habitat

for native wildlife, so the reduction in habitat from the death or stunting of invasive plants would not be a significant factor in habitat degradation. It is more likely that the existence of the invasive plant is the more important factor in habitat degradation than the suppression of the invasive plant. Additionally, this alternative stipulates that extensive treatment will not be accomplished without a commitment to restoration of the site. Therefore, any loss of biomass would be a short-term impact. The impacts from use of biocontrols in treatment of invasive plants would be **indirectly adverse, negligible, short-term, and site-specific.**

Alternative 2, using the Optimum Tool to manage invasive plants, would help parks achieve the desired conditions necessary to maintain native animals as parts of the natural ecosystems of parks. The impacts of Alternative 2 on wildlife and fish would be **directly and indirectly adverse, negligible, short-term, and site-specific**. This alternative would not result in impairment to wildlife resources.

Alternative 3: No Chemical, Biological, or Heavy Equipment

By controlling invasive plants and promoting healthy native riparian communities, terrestrial and aquatic biotic communities at the 15 parks could indirectly benefit from treatment. Indirect benefits include restoration of terrestrial ecosystem structure, surface water hydrology, water quality, and riparian habitat. Beneficial effects would be measureable in some areas once native plant communities are rehabilitated. The impacts of invasive plant management on wildlife and fish would be **indirectly beneficial, minor, long-term, and site-specific to local**. This alternative would not result in impairment to aquatic wildlife and fish resources.

The adverse impacts would be similar to those expressed in Alternative 2. They would be increased somewhat by the extended time required and the repeat treatments that may be necessary to achieve program goals, thereby extending the period of exposure to generations for some species. Although mitigation measures will minimize the disturbance to animals, repeated exposure to even the smallest disturbance can affect breeding success and other factors that determine population conditions over time. Therefore, the impacts on fish and wildlife are **indirectly adverse, minor, long-term, and site-specific.**

Summary

Invasive plant management would help parks achieve the desired conditions to maintain native animals as part of the natural ecosystems of the parks. However, Alternative 2 would likely achieve the desired conditions at parks before it would be reached under the No Action Alternative or Alternative 3, thus reducing the need to repeat treatments. The few negligible, short-term, site-specific, adverse impacts of Alternative 2 may be entirely mitigated and would be outweighed by the long-term benefits to habitat.

4.1.6 Threatened and Endangered Species

The Endangered Species Act of 1973 (ESA), as amended, requires federal agencies to ensure that any action authorized, funded, or carried out does not jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modifications of critical habitat. Section 7 of the ESA requires federal agencies to consult with the USFWS or the National Marine Fisheries Service on any action that may affect federal threatened, endangered, or candidate species, or that may adversely modify critical habitat. The purpose of consultation is

to "*...insure that any action authorized, funded or carried out by such agenc[ies]…is not likely to jeopardize the continued existence or destruction or adverse modification of habitat of such species which is...critical.*"

According to NPS Management Policies 2006, Section 4.4.2.3, page 45, the NPS will survey for, protect, and strive to recover all species native to National Park System units that are listed under the ESA. The guidance, NPS-77 and the not yet released DO-77, addresses the management of federally listed threatened, endangered, and candidate species, and state species of concern (T&E). It also addresses the management of state species of concern identified by other groups such as locally designated species or those established by organizations such as Partners in Flight or The Nature Conservancy. Consultation with the USFWS was undertaken in developing this plan and the USFWS provided recommendations for mitigations.

The impacts of cultural methods on T&E would be directly beneficial, minor, long-term, and site-specific for all alternatives.

Those alternatives that allow the use of pesticides, such as those shown in Table 4.1.1, would follow label mitigations and would consider the potential for impacts to T&E. The two principle issues of concern from scoping were:

- Negative impacts on threatened or endangered species and habitat.
- Impacts to species of continental importance or management concern.

Alternative 1: No Action

At those parks where T&E are present, species directly benefit from the restoration of native plant communities and wildlife habitat. Invasive species management has the directly beneficial effect of promoting the reestablishment of native vegetation. The level of benefit is related to the success and sustainability of native species restoration. Beneficial effects to habitat can be detected in some areas. Habitat improvements can benefit T&E populations using those areas. For plants, impacts are site-specific, but for animals, impacts are local. The impacts of invasive plant management on threatened, endangered, and state species of concern are **indirectly beneficial, negligible to moderate, short- and long-term, and site-specific to local**.

Potential short-term impacts could occur under the No Action Alternative and are variable by park. Parks with invasive plant management plans that have completed consultation with USFWS on mitigations and restrictions needed to protect T&E species are able to apply those mitigations to minimize impacts to T&E species. Those parks that do not have invasive species management plans, but treat species under other related planning instruments, may not have had consultation with USFWS that specifically focused on invasive plant treatments, thus limiting actions that may be permitted. The No Action Alternative is not associated with explicit mitigations and BPs that minimize adverse impacts to T&E species. Potential impacts of various treatments on T&E are summarized below:

- Inadvertent impacts from manual or mechanical treatments (light or heavy equipment), or any treatments requiring intrusion into habitat, may include (1) escape flight response, (2) direct exposure of young to pesticides or physical disturbance, and (3) damage to unrecognized critical habitat. Plants could be individually trampled or damaged, which in the case of T&E species, may impact entire populations. This impact increases with the size of equipment used and the size of the area treated. Generally, parks with federally

listed plants are aware of their locations and have park specific policies that help protect those plants. Parks may not be as familiar with the long list of state species of concern. Fish and wildlife species are transient and more difficult to protect from inadvertent adverse impacts. Therefore, a realistic assessment of risks to T&E species, including state species of concern, is for impacts to be **indirectly and directly adverse, minor, short-term to long-term, and site-specific to local**.

- It is unlikely that adult T&E individuals, either plant or animal, would receive direct exposure to pesticides during application, and it is also unlikely that they would be overexposed to pesticides over time when used under label specification and management practices. Without the application of mitigations, juveniles of some species may be exposed to pesticide drift. Parks with federally listed plant species are generally aware of their locations and implement park policies that protect those species. Parks are generally less familiar with state-listed species of concern. Therefore, impacts, including those to state species of concern, are **directly and indirectly adverse, minor, short-term, and site-specific**.

In some cases, parks may not have the benefit of consultation with USFWS that focuses strictly on invasive plant management actions. Invasive plant management may indirectly affect individuals of a listed species or its critical habitat, but the change is minor and does not result in take. Invasive plant management may affect, but not adversely affect, federally listed threatened and endangered species in accordance with USFWS terminology. Impacts to T&E species, including state species of concern, are **indirectly and directly adverse, minor, short- to long-term, and site-specific to local**. This alternative would not result in impairment to T&E species or associated habitat.

Alternative 2: IPM

At those parks where T&E are present, these species may directly benefit from the restoration of native plant communities and wildlife habitat. The high likelihood of attaining program goals in this alternative would suggest that beneficial effects would be detectable in some areas, and would benefit T&E populations using those areas. Indirect benefits include restoration of terrestrial ecosystem structure, surface water hydrology, water quality, and riparian habitat. Management of invasive species may reduce competition for T&E plant populations. Most reduction in native populations that place species in jeopardy can be attributed to habitat degradation. Habitat improvement through control of invasive species is the antithesis of the cause of jeopardy. This applies to stream and small lake habitats as well, because of the interaction of watershed land uses and aquatic habitat conditions with the quality of riparian buffers playing a critical role. Incidentally, the additional biomass created by the introduction of biocontrols may indirectly benefit T&E mammal and bird species that prey on terrestrial insects. For plants, impacts are site-specific, but for animals, impacts are local. The impacts of invasive plant management on T&E would be **indirectly beneficial, major, long-term, and site-specific to local**.

Although candidate species are not afforded any protection under the ESA, efforts will be made to avoid or minimize potential impacts to these species. Similarly, state-listed species and species identified by other conservation organizations will be protected through BPs and mitigations under this Alternatives 2. The USFWS assisted with the development of mitigations for federally listed species, specifically for three bat species, two vipers, Topeka shiner, Arkansas darter,

Ozark hellbender, rare bi-valves, least tern and piping plover, migratory and other protected birds, western prairie fringed orchid, and Missouri bladderpod. Potential impacts include:

- Manual and mechanical treatment would result in no direct impacts to federally listed wildlife or plants from physical disturbance because of proposed mitigation measures. Greater awareness of state T&E species is expected under this alternative. No escape-flight response is expected from T&E species because mitigations and BPs would avoid disturbing these species. The impacts of manual and mechanical treatments on T&E species would be **indirect, negligible, short-term, and site-specific**.
- It is unlikely that T&E would receive direct exposure to pesticides during application, and it is unlikely that they would be overexposed to pesticides over time when used under label specifications, mitigations, and BPs. The impacts of pesticides on T&E would be **indirect, negligible, short-term, and site-specific**.
- Biocontrols released in a park would be approved by APHIS with no demonstrated affinity for T&E plant species. At those parks where T&E species are present, these species may benefit from the restoration of native plant communities and wildlife habitat. This alternative necessitates a commitment to restoration of areas where major defoliation has occurred, thus reducing indirect impacts to T&E plants. Therefore, adverse impacts would be **indirect, negligible, short-term, and site-specific**.

The USFWS, Ecological Services Field Office, in Ohio provided a letter early in the informal consultation processes that outlined mitigations necessary to prevent adverse effects to T&E species. Those mitigations were incorporated in those listed for Alternatives 2 and 3 across all parks where the affected species may occur. Additional consultation is expected during agency review of the draft EPMP/EA.

Formal biological assessments were not specifically prepared for this project to evaluate potential effects on federally listed threatened and endangered species. Biological assessments have been done by the parks for other projects, particularly construction projects. This EPMP/EA assessment of effects was determined by consultation between the EPMT coordinator and park resource managers. One of three possible determinations was chosen for each federally listed species based on the best available scientific literature, a thorough analysis of the potential effects of the project, and the professional judgment of the biologists and ecologists who completed the evaluation. The three possible determinations (USFWS 1998) are as follows:

- "No effect" – where no effect is expected;
- "May affect - not likely to adversely affect" – where effects are expected to be beneficial, insignificant (immeasurable), or discountable (extremely unlikely); and
- "May affect - likely to adversely affect" – where effects are expected to be adverse or detrimental.

A determination of the effects, as determined by the IDT, is listed in Table 4.1.2.

Table 4.1.2. Summary of the T&E determination of effects

Common Name	Scientific Name	Status	Effects Determination
Birds			
Bald eagle	*Haliaeetus leucocephalus*	Delisted	May affect, but is not likely to adversely affect
Mammals			
Indiana bat	*Myotis sodalis*	Endangered	May affect, but is not likely to adversely affect
Gray bat	*Myotis grisescens*	Endangered	May affect, but is not likely to adversely affect
Ozark big-eared bat	*Corynorhinus townsendii ingens*	Endangered	May affect, but is not likely to adversely affect
Herpetofauna			
American alligator	*Alligator mississippiensis*	Threatened	N/A, listing due to similarity in appearance
Ozark hellbender	*Cryptobranchus alleganiensis bishopi*	Candidate	May affect, but is not likely to adversely affect
Fish			
Topeka shiner	*Notropis topeka*	Endangered	May affect, but is not likely to adversely affect
Arkansas darter	*Etheostoma cragini*	Candidate	May affect, but is not likely to adversely affect
Ozark shiner	*Notropis ozarcanus*	Candidate	May affect, but is not likely to adversely affect
Invertebrates			
Higgins eye pearly mussel	*Lampsilis higginsii*	Endangered	May affect, but is not likely to adversely affect
Neartic paduniellan caddisfly	*Paduniella nearctia*	Candidate	May affect, but is not likely to adversely affect
Plants			
Western prairie fringed orchid	*Platanthera praeclara*	Threatened	May affect, but is not likely to adversely affect
Missouri bladderpod	*Lesquerella filiformis*	Endangered	May affect, but is not likely to adversely affect

Potential impacts could occur under Alternative 2, but consultation with USFWS on the specific mitigations and restrictions needed to protect T&E species make these impacts negligible and short-term. Consultation with USFWS and a determination of "No effect" – where no effect is expected or "May affect - not likely to adversely affect" are prerequisite to any action. Letters of concurrence from USFWS offices are in Appendix O (to be added after agency review).

Alternative 2 would help parks attain the desired conditions to maintain populations of native plant and animal species functioning in as natural condition as possible. It will also assist in restoration of extirpated native plant and animal species to parks, where restoration is intended. Therefore, general impacts of Alternative 2 on T&E would be **indirectly adverse, negligible, short-term, and site-specific**. This alternative would not cause impairment to T&E species or their habitat.

Alternative 3: No Chemical, Biological, or Heavy Equipment

By controlling invasive plants and promoting healthy native plant communities, terrestrial and aquatic biotic communities at the 15 parks could indirectly benefit from treatment. Indirect benefits include restoration of terrestrial ecosystem structure, surface water hydrology, water quality, and riparian habitat. Beneficial effects would be measureable in some areas once native plant communities are rehabilitated and producing habitat for T&E species. For plants, impacts are site-specific, but for animals, impacts are local. The impacts of invasive plant management on T&E would be **indirectly beneficial, minor, long-term, and site-specific and local** depending on the degree of success with restoration and sustainability. This alternative would not result in impairment to aquatic wildlife and fish resources.

The adverse impacts would be similar to those expressed in Alternative 2 with awareness of T&E species expected under this alternative. Repeat treatments may be necessary to achieve program goals, thereby extending the period of treatment exposure to generations for some species. Although mitigation measures will minimize the disturbances, repeated exposure to even the smallest disturbance can affect population conditions. To avoid impacts to federally listed species, consultation with USFWS would be necessary to ensure that impacts would be minimal. Therefore, the impacts on T&E are **indirectly adverse, negligible, long-term, and site-specific.**

Summary

Invasive plant management would help parks achieve the desired conditions to maintain critical habitat and T&E species in natural landscapes of the parks. The potential for restoration of extirpated species in the improved habitat exists for all alternatives. However, Alternative 2 would likely achieve the desired conditions at parks before it would be reached under the No Action Alternative or Alternative 3, thus reducing the need to repeat treatments. The few negligible, short-term, site-specific, adverse impacts of Alternative 2 would be outweighed by the long-term benefits to habitat.

4.1.7 Archeological Resources

For the purpose of this analysis cultural resources, including archeological and historic structures are being combined. Impacts to documented historic structures are mitigated in the alternatives and only undocumented resources could be subject to impacts. Section 106 of the NHPA requires federal agencies to consider the effects of their proposals on pre-historic and historic properties, and to provide state historic preservation officers, tribal historic preservation officers, and, as necessary, the Advisory Council on Historic Preservation, a reasonable opportunity to review and comment on these actions.

Three issues were identified in scoping:

- The damage to cultural resources such as artifacts, structures, and historic materials.
- The use of pesticides could affect organic materials within cultural sites. Pesticides may affect archeological site features, including hearth features, organic materials, bone, pollen, seeds, and objects made from plant fiber.
- The removal of plants that indicate possible locations of archeological or historical interest, or that are part of the archeological or historical site.

Mitigations and BPs protect known artifacts, structures, historical materials, and archeological sites. Only unknown materials have potential for damage. Therefore, the analysis applies to archeological sites and materials that are not documented and the plant communities that may be associated with potential archeological sites. The removal of plants that indicate possible locations of archeological or historical interest is a potentiality that exists under all alternatives and should be avoided through the compliance process for NHPA § 106.

Restoration of a vegetation community using plant species approved through the NHPA §106 process (reviewed as part of a work plan or approved treatment document) would cause negligible direct impacts to subsurface resources. The NHPA §106 process would assess species for their potential impacts to archeological resources (e.g., deep rooted grasses and trees may affect subsurface resources). Vegetation restoration activities, such as reseeding, would have negligible short-term direct impacts to this subset of cultural resources. The adverse impacts of vegetation restoration to archeological and structural resources would be the same for all alternatives. The use of various types of equipment for reseeding or other actions is considered under the headings of manual or mechanical actions.

Alternative 1: No Action

Any action that helps to stabilize soils is beneficial to subsurface artifacts and prehistoric materials. Actions that reduce threats from vegetation that damages materials would also benefit resources. For example, vegetation, such as kudzu, can tear down structures if untreated. Therefore, an invasive plant management program would be **indirectly beneficial, moderate, long-term, and site-specific**.

Any damage to these resource types has no potential for being corrected and integrity is eroded. Once archeological resources are degraded or integrity destroyed, their unique qualities and scholarly value cannot be replaced through any available treatment alternatives. Once historical material is removed, it cannot be returned. Therefore, impacts to these resources are considered long-term.

- Surface disturbance associated with manual and mechanical actions can cause minor impacts to unknown archeological resources. However, the NHPA §106 approval process for proposed actions limits the potential for these impacts. Potential disturbance to these resources is minor and site-specific. Therefore, impacts are **directly adverse, minor, long-term, and site-specific.**
- Large equipment can disturb and affect subsurface resources, when accessing areas or engaging in work at the project area. Equipment could affect unknown resources in areas not yet surveyed. Additionally, parks stop a project when unknown resources are found. The impacts on resources from invasive plant management techniques using large equipment are **directly adverse, minor, long-term, and local**.
- The potential effects of pesticides on cultural resources especially those composed of limestone or organic material is not well understood. Chemical applications could affect the characteristics or features of any NRHP eligible, undocumented resources. Similarly, pesticide application to archeological resources could cause a chemical reaction resulting in damage to the artifact. Most applicators generally avoid applying pesticides directly to these resources due to unknown impacts. It is foreseeable that unknown impacts could occur if pesticides were applied to porous and erosive resources composed of limestone

or organic materials, but the NHPA §106 process should reduce this risk. Therefore, adverse impacts are **directly adverse, minor, long-term, and site-specific**.

Section 106 review would document whether an area has been surveyed or whether a survey is required prior to treatment. The locations of species being removed may not be clearly indicated and a geodatabase for spatial reference is not usually available, making determination difficult in this alternative. Overall, adverse impacts of this alternative are **direct, minor, long-term, site-specific, and local**. This alternative does not result in impairment to cultural resources.

Alternative 2: IPM

Any action that helped to stabilize soils would be beneficial to subsurface artifacts. Actions that reduce threats from vegetation that could damage archeological materials and integrity of the site would also benefit resources. Vegetation can weigh down fragile structures or their root systems can damage or dislodge subsurface features, artifacts, and structures. Controlling plants that can damage these resources is typically viewed as beneficial. Therefore, an invasive plant management program would be **indirectly beneficial, moderate, long-term, and site-specific**.

A number of BPs and mitigations, and the NHPA §106 review process would be implemented to minimize potential impacts to cultural resources under this alternative. The work plan would be presented in a manner easily used for the NHPA §106 review process.

- Manual and light mechanical treatments would have negligible effects on archeological structural resources. Mechanical treatments may disturb unknown cultural resources, but work will cease if there is indication of resources at the site. Specific BPs address precautions that reduce or eliminate impacts. The impacts of manual and light mechanical treatments to this subset of cultural resources would be **directly adverse, negligible, long-term, and site-specific**.
- Personnel might use heavy equipment in mechanical treatments, and this could potentially affect resources in areas without completed surveys. However, BPs and mitigations would be implemented to minimize the potential for accidental impacts to undocumented resources. The impacts of invasive plant management on this subset of cultural resources would be **directly adverse, minor, long-term, and local.**
- No physical alteration of historical structures or building features would occur in this alternative. Pesticides are not expected to affect the character or features of any NRHP eligible or listed resources under the BPs and mitigations of this alternative. The impacts of invasive plant management on this subset of cultural resources would be **directly adverse, negligible, long-term, and site-specific**.
- There are no known direct impacts from biocontrol to archeological and structural resources. Impacts of biocontrols would be negligible.

Integrated Pest Management would not inhibit the maintenance of the desired conditions to have archeological and structural resources protected in an undisturbed condition. In general, potential adverse impacts to archeological and historic resources would be **direct, negligible and minor, long-term, site specific and local.** This alternative would not result in impairment to cultural resources.

Alternative 3: No Chemical, Biological, or Heavy Equipment

Any action that helps to stabilize soils would be beneficial to subsurface and surface artifacts, helping to retain their integrity. Actions that reduced threats from vegetation to historical materials would also benefit resources. Alternative 3 is expected to be less effective than Alternative 2 in achieving success in vegetation control and could require repeated treatment. Therefore, an invasive plant management program using Alternative 3 would be **indirectly beneficial, minor, long-term, and site-specific**.

A number of BPs would be implemented to minimize potential impacts to archeological and structural resources under this alternative. Manual and light mechanical treatments would have negligible effects on this subset of cultural resources. Surface disturbing activities would only be used on a limited basis and only in areas unlikely to impact these resources. Removal of plants that may indicate locations of possible archeological sites would be unlikely, because of the clear specification of species being removed and spatial references presented in the work plan, which receives NHPA §106 review. The impacts of this alternative to this subset of cultural resources would be **directly adverse, negligible, long-term, and site-specific**. This alternative would not result in resource impairment.

Summary

Invasive plant management would not inhibit the maintenance of the desired conditions and protection of material integrity. Adverse impacts that potentially could arise from the No Action Alternative are balanced to some extent by beneficial impacts, but are still greater than those for Alternative 2 or Alternative 3. Alternative 2 best protects documented and undocumented resources while having a high probability of short- and long-term success. Invasive plant management typically would not result in impairment of cultural resource materials.

4.1.8 Cultural Landscapes

Cultural landscapes are a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. Cultural landscapes often have both native and cultivated/exotic vegetation that contribute to a site's historic integrity. Cultural landscapes that have been documented as eligible for or listed on the NRHP often have approved treatment documents that provide guidance on management and representation of specific plants and vegetative cover. In some cases, the types of plant cover in the cultural landscape may be of importance, but are less affected by exact species composition than the type of vegetation community. With any invasive plant management, and with all alternatives, negligible effects to invasive plants managed as cultural resources may occur, but impacts would be vetted through the NHPA §106 process before actions were implemented.

Two concerns were identified during scoping:

- Degradation of cultural landscapes (historic integrity, historicity, and aesthetics).
- Changes that are not desirable for interpreting the period of significance, integrity, and historicity may occur to the cultural landscape.

Cultural method techniques, including restoration and rehabilitation, using plant types or species approved through the NHPA §106 process, would result in restoration and rehabilitation of

natural areas. These natural areas represent the landscape believed to have attracted people to a location, historically, contributing to cultural landscape desired conditions. Many of the parks seek to incorporate low maintenance native vegetation communities that complement their cultural landscape type, be it historical site, historical designed landscape, historical vernacular landscape, or ethnographic landscape. In many cases, restoration and rehabilitation of native vegetation communities establishes a scene that is more authentic to the period of significance than the current community is, or is a representation of a type of landscape important to the period of significance. Restoration and rehabilitation activities, such as reseeding in accordance with cultural landscape treatment recommendations, would have negligible adverse impacts to cultural landscapes. The adverse impacts of restoration and rehabilitation activities to this subset of cultural resources would be the same for all alternatives. The use of various types of equipment for reseeding or other actions is considered under the headings of manual or mechanical actions.

Alternative 1: No Action

Invasive plant management has a long-term beneficial effect of restoring and rehabilitating cultural landscapes, when done according to CLR treatment plans. Cultural landscapes are usually a combination of characteristics and features, inclusive of scenes and vegetation. Therefore, site-specific actions could affect views, vistas, circulation patterns, and/or the characteristics that make up a landscape's setting or context. Long-term beneficial effects to cultural landscapes vary from park to park and are likely the greatest at those parks that have CLR treatment plans and current invasive plant management plans. Therefore, beneficial impacts of the no action alternative are **direct, negligible to major, long-term, and local**.

This alternative does not have explicit programmatic mitigation and BPs.

- Manual and mechanical treatments have negligible adverse effects on cultural landscapes when done in accordance with CLR treatment recommendations. Impacts do not diminish the overall integrity of the landscape. Control of invasive plants results in short-term, temporary disturbance to a cultural landscape, but may also restore plants to their historic boundaries. The impact of invasive plant management to cultural resources is **directly adverse, negligible, short- term, and local**.
- Use of heavy equipment may have short-term impacts similar to manual or mechanical actions, except that intensity might be greater. Some alterations of patterns or features of a cultural landscape might occur, but they could be restored if documented before IPM actions. In such cases, the overall integrity of the landscape would not be diminished. Control of invasive plants could result in temporary disturbance to a cultural landscape. Therefore, adverse impacts are **directly adverse, minor, short- term, and local.**
- Non-target plants subjected to physical disturbance or pesticide drift could experience no effect, reduced vigor, or death depending on the sensitivity of the plant species to the disturbance. Overall, these impacts are infrequent, short-term, and minor with little effect on cultural landscapes. The impact of invasive plant management to invasive plants managed as cultural resources can occur, but is unlikely due to care taken during application of product and use of equipment. Therefore, pesticide impacts are **directly adverse, minor, short-term, and local**.

Invasive plant management within cultural landscapes seeks to protect historic integrity, and to restore and rehabilitate vegetative conditions. It does not knowingly inhibit the maintenance of the desired condition outlined in approved planning documents. The overall adverse impacts of the no action alternative are **direct, negligible and minor, short- and long-term, local**. This alternative does not result in impairment of the cultural landscapes.

Alternative 2: IPM

Invasive plant management would have a long-term beneficial effect of restoring or rehabilitating a cultural landscape in accordance with the CLR and other approved planning documents. Long-term beneficial impacts depend on the degree to which a cultural landscape requires a healthy native vegetation community to attain desired conditions. Integrated Pest Management could have a long-term beneficial effect of restoring or rehabilitating a cultural landscape in sensitive, effective, and efficient manner. Intensity of beneficial impacts depends on the level of impact from existing invasive species in the parks. In some cases, invasive species are identified as a major problem in a specific cultural landscape. Therefore, beneficial impacts of IPM are **direct, major, long-term, and local**.

This alternative will implement programmatic mitigations and BPs to reduce or eliminate the effects of impacts.

- Manual and mechanical treatments would likely have negligible effects on a cultural landscape's characteristics and features. Impacts would be to individual plants or small patches, but the overall integrity of the landscape would not be diminished. Control of invasive plants may result in temporary disturbance to a site, and so to the overall cultural landscape. The impact of invasive plant management to cultural landscapes would be **directly adverse, negligible, short- term, and local**.
- Heavy equipment may cause some temporary alterations in the characteristics and features of the cultural landscape, but the overall integrity of the landscape would not be diminished. Working in the site with heavy equipment might detract from the cultural landscape, but this impact would be very short-lived. Control of invasive plants may cause **direct, minor, short-term, local** impacts to the cultural landscape.
- The IPM decision-tree would limit potential impacts to invasive species managed as cultural resources, because of the cultural landscape value placed on that species. Invasive plants that are managed as cultural resources would not be treated under this alternative in the areas where they are maintained for cultural purposes. Non-target plants subjected to physical disturbance or pesticide drift could experience no effect, reduced vigor, or death depending on the sensitivity of the plant species to the disturbance. Overall, these impacts would be infrequent, short-term, and minor and would not affect a cultural landscape's integrity. The impacts of pesticides on a cultural landscape's characteristics and features would be **directly adverse, negligible, short-term, and local**.
- Biocontrols would be selected in a manner that would eliminate or reduce the potential for affecting invasive species that are maintained as part of a cultural landscape. They would not alter the integrity of a cultural landscape, but resulting dead vegetation could detract temporary from the desired vista conditions. Therefore, biocontrol potentially could result in **indirectly adverse, negligible, short-term, and local.**

Invasive plant management within cultural landscapes seeks to protect historic integrity, and to restore and rehabilitate vegetative conditions collaboratively. Integrated Pest Management does not knowingly inhibit the maintenance of the desired condition outlined in approved planning documents. The overall adverse impacts from IPM would be **direct and indirect, negligible and minor, short-term, and local**. This alternative would not result in impairment of cultural landscapes.

Alternative 3: No Chemical or Heavy Equipment

Invasive plant management would have a long-term beneficial effect of restoring or rehabilitating a cultural landscape in accordance its CLR and other approved planning documents. Because the full suite of IPM is not available under this alternative, a long-term beneficial effect of restoring or rehabilitating a cultural landscape may not be realized as quickly or as intensively as with Alternative 2. Therefore, beneficial impacts from Alternative 3 are **direct, moderate, long-term, and local**.

This alternative will implement programmatic mitigations and BPs to reduce the effects of impacts associated with IPM. Impacts to individual plants or small patches of vegetation may occur, but the overall integrity of the landscape would not be diminished. Control of invasive plants may result in temporary disturbance to a cultural landscape. The impact of invasive plant management to this subset of cultural resources would be **directly adverse, negligible, short-term, and local**. Invasive plant management seeks to protect historic integrity, and to restore and rehabilitate vegetative conditions. Alternative 3 would not likely inhibit the maintenance of desired conditions outlined in approved planning documents. This alternative would not result in impairment of cultural landscapes.

Summary

Invasive plant management would endeavor to maintain the desired conditions outlined in approved planning documents. In fact, the tendency of invasive plants to dominate and eventually exclude other desirable species makes invasive plant management beneficial within cultural contexts. Benefits positively correlate with timeliness and the degree of successful treatment. Alternative 2 provides the best probability of success and employs mitigations and BPs that protect cultural landscapes. Because Alternative 2 allows the use of treatments that could leave visible disturbance for the short-term, the probability of visual impacts to a cultural landscape is similar or slightly greater than for Alternative 3. The long-term benefits of successful management through Alternative 2 outweigh the negligible increase in risk. Invasive plant management would not result in impairment of cultural landscapes.

4.1.9 Ethnographic Resources

Ethnographic resources are those sites, structures, objects, landscapes, or natural resource features assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. In parks, this includes landscapes, quarries, American Indian earthen mounds, and several geological features. Ethnographic resources also include traditional use areas or traditional cultural properties, such as vision quest, celebration, and ceremonial sites, and plant-gathering areas. According to the NPS Management Policies 2006, Chapter 5 title page,

> *"The National Park Service will protect, preserve, and foster appreciation of the cultural resources in its custody and demonstrate its respect for the peoples traditionally associated with those resources through appropriate programs of research, planning, and stewardship."*

Three topics of concern were identified in internal and external scoping:

- Degradation of ethnographic landscapes.
- Damage to ethnographic resources such as artifacts, structures, and historical materials.
- Damage to traditional use plants or plants that provide a sense of place or sacredness to a site.

Generally, traditional use or historically significant plants are not considered invasive plants. By removing or controlling invasive plants, the landscape might be restored to conditions that best serve traditional uses and enhance ethnographic resources. Invasive plants that mask views of or inhibit access to ethnographic features would be managed to allow views and access of those features. Invasive plants with deep root structures may affect subsurface artifacts and so the benefits that are stated for archeology apply to subsurface resources. Therefore, invasive plant management would be directly and indirectly beneficial, but the intensity of those benefits would depend on the success of the management actions.

Cultural method techniques, including vegetation community restoration using plant types or species approved through the NHPA §106 process and in consultation with tribes could result in restoration or rehabilitation of ethnographic landscapes. In many cases, restoration of native vegetation communities with few invasive plants recreates a scene that complements the ethnographic landscape. Activities, such as reseeding, would have negligible adverse impacts to ethnographic landscapes. The adverse impacts of cultural methods to ethnographic resources would be the same for all alternatives. The use of various types of equipment for reseeding or other actions is considered under the manual or mechanical actions.

Alternative 1: No Action

Invasive plant management has direct and indirect beneficial impacts on ethnographic resources and access to them, commensurate to the level of success achieved by the parks and the dependence of desired conditions on a healthy native vegetation community. Best success is expected for those parks with invasive plant management programs in place. Therefore, beneficial impacts from the no action alternative to ethnographic resources dependent on native vegetation are **indirectly and directly beneficial, negligible to moderate, long-term, and local**.

The impacts expressed in Cultural Landscapes apply to Ethnographic Resources, as well. Invasive plant management can adversely impact areas where American Indians gather plants or practice religious activities for a short time. Some impacts from physical disturbance or pesticide application have the potential to occur to non-target traditional use or medicinal plants. These impacts can be directly adverse, short-term, and moderate to individual plants. Infrequent impacts to individual plants generally do not affect plant populations, plant communities, or ecological processes. In the case of plants collected for ethnographic uses, individuals of the species are of concern. Invasive plant management does not inhibit the maintenance of the desired conditions for American Indian religious practitioners to access and use ceremonial or

sacred sites. The impacts of invasive plant management on ethnographic resources are **indirectly and directly adverse, minor, short-term, and local**. This alternative does not result in impairment to ethnographic resources.

Alternative 2: IPM

Invasive plant management would have direct and indirect, beneficial impacts on ethnographic resources and access to them based on the dependence of desired conditions on the health of the native vegetation community. Since good success is predictable with a strategic and sustainable program, beneficial impacts to ethnographic resources dependent on native vegetation would be **directly and indirectly beneficial, major, long-term, and local**.

The impacts expressed in Cultural Landscapes apply to Ethnographic Resources, as well. Best Practices and mitigations would reduce or eliminate impacts from most sources. Parks would identify religious sites and traditional use plant species based on consultation with tribes. Invasive plant management activities would be avoided during periods when American Indians use these areas. All appropriate mitigations and BPs would be implemented. Integrated Pest Management, including the use of biocontrols, would not inhibit the maintenance of the desired conditions for American Indian religious practitioners to have access to and use of ceremonial and sacred sites. Infrequent impacts to collection areas should not affect plant populations, plant communities, or ecological processes, but loss of individual plants is significant in traditional use considerations. The impacts of invasive plant management on ethnographic resources would be **directly adverse, negligible, short-term, and local**. This alternative would not result in impairment to ethnographic resources.

Alternative 3: No Chemical, Biological, or Heavy Equipment

Invasive plant management would have direct and indirect beneficial impacts on ethnographic resources and access to them based on the level of success in managing invasive plants. Since beneficial impacts are related to the degree of success in invasive plant management, impacts on ethnographic resources dependent on vegetation would be **directly and indirectly beneficial, moderate, long-term, and local**.

This alternative would not inhibit the maintenance of the desired conditions for American Indian religious practitioners to have access to and use of ceremonial and sacred sites. Impacts would be similar to those for Alternative 2, except that less potential for damage would result because of the exclusion of large equipment, pesticides, and biocontrols. Infrequent impacts to individual plants generally do not impact plant populations, plant communities, or ecological processes, but loss of individuals can impact collection for traditional uses. The impacts of invasive plant management on ethnographic resources would be **directly adverse, negligible, short-term, and local**. This alternative would not result in impairment to ethnographic resources.

Summary

Many of the impacts to ethnographic landscapes are similar to those to cultural landscapes. Additionally, access to ethnographic features or ceremonial use areas is important to this resource. Invasive plant management would beneficially affect access to and views of features, and establish viable vegetation communities that are of ethnographic value. Thus, the benefits of invasive plant management are significant. Mitigations and BPs help to minimize adverse impacts from management activities. The No Action Alternative may have greater impacts than

the other two alternatives because of the lack of mitigations and BPs that would protect resources. Alternative 3 will not always produce desired results as quickly as the use of IPM. Alternative 2 combines a manageable level of risk with significant benefits. None of the alternatives would inhibit the maintenance of the desired conditions for religious practitioners to have access to and use of traditional, ceremonial, and sacred sites. None of the alternatives would result in impairment to the ethnographic resources.

4.1.10 Visitor Use and Experience

The NPS Management Policies 2006, page 90, states, "*The purpose of NPS interpretive and educational programs is to advance this mission by providing memorable educational and recreational experiences that will (1) help the public understand the meaning and relevance of park resources, and (2) foster development of a sense of stewardship.*"

The NPS Management Policies 2006, section 8.2, page 99, states, "*Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks.*"

Concerns identified during scoping include:

- Various treatments may affect public access to some areas within parks.
- Chemical application methods (e.g., UTVs) may affect visitor experience.
- Chemically treated areas may lack aesthetic appeal and impact interpretation or quality of visitor experience (this applies to Wilderness and WSR, also).
- Invasive plant treatment may create educational opportunities.

Visitor use and experience may be impacted by invasive plants in three ways:

- Dense or tall invasive vegetation may reduce the impact of vistas and mask certain features, reducing the sense of place or the experience of the desired view.
- Crews and equipment used in invasive plant management may affect visitor experience by intruding into the vista or soundscape.
- The aftermath of treatment may leave areas with dead or cut vegetation where visitors expect to see pristine sites.

Director's Order - 83 states that

> *"It is the policy of the NPS to protect the health and well-being of NPS employees and park visitors through the elimination or control of disease agents and the various modes of their transmission to man and to ensure compliance with applicable federal, state and local public health laws, regulations, and ordinances. Implementation of this policy will be tempered by the Organic Act's requirement that the NPS conserve the scenery and natural and historic objects and the wildlife therein in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."*

The NPS Management Policies 2006, section 1.4.5, page 11, states that natural soundscapes and smells are park resources and values. Director's Order - 47 states that soundscape preservation and noise management activities will be subject to NPS policies. The NPS Management Policies 2006, section 8.2, page 101, states,

> *"the Service will take action to prevent or minimize those noises that adversely affect the visitor experience or that exceed levels that are acceptable to or appropriate for visitor uses of parks."*

Section 4.1.5 states that restoration of natural systems will include the restoration of natural soundscapes. Descriptions of soundscapes are not included in the park descriptions but the definition of natural sounds comes from section 4.9. Natural soundscapes exist in the absence of human-caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials (NPS 2006d: 56).

Cultural invasive plant treatments, such as education or restoration, would enhance or complement the visitor experience. Some visitors are familiar with invasive species and find them to be disturbing or distracting in the park setting. Rehabilitation of native plant communities at parks would be readily apparent to some visitors and likely have long-term, moderate, beneficial effects to visitor experience. Visitors would likely be aware of the beneficial effects of invasive plant management and might express positive opinions about the changes. Restoration activities, such as reseeding, would have negligible, short-term impacts to visitor use and experience. Visitors that come to parks to engage in informal education will appreciate education associated with an invasive plant management program. The adverse impacts of cultural invasive plant treatments and community restoration actions to visitor use and experience would be the same for all alternatives.

Alternative 1: No Action

In general, invasive plant management has a long-term, beneficial effect on visitor use and experience. However, the beneficial effects of invasive plant management vary from park to park. Several parks have received complaints from visitors when invasive plants were observed within the park. These complaints might continue at those parks that do not have effective invasive plant management programs. Vistas are critical to a sense of place at many parks and can be enhanced or maintained with invasive plant management. The impacts of invasive plant management on visitor use and experience under the No Action Alternative are **indirectly beneficial, negligible to moderate, long-term, and site-specific**.

- Manual removal has a negligible impact on visitor use and experience, but the use of chainsaws and other motorized equipment would disturb the soundscape at a minor intensity and would be short-term. Some site disturbance is visible in the short-term and visitors are sometimes excluded from work areas for health and safety reasons. Visitor use and experience impacts would be **directly and indirectly adverse, minor, short-term, and local**.
- Heavy equipment tracks can attract unauthorized recreational vehicles, which might result in off-trail impacts. Human caused noise is short-term with some sound carrying into the local area. Human-caused noise occurs during periods of equipment operation between sunrise and sunset, and outside of wilderness areas rarely exceeds the sound levels of equipment used in other park maintenance. The impacts of intrusion of heavy equipment, resulting landscape appearance, and exclusion from work areas on visitor use and experience are **indirectly and directly adverse, minor, short-term, and local**.

- Some pesticides require visitor use closures for visitor protection during application and while the pesticide dries. The displacement of visitors is rare, short-term, and site-specific due to the wide distribution of invasive plants. Invasive plant management does not inhibit the maintenance of the desired conditions for visitor safety and health or for visitor uses and experiences. The impacts of invasive plant management on visitor use and experience are **directly adverse, minor, short-term, and site-specific**.

Impacts to visitor experience, including soundscapes and health and safety are **directly and indirectly adverse, negligible to moderate, short-term, and site-specific and local**. Invasive plant management does not inhibit natural soundscapes of parks or protection of enjoyment of park resources and values by the people of the United States. This alternative would not result in impairment to visitor use and experience, including soundscapes.

Alternative 2: IPM

Education plays a small role in this alternative with each park's interpretive services directly helping visitors to understand the need for invasive plant management. Visitors that use parks as a location for informal learning would appreciate the information. In general, IPM would have a long-term, beneficial effect on visitor use and experience by allowing 15 parks to attain desired conditions for vegetation communities and cultural landscapes, thus indirectly affecting visitor experience. The impacts of invasive plant management on visitor use and experience would be **directly and indirectly beneficial, moderate, long-term, and site-specific**.

Best management practices would reduce or eliminate the potential for adverse impacts.

- Manual removal would likely not have more than a negligible impact on visitor use and experience, but the use of chainsaws and other motorized equipment would disturb the soundscape at a minor intensity and would be short-term and local. Visibility of work crews could distract some visitors. Visitors may be excluded from work areas for safety reasons. Some disturbed areas would be visible in the short-term. Using mitigations and BPs, visitor use and experience impacts would be **directly adverse, negligible, short-term, and local**.
- Several best management practices would limit potential adverse impacts to visitor use and experience. Human-caused noise would be audible during periods of equipment operation between sunrise and sunset, but at levels only somewhat detectable above routine maintenance sounds in many areas, except in designated wilderness, where sounds would exceed background levels. No human-caused noise resulting from IPM would be audible between sunset and sunrise. Visitors may be excluded from work areas for safety reasons. Some disturbed areas would be visible in the short-term. This alternative would not result in impairment to soundscapes, vistas, or visitor use and experiences. The impacts of heavy equipment on visitor use and experience would be **directly adverse, minor, short-term, and local**.
- Pesticide treatment areas may require closures for visitor protection during pesticide application and while the pesticide dries. The displacement of visitors would be rare, temporary, and site-specific. Mitigations and BPs ensure visitor safety. Treatment areas may contain dead vegetation in the short-term. Impacts to visitor experience and use would be **directly adverse, negligible, short-term, and site-specific** impacts.

- Biocontrols are intended to have no direct impacts on anything but target species. If large areas of invasive plants are treated with biocontrols, it may result in patches of dead vegetation that could intrude upon the visitor experience and use. This would be rare and non-recurring. Otherwise, biocontrols are inconspicuous to visitors. Therefore, their adverse impacts to visitor use and experience would be **indirectly adverse, negligible, short-term, and site-specific**.

Impacts to visitor use and experience, including soundscapes, would be **directly and indirectly adverse, negligible and minor, short-term, and site-specific and local**. Integrated Pest Management would not inhibit visitor and employee safety and health, natural soundscapes of parks, or protection of enjoyment of park resources and values by the people of the United States would not be inhibited by IPM. This alternative would not result in impairment to visitor use and experience, including soundscapes.

Alternative 3: No Chemical or Heavy Equipment

In general, invasive plant management would have a long-term, beneficial effect on visitor use and experience that coincides with the intensity of success in controlling invasive plants. The potential for interpretive opportunities from invasive plant management offers direct benefits to visitor experience and use. Rehabilitation of native plant communities would be readily apparent to some visitors and likely have indirect, beneficial impacts on visitor use and experience commensurate with attainment of program goals. The impacts of invasive plant management on visitor use and experience would be **indirectly and directly beneficial, moderate, long-term, and site-specific**.

Impacts would be similar to those for Alternative 2, except that impacts from the use of heavy equipment, pesticides, and biocontrols would be absent. Impacts to visitor experience, including soundscapes, vistas, and health and safety, would be **directly adverse, negligible, short-term, and local**. Visitor and employee safety and health would not be inhibited by this alternative. Natural soundscapes of parks are preserved and enjoyment of park resources and values by the people of the United States are protected. This alternative would not result in impairment to visitor use and experience, including soundscapes.

Summary

Visitor experience can be improved when visitors understand management decisions and techniques. The education that would be part of Alternatives 2 and 3 would reduce some of the adverse impacts associated with intrusion of workers, equipment, sounds, and disturbed areas into the visitor experience. The most effective strategy that minimizes adverse environmental impacts would result in long-term improvements to the visitor experience and use. All adverse impacts are short-term. Goals of the program are consistent with those of the WSR and Wilderness designations and result in improvements in vegetation that could benefit visitor experience. Visitor and employee safety and health would not be inhibited by invasive plant management. Management would not inhibit the maintenance of the desired conditions to have, to the greatest extent possible, the natural soundscapes of parks preserved. Invasive plant management would not inhibit the enjoyment of park resources and values by the people of the United States. This alternative would not result in impairment to visitor use or experience, or to soundscapes.

4.2 Cumulative Impacts

The CEQ regulations to implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as

> *"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."* (40 CFR 1508.7)

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at the parks and, if applicable, the surrounding region. Beneficial impacts may be complementary or synergistic, and so not considered cumulative. Internal and external scoping specifically addressed cumulative impacts with actions or events that revolve around:

- Use of fire in invasive plant management.
- Effects of emerald ash borer, climate change, and other disturbances on invasive plant distribution.
- Effects of other plans implemented during the course of invasive plant management.

4.2.1 Use of Fire

The use of fire in the presence of other management activities in parks was analyzed in each fire management plan. At those parks that use prescribed fire, no cumulative impacts were detected. No effects would occur at those parks that do not use prescribed fire.

Alternative 1: No Action

Park fire management plans take into account cumulative impacts at the time they are written and again with each five-year review. All parks have addressed any foreseeable invasive plant treatment under the No Action Alternative in those fire management plans. No effects would occur at those parks that do not use prescribed fire.

Alternative 2: IPM

At those parks that currently use prescribed fire as a resource management tool, fire may cause impacts, as analyzed in the fire management planning process, but no adverse cumulative impacts would be expected between fire and any other proposed technique. This is because fire use would enter into the Optimum Tool selection process, where impacts of all actions are considered. The decision process considers cumulative impacts, such as

- Loss of vegetation from fire could cause minor temporary increases in erosion and sedimentation.
- Runoff from burned areas could contain ash and sediment.
- Deposition of carbonaceous residue and carbonaceous blackening of soils.
- Mechanical disturbance during firefighting or cleanup.
- Fire impacts on individual plants.

- Fire could encourage the establishment of invasive plants by temporarily reducing plant competition for light and nutrients.
- Fire can have direct mortality on small mammals, some invertebrates, reptiles, and amphibians, and non-mobile species of wildlife.
- Fire stresses wildlife that escape management actions and can impact food sources.
- Wildlife may use adjacent habitat while burned areas recover.
- Adjacent areas may provide sources of wildlife for colonizing burned areas.

Only those parks with approved fire management plans would include use of prescribed fire under these alternatives. Prescribed fire provides an overall benefit to the continued growth, health, and maintenance of the mixed and tallgrass prairie ecosystems and fire dependent woodlands. Fire may be used synergistically with or as a complement to invasive plant management. Therefore, no adverse cumulative impacts would be expected with the use of fire.

Alternative 3: No Chemical, Biological, or Heavy Equipment

As with Alternative 2, the tool selection process would recognize fire as a potential tool and would consider the cumulative effects of fire planned for other objectives in the environment during the selection process. Therefore, no adverse cumulative impacts would be expected with the use of fire.

4.2.2 Emerald Ash Borer, Climate Change, and other Disturbance

Emerald ash borer (*Agrilus planipennis*) threatens ash tree species (*Fraxinus spp*.) in hardwood forests within the parks. Ash trees constitute a significant portion of the forest cover in several of the parks. Effects of emerald ash borer may be similar to those of chestnut blight or Dutch elm disease, in which case, parks expect to lose all or most of the ash trees in their forests once the borer has reached the parks. As ash trees in forests die, gaps form in the forest canopy, allowing light to reach understory vegetation. Native trees may respond and fill in the gaps or invasive species may take advantage of the sudden openings. Invasive plant species may be facilitated by the increased light levels, allowing the plants to colonize new areas, grow rapidly, and reproduce. Native herbaceous plants may be impacted by the loss of the ash trees and the responses of other vegetation.

Information from the US Department of Agriculture, Forest Service Climate Change Resource Center[35] suggests that climate change is exacerbating changes in native ecosystems by altering physical conditions in ways that interfere with species that are adapted to long-term, local conditions. This provides opportunities for invasive species that were not originally a part of the ecosystem to flourish with reduced stress from competition. Predictions for individual species are not powerful enough to help us determine how ecosystems will respond. Because so little is known, it is only through adequate, detailed monitoring that we will be able to recognize, follow, and document these changes. Therefore, early detection and rapid response are the most important options for management of changes in community composition that result from climate change.

[35] http://www.fs.fed.us/ccrc/topics/invasive-plants.shtml (accessed September 12, 2011).

These are only two of a multitude of disturbances that threaten the integrity of plant communities. More disturbances may be expected with the influx of new pests, parasites, and pathogens through our global commerce and with climate change. Any treatment that is developed in the future to protect plant communities from pests, parasites, and pathogens would require implementation planning that considers cumulative impacts with programs and actions currently in place.

Alternative 1: No Action

Disturbance and stressors migrate to the parks. The parks use plant community monitoring data from the Heartland I&M Network to determine status and trends of plant communities. Park actions in invasive plant management are largely responsive to increases in invasive species cover within the plant community monitoring data, not from specific invasive plant monitoring data. Some parks track problem areas and treatments, but rarely analyze trends in invasive plant cover. A full suite of treatment actions and monitoring would be necessary to manage potential disturbance situations and resulting invasive species effectively.

There would be no adverse cumulative impacts expected from the No Action Alternative, but conservative selection of treatments would be necessary to ensure that actions would not increase stress in an already disturbed environment. Beneficial impacts would be expected from actions in invasive plant management that addresses those species that take advantage of the disturbance from disease, parasites, or other environmental perturbations.

Alternative 2: IPM

An effective and strategic approach to invasive plant management responds to the needs of a changing plant community, but it must also identify the potential problem areas and problem species through collection of data specific to an invasive plant program. To prevent invasive species from taking advantage of disturbance, early detection followed by a rapid response to eradicate initial infestations would be used. Detailed monitoring and managed databases contribute to early detection and proactive management. This alternative provides a monitoring program that tracks actions and infestations. The EPMT could eventually merge data with models, such as climate-change response predictions.

Because the Optimum Tool takes into account all environmental conditions when selecting the best treatment for a priority species and location, it is unlikely to have cumulative impacts with altered conditions caused by disturbance or other actions designed to manage new stressors and disturbances. The impacts of the alternative would be complementary and beneficial, in that they would manage those invasive species that use disturbance as an opportunity to proliferate.

Alternative 3: No Chemical or Heavy Equipment

All of the factors in Alternative 2 apply to this alternative with the exception that fewer tools are at the manager's disposal to treat infestations that are found through the active monitoring program. An effective and strategic approach to invasive plant management would be responsive and proactive in identifying the potential problem areas and problem species. The data management system would provide some predictive capabilities for invasive plant hot spots and interactions with surrounding stressors and disturbances.

The decision-tree would take into account stressors and disturbance, when selecting the best treatment. This alternative is unlikely to have cumulative impacts with altered conditions caused by disturbance or actions designed to manage other stressors and disturbances. The impacts of the alternative would be complementary and beneficial, in that they would manage those invasive species that have used disturbance as an opportunity to proliferate.

4.2.3 Other Plans and Actions

Cumulative effects are "additive" impacts to a particular resource and include impacts of actions in the past, the present, and the reasonably near future. A complete picture of forces already acting upon a particular environmental resource is essential in making reasonable decisions about the management of that resource. Although a multitude of actions may contribute impacts to resources, only those that resource specialists feel are clear contributors or that can feasibly be analyzed need to be included.

Each of the parks has plans that might interact with this EPMP. These plans would include fire management plans, vegetation management plans, or some of the other plans that are presented in Table 2.1.0. The plans that potentially share connection with or similarity to the EPMP were examined as potential sources of cumulative impacts (Table 4.2.1).

The Optimum Tool selection and the decision-tree minimize adverse interactions between plans and actions, because it accounts for those plans in the selection process. Therefore, Alternative 2 and Alternative 3 would not interact with other actions that would result in cumulative impacts. The No Action Alternative relies on the existing approved plans for the authority to take actions. Therefore, no cumulative impacts would be expected for any of the alternatives.

Table 4.2.1. Assessment of cumulative impacts of related actions

Park Unit	Plan Title	Potential Cumulative Impacts
CUVA	Control Plan for Alien Plant Species, 1990	Park implementation plan for control of exotic plant species will guide priorities and establishes thresholds for action for IPM. This plan guides the current actions, the No Action Alternative. No adverse cumulative impacts are expected under any of the alternatives.
	Final Rural Landscape Management Program EIS, 1993	Determines landscape types and appearances at specific locations as well as providing a general goal relative to landscape. This plan would be consulted under the No Action Alternative and would be a guide to prioritization in IPM process. No adverse cumulative impacts are expected under any of the alternatives.
	Riparian Buffer Plan for Proposed Agricultural Lands, 2002	Uses vegetation to achieve effective stream buffer. For those buffers that may be treated for invasive plants, this plan will set objectives and priorities for treatment in all alternatives. No adverse cumulative impacts are expected under any of the alternatives.
	Wetland Protection Plan for Proposed Agricultural Lands, 2002	Agricultural lands may be a source of invasive species affecting distribution in wetlands. This plan would guide actions under the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. The PUP system checks for acreage proposed for treatment within a park to ensure that it does not exceed standards. No adverse cumulative impacts are expected under any of the alternatives.
	Disturbed Site Restoration Management Plan, 1994	Restoration influences distribution of invasive plants and restoration actions are a type of invasive plant management. This plan guides restoration actions in the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Wildland Fire Management Plan, 2004	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Degraded Wetland Restoration Plan, 2005	Wetland restoration must be considered as part of the annual work plan. This plan would guide actions under the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. The PUP system checks for acreage proposed for treatment within a park to ensure that it does not exceed standards. No adverse cumulative impacts are expected under any of the alternatives.
	Invasive Exotic Plant Management Recommendations for CUVA, 2007	Specific recommendations that would be incorporated into annual invasive plant management work plans are provided here. Recommendations would set priorities for treatment. No adverse cumulative impacts are expected under any of the alternatives.
	Resource Stewardship Strategies, in progress	Program level guidance that may address exotic plant management and guides implementation plans for vegetation management. All implementation plans must remain consistent with program level plans. No adverse cumulative impacts are expected under any of the alternatives.
EFMO	Fire Management Plan, in review 2011	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.

Park Unit	Plan Title	Potential Cumulative Impacts
HOCU	Fire Management Plan, 2004	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. At this time, park policy excludes the use of to achieve natural resource objectives. No adverse cumulative impacts are expected under any of the alternatives.
	Integrated Pest Management Plan, 2005	Addresses action plan for and treatment of tree of heaven, autumn and Russian olive, goldenrain tree, garlic mustard, multiflora rose, bush honeysuckles, and weeds on old fields.
LIBO	Fire Management Plan, 2003	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Report on the Trends in the Tree and Shrub Vegetation, 2004	Assist the park in prioritizing areas for invasive plant management actions. It complements and informs the EPMP. No adverse cumulative impacts are expected under any of the alternatives.
	Cultural Landscape Report, 2001	Contains treatment recommendations to achieve desired conditions for the cultural landscape that will inform the EPMP. No adverse cumulative impacts are expected under any of the alternatives.
	Forest Restoration, 1989	Assists the park in prioritizing areas for invasive plant management actions. It complements and informs the EPMP. No adverse cumulative impacts are expected under any of the alternatives.
ARPO	Fire Management Plan, 2004	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Cultural Landscape Report, 2006	Assists the park in determining desired conditions and in prioritizing areas for invasive plant management actions. No adverse cumulative impacts are expected under any of the alternatives.
	Draft Integrated Pest Management Plan, 2010	Provides guidance on controlling and eradicating weeds that will help to inform the EPMP annual work plans. Actions taken in the work plans must be consistent with this plan. No adverse cumulative impacts are expected under any of the alternatives.
HOSP	Fire Management Plan, 2005, update 2011	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	New GMP, in progress	Guide all program actions. No adverse cumulative impacts are expected under any of the alternatives. It will address the need to control invasive
	Cultural Landscape Report and Environmental Assessment, 2010	Applies specifically to the Historic District and few other areas. It will assist the park in determining desired conditions and in prioritizing areas for invasive plant management actions. Although its focus is on the cultural resources with little guidance for natural areas, it complements the EPMP. No adverse cumulative impacts are expected under any of the alternatives.

Park Unit	Plan Title	Potential Cumulative Impacts
BUFF	Terrestrial Habitat Management Plan and Environmental Assessment, 2006	Outlines enhancements to native habitats and restorations. This plan calls for low tolerance of invasive species. It also states, "herbicide use will not be authorized if pest species can be controlled with methods such as cutting, pulling, mowing, or burning." It guides the No Action Alternative and informs the selection and prioritization processes for Alternatives 2 and 3. It may allow expansion of rare or endangered plant habitat and the re-introduction of rare and uncommon plants into treatment areas. Monitoring prior to treatments and use of BPs and mitigations for Alternatives 2 and 3 will prevent potential interactions. No adverse cumulative impacts are expected under any of the alternatives.
OZAR	Fire Management Plan, 2004	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
GWCA	Fire Management Plan, 2004	Allows use of fire on park owned land for vegetation management and restoration. It permits the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include coordinating actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Prairie Restoration Management Review, 2009	Provides a history that allows managers to avoid actions that would be cumulative with past actions. No adverse cumulative impacts are expected under any of the alternatives.
	Prairie Management Recommendations, 2010	Determined desired conditions and prioritized areas for invasive plant management actions. This plan would guide actions under the No Action Alternative. It complements and informs the EPMP. Best practices for Alternative 2 and 3 include coordinating actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Prescription Burn History, 1982 - 2010	Provides a history that allows managers to avoid actions that would be cumulative with past actions. No adverse cumulative impacts are expected.
PERI	Fire Management Plan, 2005	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Vegetation Management Plan, in progress	Will integrate the cultural landscape and natural landscape in a way that takes a holistic approach to land management. This plan will provide guidance for annual work plans and complement the EPMP.
WICR	Fire Management Plan, 2007	Allows use of fire on park owned land for vegetation management and restoration. It permits the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include coordinating actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Cultural Landscape Report, 2004	Contains treatment recommendations to achieve desired conditions for the cultural landscape that will inform the EPMP. No adverse cumulative impacts are expected under any of the alternatives.
HEHO	Prairie Management Plan, 2003	This plan would guide actions under the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. Due to the age of this document, it would be retired with the implementation of the EPMP. No adverse cumulative impacts are expected under any of the alternatives.

Park Unit	Plan Title	Potential Cumulative Impacts
	Cultural Landscape Report, 1995	Contains recommendations for desired conditions for the cultural landscape and informs the EPMP. No adverse cumulative impacts are expected under any of the alternatives.
	Fire Management Plan, 2008	Allows use of fire on park owned land for vegetation management and restoration. It permits the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include coordinating actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
HOME	Vegetation Management Action Plan, 2004-2014	Guide actions under the No Action Alternative and would contribute the priorities for Alternatives 2 and 3. It would guide the development of annual work plans. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Fire Management Plan, 2009	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Cultural Landscape Report, 2000	Determines desired conditions and prioritizes areas for invasive plant management actions. It complements and informs the Vegetation Management Action Plan and the EPMP. No adverse cumulative impacts are expected under any of the alternatives.
PIPE	Fire Management Plan, 2009	Allows use of fire on park owned land for vegetation management and restoration. This plan would permit the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Integrated Pest Management Plan, 2009	Allows a cooperative agreement with Cooperative Weed Management Areas. It provides guidance on controlling and eradicating weeds and helps to inform the EPMP annual work plans. Work plans must be consistent with this plan. No adverse cumulative impacts are expected under any of the alternatives.
TAPR	Fire Management Plan, in review	Guides prescribed fire use for vegetation management and restoration. It permits the use of fire in an IPM management program and is currently part of the No Action Alternative. Best practices for Alternative 2 and 3 include coordinating actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.
	Cultural Landscape Report, 2004	Assists the park in determining desired conditions and in prioritizing areas for invasive plant management actions. Although its focus is on the cultural resources, the natural and cultural landscapes are integrated. Therefore, it complements and informs the EPMP. No adverse cumulative impacts are expected under any of the alternatives.
	Tallgrass Prairie Bottomland Restoration Plan, 2006	Guides actions under the No Action Alternative. This document will assist the park in prioritizing bottomland areas for invasive plant management actions. It also complements the EPMP by providing for restoration, a cultural method that is part of each alternative. Best practices for Alternative 2 and 3 include that managers coordinate actions under various implementation plans. No adverse cumulative impacts are expected under any of the alternatives.

4.2.4 Summary

Connected actions differ from adverse cumulative actions or impacts in that they are planned with a predetermined, beneficial, and collective outcome. Connected actions will occur from year to year under all alternatives. They are actions that are closely related to the proposal and alternatives. Connected actions automatically trigger other actions; they cannot or will not proceed unless other actions have been taken previously or occur simultaneously, or they are interdependent parts of a larger action and depend on the larger action for their justification. They are the product of long-term strategic planning.

Connected actions are implemented sequentially through annual work plans in this EPMP. The alternatives have a differing need for connected actions. The No Action Alternative and Alternative 3 may not result in rapid achievement of desired conditions. This may affect the amount of connected action required to attain program goals. Because each work plan will be reviewed for expected impacts, cumulative impacts can be avoided, but the best insurance for avoiding unexpected impacts is to complete the objective quickly, efficiently, and with the fewest connected actions. Thus, although cumulative impacts are not expected in any alternative, there is the potential for unintended consequences from multiple connected actions over time.

Similar actions are those that have similar geography, timing, purpose, or any other feature that provides a basis for evaluating their combined impacts, but they do not result in adverse cumulative impacts. Similar actions will occur in some parks and will result from actions under other implementation plans (Table 4.2.1). This EPMP is driven by the needs and recommendations of the parks. Some of these needs and recommendations are already stated in individual park implementation plans. The No Action Alternative is often guided by these plans. In Alternatives 2 and 3, similar actions will be taken into account when developing annual work plans and selecting the Optimum Tool through the decision-tree. Cumulative impacts will be reassessed during development of work plans in Alternatives 2 and 3. Work plans will be altered to minimize adverse cumulative impacts.

The impact analysis that was completed for each resource topic area (summary at Table 4.2.2) considered the potential for cumulative impacts. Cumulative impacts were also considered with regard to other stressors in the environment. Finally, cumulative impacts were considered with respect to other park projects and plans. No adverse cumulative impacts were found for the alternatives, and measures are in place for Alternatives 2 and 3 that would consider future cumulative impacts. The decision-tree presented in Chapter 2 and detailed in Appendix H highlights the extensive system used to minimize impacts to the environment and the multiple opportunities for checks on cumulative impacts.

Table 4.2.2. A summary of impacts related to each treatment type.

Equipment that may be used in implementing cultural practices is considered under the type of action, manual, mechanical, heavy equipment, etc. Impacts identified for cultural practices in general, such as prevention or education, are the same across all alternatives.

Green cells represent beneficial impacts and red cells represent the overall adverse impacts. Overall impacts are composite ranges for the constituents.

Alternative 1: No Action

Resource	Treatment	Impact Type	Intensity	Duration	Context
Water, Wetlands, and Karst Hydrology	Beneficial Invasive Plant Management	Direct	Negligible to minor	Short and long-term	Site-specific and local
	Manual / Mechanical	Direct and indirect	Minor	Short-term	Site-specific or local
	Mechanical: Heavy Equipment	Direct	Negligible to minor	Short-term	Local
	Pesticide	Direct and Indirect	Negligible to minor	Short-term	Local
	Overall Adverse Impacts	Direct and indirect	Negligible and minor	Short-term	Site-specific and local
Geology, including Soils and Karst Features	Beneficial Invasive Plant Management	Indirect	Negligible and minor	Long-term	Site-specific
	Manual / Mechanical	Direct	Negligible	Short-term	Site-specific
	Mechanical: Heavy Equipment	Direct and indirect	Minor	Short- to long-term	Local
	Pesticide	Direct	Minor	Short-term and long-term	Site-specific
	Overall Adverse Impacts	Directly and indirectly	Negligible and minor	Short-term and long-term	Site-specific and local
Vegetation Communities	Beneficial Invasive Plant Management	Direct	Negligible to moderate	Short-term to long-term	Local
	Manual / Mechanical	Direct	Negligible	Short-term	Site-specific
	Mechanical: Heavy Equipment	Direct and indirect	Negligible	Short-term	Site-specific
	Pesticide	Direct and indirect	Negligible to Minor	Short- and long-term	Site-specific
	Overall Adverse Impacts	Direct and indirect	Negligible and minor	Short- and long-term	Site-specific
Wildlife and Fish	Beneficial Invasive Plant Management	Indirect	Negligible to moderate	Short- to long-term	Local
	Manual / Mechanical	Direct and indirect	Negligible to minor	Short-term	Site-specific
	Mechanical: Heavy Equipment	Direct and indirect	Negligible to minor	Short-term	Site-specific
	Pesticide	Direct and indirect	Negligible to minor	Short-term	Site-specific
	Overall Adverse Impacts	Direct and indirect	Negligible and minor	Short-term	Site-specific
Threatened and Endangered	Beneficial Invasive Plant Management	Direct and indirect	Negligible to moderate	Short-term to long-term	Site-specific or local
	Manual / Mechanical	Direct and indirect	Minor	Short-term	Site-specific

Species	Mechanical: Heavy Equipment	Direct and indirect	Minor	Short-term to long-term	Site-specific to local
	Pesticide	Direct and indirect	Minor	Long-term	Site-specific
	Overall Adverse Impacts	Direct and indirect	Minor	Short-term to long-term	Site-specific to local
Archeological Resources	Beneficial Invasive Plant Management	Indirect	Moderate	Long-term	Site-specific
	Manual / Mechanical	Direct	Minor	Long-term	Site-specific
	Mechanical: Heavy Equipment	Direct	Minor	Long-term	Local
	Pesticide	Direct	Minor	Long-term	Site-specific
	Overall Adverse Impacts	Direct	Minor	Long-term	Site-specific and local
Cultural Landscapes	Beneficial Invasive Plant Management	Direct	Negligible to major	Long-term	Local
	Manual / Mechanical	Direct	Negligible	Short-term	Local
	Mechanical: Heavy Equipment	Direct	Minor	Short-term	Local
	Pesticide	Direct	Minor	Short-term	Local
	Overall Adverse Impacts	Direct	Negligible and minor	Short- and long-term	Local
Ethnographic Resources	Beneficial Invasive Plant Management	Direct and indirect	Negligible to moderate	Long-term	Local
	Overall Adverse Impacts	Direct and indirect	Minor	Short- term	Local
Visitor Use and Experience, including soundscapes	Beneficial Invasive Plant Management	Indirect	Negligible to moderate	Long-term	Local
	Manual / Mechanical	Direct and indirect	Minor	Short-term	Local
	Mechanical: Heavy Equipment	Direct and indirect	Minor	Short-term	Local
	Pesticide	Direct	Minor	Short-term	Site-specific
	Overall Adverse Impacts	Direct and indirect	Minor	Short-term	Site-specific and local

Table 4.2.2. (con't) A summary of impacts related to each treatment type.

Alternative 2: Preferred Alternative, IPM

Resource	Treatment	Impact Type	Intensity	Duration	Context
Water Resources and Karst System, including wetland, floodplain, and riparian values	Beneficial Invasive Plant Management	Indirect	Moderate	Long-term	local
	Manual / Mechanical	Direct	Negligible	Short-term	Site-specific
	Mechanical: Heavy Equipment	Direct and Indirect	Negligible	Short-term	Site-specific
	Pesticide	Direct	Negligible	Short-term	Site-specific
	Biological[36]	No known	Negligible	None	None
	Overall Adverse Impacts	Direct and Indirect	Negligible	Short-term	Site-specific
Geology, including soils and physical structure of karst (caves)	Beneficial Invasive Plant Management	Indirect	Moderate	Long-term	Site-specific
	Manual / Mechanical	Direct	Negligible	Short-term	Site-specific
	Mechanical: Heavy Equipment	Direct	Negligible	Short-term	Site-specific
	Pesticide	Direct	Negligible	Short-term	Site-specific
	Biological	No known	Negligible	None	None
	Overall Adverse Impacts	Direct	Negligible	Short-term	Site-specific
Vegetation	Beneficial Invasive Plant Management	Direct	Major	Long-term	Local
	Manual / Mechanical	Direct	Negligible	Short-term	Site-specific
	Mechanical: Heavy Equipment	Direct	Negligible	Short-term	Site-specific
	Pesticide	Direct	Negligible	Short-term	Site-specific
	Biological	Indirect	Negligible	Short-term	Site-specific
	Overall Adverse Impacts	Direct and indirect	Negligible	Short-term	Site-specific
Wildlife and fish	Beneficial Invasive Plant Management	Indirect	Moderate	Long-term	Local
	Manual / Mechanical	Indirect	Negligible	Short-term	Site-specific
	Mechanical: Heavy Equipment	Indirect	Negligible	Short-term	Site-specific
	Pesticide	Indirect	Negligible	Short-term	Site-specific
	Biological	Indirect	Negligible	Short-term	Site-specific
	Overall Adverse Impacts	Indirect	Negligible	Short-term	Site-specific
Threatened and Endangered Species	Beneficial Invasive Plant Management	Indirect	Major	Long-term	Site-specific and local
	Manual / Mechanical	Indirect	Negligible	Short-term	Site-specific
	Mechanical: Heavy Equipment	Indirect	Negligible	Short-term	Site-specific
	Pesticide	Indirect	Negligible	Short-term	Site-specific
	Biological	Indirect	Negligible	Short-term	Site-specific
	Overall Adverse Impacts	Indirect	Negligible	Short-term	Site-specific

[36] Specific biocontrols have not been identified, but are not excluded from potential use.

Archeological Resources	Beneficial Invasive Plant Management	Indirect	Moderate	Long-term	Site-specific
	Manual / Mechanical	Direct	Negligible	Long-term	Site-specific
	Mechanical: Heavy Equipment	Direct	Minor	Long-term	Local
	Pesticide	Direct	Negligible	Long-term	Site-specific
	Biological	No known	Negligible	None	None
	Overall Adverse Impacts	Direct	Negligible and minor	Long-term	Site-specific and local
Cultural Landscapes	Beneficial Invasive Plant Management	Direct	Major	Long-term	Local
	Manual / Mechanical	Direct	Negligible	Short-term	Local
	Mechanical: Heavy Equipment	Direct	Minor	Short-term	Local
	Pesticide	Direct	Negligible	Short-term	Local
	Biological	Indirect	Negligible	Short-term	Local
	Overall Adverse Impacts	Direct	Negligible and minor	Short-term	Local
Ethnographic Resources	Beneficial Invasive Plant Management	Direct and indirect	Major	Long-term	Local
	Overall Adverse Impacts	Direct	Negligible	Short-term	Local
Visitor Use and Experience, including soundscapes	Beneficial Invasive Plant Management	Direct and indirect	Moderate	Long-term	Site-specific
	Manual / Mechanical	Direct	Negligible	Short-term	Local
	Mechanical: Heavy Equipment	Direct	Minor	Short-term	Local
	Pesticide	Direct	Negligible	Short-term	Site-specific
	Biological	Indirect	Negligible	Short-term	Site-specific
	Overall Adverse Impacts	Direct and indirect	Negligible and minor	Short-term	Site-specific and local

Table 4.2.2. (con't) A summary of impacts related to each treatment type.

Alternative 3: No Pesticide, Biological, or Heavy Equipment

Resource	Treatment	Impact Type	Intensity	Duration	Context
Water Resources and Karst System	Beneficial Invasive Plant Management	Direct and Indirect	Minor	Short-term	Site-specific and Local
	Manual / Mechanical	Direct and Indirect	Negligible	Short-term	Site-specific
Geology, including Soils and Karst features	Beneficial Invasive Plant Management	Indirect	Negligible	Long-term	Site-specific
	Manual / Mechanical	Direct	Negligible	Short-term	Site-specific
Vegetation	Beneficial Invasive Plant Management	Direct	Minor	Long-term	Local
	Manual / Mechanical	Direct	Minor	Short- and Long-term	Site-specific
Wildlife and Fish	Beneficial Invasive Plant Management	Direct and indirect	Minor	Long-term	Site-specific and local
	Manual / Mechanical	Indirect	Minor	Long-term	Site-specific
Threatened and Endangered Species	Beneficial Invasive Plant Management	Direct and indirect	Minor	Long-term	Site-specific and local
	Manual / Mechanical	Indirect	Negligible	Long-term	Site-specific
Archeological Resources	Beneficial Invasive Plant Management	Indirect	Minor	Long-term	Site-specific
	Manual / Mechanical	Direct	Negligible	Long-term	Site-specific
Cultural Landscapes	Beneficial Invasive Plant Management	Direct	Moderate	Long-term	Local
	Manual / Mechanical	Direct	Negligible	Short-term	Local
Ethnographic Resources	Beneficial Invasive Plant Management	Direct and indirect	Moderate	Long-term	Local
	Manual / Mechanical	Direct	Negligible	Short-term	Local
Visitor Use/ Experience, soundscapes	Beneficial Invasive Plant Management	Direct and indirect	Moderate	Long-term	Site-specific
	Manual / Mechanical	Direct	Negligible	Short-term	Local

Table 4.3.1. Summary of impact analysis

Colors indicate the intensity of benefit (green) and the intensity of adverse impact (red). The greater the color intensity indicates the greater the impact intensity. Duration and context are not indicated in the color scheme, except when more than one intensity is represented. In such cases, a short-term, negligible and minor intensity received the pale color and a long-term impact of the same intensity received the darker shade.

Impact Topic	Alternative 1, No Action	Alternative 2, Integrated Pest Management	Alternative 3, No Chemical, Biological, or Heavy Equipment
Achieve objectives	Non-attainment for some of the 15 parks	Attainment	Attainment, but possibly requiring repeat treatment over time
Water, wetlands, and karst hydrology	directly beneficial, negligible to minor, short- and long-term, site-specific and local	indirectly beneficial, moderate, long-term, local	directly and indirectly beneficial, minor, short-term, site-specific and local
	directly and indirectly adverse, negligible to minor, short- term, local	indirect and directly adverse, negligible, short-term, site-specific	directly and indirectly adverse, negligible, short-term, site-specific
Geological Resources and Soils	indirectly beneficial, negligible to minor, long-term, site specific	indirectly beneficial, moderate, long-term, site-specific	indirectly beneficial, negligible, long-term, site-specific
	directly and indirectly adverse, negligible and minor, short-term and long-term, site-specific and local	directly adverse, negligible, short-term, site-specific	directly adverse, negligible, short-term, site-specific
Vegetation	directly beneficial, negligible to moderate, short- to long-term, local	directly beneficial, major, long-term, local	directly beneficial. minor, long-term, local
	indirect and directly adverse, negligible to minor, short- and long-term, site-specific	indirectly and directly adverse, negligible, short-term, site-specific	directly adverse, negligible, short- and long-term, site-specific
Wildlife and Fish	indirectly beneficial, negligible to moderate, short- and long-term, local	indirectly beneficial, moderate, long-term, local	directly beneficial, minor, long-term, site-specific and local
	indirect and directly adverse, negligible to minor, short-term, site-specific	indirectly adverse, negligible, short-term, site-specific	directly and indirectly adverse, minor, long-term, site-specific
Threatened and Endangered Species	indirect and directly beneficial, negligible to moderate, short- and long-term, site-specific	indirectly beneficial, major, long-term, site-specific and local	indirectly beneficial, minor, long-term, site-specific and local
	indirect and directly adverse, negligible to minor, short-term to long- term, site-specific or local	indirectly adverse, negligible, short-term, site-specific	indirectly adverse, negligible, long term, site-specific.
Archeological Resources	indirectly beneficial, moderate, long-term, site-specific	indirectly beneficial, moderate, long-term, site-specific	indirectly beneficial, minor, long-term, site-specific
	directly adverse, minor, long-term, site-specific and local	directly adverse, negligible and minor, long-term, site-specific and local	directly adverse, negligible, long-term, site-specific
Cultural Landscapes	directly and indirectly beneficial, negligible to moderate, long-term, local	directly and indirectly beneficial, major, long-term, local	directly and indirectly beneficial, moderate, long-term, local
	directly adverse, negligible and minor, short- and long-term, local	directly adverse, negligible and minor, short-term, local	directly adverse, negligible, short- term, local
Ethnographic Resources	indirectly beneficial, negligible to moderate, long-term, local	indirectly and indirectly beneficial, major, long-term, local	directly and indirectly beneficial, moderate, long-term, local
	directly and indirectly adverse, minor, short-term, local	directly adverse, negligible, short-term, site-specific	directly adverse, negligible, short-term, local
Visitor Use and Experience	indirectly beneficial, negligible to moderate, long-term, local	directly and indirectly beneficial, moderate, long-term, site-specific	indirectly and directly beneficial, moderate, long-term, site-specific
	directly and indirectly adverse, minor, short-term, site-specific and local	directly and indirectly adverse, negligible and minor, short-term, site-specific and local	directly adverse, negligible, short-term, local
Cumulative impacts	beneficial impacts are expected, commensurate with program effectiveness	beneficial impacts are expected, commensurate with program effectiveness	beneficial impacts are expected, commensurate with program effectiveness
	no adverse cumulative impacts are expected	no adverse cumulative impacts are expected	no adverse cumulative impacts are expected

4.4 Conclusions

This section summarizes (1) the degree to which each alternative meets the purpose and need, (2) overall impacts of each alternative, (3) major findings, (4) cumulative impacts, and impairment. Potential for the alternative to achieve program goals and objectives appears in Table 4.4.2. Potential impacts of alternatives were summarized in Table 4.3.1.

In general, the scope of this EPMP/EA was to develop a long-term management plan using an approach that would reduce the impacts of (or threats from) exotic and pest plants to native plant communities and other natural and cultural resources at 15 park units located in the Heartland Inventory and Monitoring Network. Alternatives 2 and 3 meet the purpose and need, but to varying degrees. The No Action Alternative fails to meet purpose and need by failing to meet the objectives of an invasive plant management program (Table 4.4.1).

Table 4.4.1. Achieving the objectives of program

Goal	Alternative	Goal attainment
Achieve desired conditions	1	In long-term, variable
	2	Most rapid achievement, yes
	3	In long-term, yes
Sustainable	1	No
	2	Yes
	3	Yes
Use Optimum Tool	1	Limited by CE, no
	2	Yes
	3	Potentially limited, no
Ensure planning and compliance	1	Limited, no
	2	Yes
	3	Yes
Use best management practices	1	No
	2	Yes
	3	Yes, but Optimum Tool may be excluded

Overall, Alternative 2 is most effective in meeting the project purpose and need, because it integrates a standardized approach to assist in decision-making that does not exclude potential tools. Alternative 3 is similar to Alternative 2 in providing an effective strategic process, but it limits the tools that managers may implement to treat invasive plant infestations, thus reducing the effectiveness of implementation. Alternative 2 is more immediately effective than Alternative 3, resulting in less time and fewer connected actions to attain desired conditions than with Alternative 3. The No Action Alternative has less overall beneficial effect because effectiveness of current invasive plant management programs is limited by available compliance and funding to implement treatment options. This limitation varies across parks.

The adverse impacts from the alternatives are mostly short-term, site-specific and local, and minor or less in intensity. Alternative 2 incorporates a greater number of standardized, resource-specific best management practices that would reduce adverse impacts to resources than does the No Action Alternative. The analysis shows that Alternative 2 has less intensive adverse impacts than the No Action Alternative, and similar adverse impact intensity as Alternative 3.

The analysis shows no adverse effect to threatened, endangered and state species of concern, or to irreplaceable materials, such as archeology, artifacts, or historical materials. A decision of no impairment was determined for every resource impact topic and each alternative. No major adverse impacts were determined for any impact topic.

Cumulative impacts are not expected, however cumulative impacts may potentially develop if connected or similar actions are managed in a way that they become cumulative. The relative adverse contributions of Alternative 2 to the overall cumulative impacts are predicted to be negligible because environmental conditions are part of the Optimum Tool decision-tree.

No potential conflicts were identified between the alternatives and other environmental laws and regulations. All alternatives achieve requirements of Sections 101 and 102(1) of NEPA. After the environmental analysis, Alternative 2: IPM became the environmentally preferable alternative, because of the safeguards placed on selecting actions and because of the likely effectiveness in achieving program goals. The environmentally preferable alternative is the alternative that will best promote the environmental benefit expressed in NEPA (Sec. 101 (b)). This includes alternatives that:

- fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- ensure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- preserve important historic, cultural, and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

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

Based on the impact analysis, Alternative 2 - Integrated Pest Management Plan is the preferred alternative.

5

Consultation, Coordination, and Civic Engagement

Consultation is discussion, conference, or forum in which advice or information is exchanged. Consultation generally takes place on an informal basis with many agencies, but formal consultation may also be required. Consultation with recognized tribes is done on a government-to-government basis.

Civic engagement is the philosophy of welcoming people into the parks and building relationships around a shared stewardship mission, such that the public engages in specific, active involvement in NPS planning and other decision-making processes.

This section summarizes agencies contacted during preparation of this document. A list of reviewers and preparers is also provided in Appendix E. Internal Scoping began in July 2010. External Scoping ran from November 2010 to March 15, 2011. Consultation letters were sent in December 2010 and consultation remained open through the drafting of the document. Consulting agency review is April and May of 2012. Public review of the document is scheduled to begin on July 1, 2012 and end on August 1, 2012.

5.1 Consultation with Other Agencies

Consultation with the State Historic Preservation Office (SHPO) and Tribal Historic Preservation Office (THPO), US Fish and Wildlife Service, and other entities or agencies is an ongoing process that does not begin or end with individual projects. It is a continuing discussion in which information or ideas are exchanged. Consultation can take place on an informal basis for most of the EA process, but formal consultation is required for compliance with some regulations. Consultation is required for federally listed endangered and threatened species or migratory birds (USFWS), and for impacts related to aquatic resources, floodplains, and wetlands (U.S. Army Corps of Engineers). It is also advisable to consult with state fish and game agencies when proposed actions may affect wildlife and fish habitat or populations.

The EPMT initiated consultation in November and December of 2010 with letters to agencies having jurisdiction over park resources. The EPMT divided the parks into clusters by state or area/districts, such that one letter went to each agency office with multiple parks listed as participants in the request for consultation. This reduced the amount of paperwork for both parks and the consulting agencies. The agencies were invited to consult with the individual parks in their jurisdiction and the EPMT to handle park specific issues. An example of the request for consultation appears in Appendix E.

Copies of letters responding to this initial consultation appear in Appendix E. The concerns and considerations went into the development of the alternatives and the listing of impact issues and topics to be analyzed in the environmental consequences.

The relationship between parks and their SHPO or THPO involves communication beyond that for most agency consultation. The NPS and SHPO or THPO work closely together at all times to ensure the preservation of archeological, ethnographic, and historic resources. Therefore, the EPMT initiated consultation on the programmatic approach to this EPMP/EA, but further consultation is ongoing to cover individual work plans.

The parks provided documentation of consultation in which the EPMT did not directly participate for inclusion in the EA. The EPMT analyzed the results of consultation and used this analysis in the final EA. Appendix E contains consultation information and the complete list of consulting agencies.

Consulting agencies received a letter requesting review of the draft EPMP/EA and the location of a digital copy of the document. They are generally given 30 days review time, but because of the length and breadth of this document, the time has been extended to 45 days. Results of consultation on the draft EPMP/EA will be included in the final document. Compliance documentation becomes part of the permanent record of decision.

5.1.1 Tribal Consultation

The Midwest Regional Office Ethnography staff and the parks were contacted for a comprehensive list of affiliated American Indian tribes for each park. That list of tribes is presented in Appendix E. Parks sent out their own tribal consultation letters.

Several tribes responded to the initial consultation letter. All tribal representatives identified for government-to-government consultation were sent the Internet address to download a copy of the draft EPMP/EA for review and comment.

5.1.2 US Fish and Wildlife Service

The initial consultation letter was sent to each of the eight Ecological Services Field Offices with jurisdiction encompassing the 15 parks. The request for consultation was in accordance with the ESA, Section 7, and the Migratory Bird Treaty. The Ohio Field Office provided an informal consultation with mitigations that were included in this EPMP/EA. All of the Field Offices with jurisdiction including a park were asked to consult and were invited to review the draft EPMP/EA.

5.1.3 US Environmental Protection Agency and US Army Corps of Engineers

The initial consultation letter was sent to each of the three EPA regional Environmental Services Division offices and seven U.S. Army Corps of Engineers district offices with jurisdiction encompassing the 15 parks. The request for consultation, in accordance with the CWA, sought to obtain expert assistance in assessing environmental consequences of the proposed action. No responses were received from the two agencies' regional and district offices. The same offices were asked to consult and review the draft EPMP/EA.

5.1.4 State Historic Preservation Officers

Each of the eight states in which parks reside has SHPO offices. The initial consultation letter was sent to each of the eight offices. The request for consultation was in accordance with NHPA and the Programmatic Agreement of 2009. Initial consultation response came from Arkansas SHPO and Kansas SHPO, both of which indicated interest in further consultation and review of the proposed actions. All SHPO offices were asked to consult and review the draft EPMP/EA.

5.1.5 State Natural Resources or Environmental Regulatory Agency

Twelve state agencies dealing with natural resources and environmental quality were identified for the 15 parks. The initial consultation letter was sent to each of the 12 offices, but no responses were received. All state offices were asked to consult and review the draft EPMP/EA.

5.1.6 Other Consulting Agencies

Numerous state, county, local, and regional agencies and organizations were contacted for consultation. Many are listed in Appendix E, but this is not an exhaustive list. Parks initiated consultation beyond what was done through the EPMT coordinator. These lists are available from the individual parks. Several of these entities responded with a letter providing cooperation and advice. These same organizations were asked to consult and review the draft EPMP/EA.

5.1.7 Technical Experts Providing Input

The technical experts were taken from the Interdisciplinary Team and Internal Scoping participants listed in Appendix E.

5.2 Summary of Civic Engagement

In all planning and strategy development, the NPS seeks input from its stakeholders. The EA process allows opportunities for public dialogue and strengthens ties with stakeholders. By engaging people with traditional, cultural or ethnic ties to NPS lands, and other partners and stakeholders, the NPS broadens its perspective on stewardship of public trust resources. Public involvement exemplifies the NPS desire to conduct the management of public resources in an open and inclusive manner.

Each park determined the best civic engagement activities to fulfill the external scoping and to advertise the public comment period (Table 5.1.0). The PEPC online software (external access: http://parkplanning.nps.gov/; internal access: https://pepc.nps.gov/userHome.cfm) provides the location for internal and external documents related to civic engagement. Parks and the EPMT published documents for public communication and meetings, using the tools available in PEPC and other digital media. A list of the individuals and organizations contacted by the program in conjunction with the preparation and review of this EA is kept by the parks. Records of civic engagement and consultation have been kept by the EPMT and copies of park specific communications are located at each park. Examples of those communications appear in Appendix E.

The announcement of initiation of planning to control invasive plants in 15 NPS parks within the Heartland Network was undertaken by each park with EPMT support and materials. Several parks submitted a civic engagement plan to the EPMT to outline their methods of contacting stakeholders and the public about external scoping, commenting procedures, and availability of the draft EA for review and comment. The project was entered into PEPC for general dissemination. The notification of initiation of planning and the PEPC entry began the period of external scoping in November 2010. The following actions were taken by parks to inform the public and welcome comment. Examples of products are located in Appendix E.

Table 5.1.0. Parks engaged the public and stakeholders using the following methods.

Park	Type
Arkansas Post National Memorial	Civic Engagement Plan External Scoping news release to media External Scoping letter to stakeholders Announcement of availability
Buffalo National River	Civic Engagement Plan External Scoping News release External Scoping Post cards Announcement of availability
Cuyahoga Valley National Park	Civic Engagement Plan External Scoping – 231 news releases External Scoping homepage announcement External Scoping 97 stakeholder letters

Park	Type
	Announcement of availability
Effigy Mounds National Monument	Civic Engagement Plan External Scoping News release Announcement of availability
George Washington Carver National Monument	Civic engagement plan External Scoping letter to stakeholders External Scoping news release Announcement of availability
Herbert Hoover National Historic Site	Civic Engagement Plan External Scoping news release External Scoping Twitter and homepage Announcement of availability
Homestead National Monument of America	Civic Engagement Plan External Scoping Facebook and Twitter announcing meeting to cover all park projects Meeting for upcoming projects Announcement of availability
Hopewell Culture National Historical Park	Civic Engagement Plan External Scoping news release to media External Scoping 18 stakeholders' letters External Scoping press release posted to website Announcement of availability
Hot Springs National Park	Civic Engagement Plan External Scoping news release Announcement of availability
Lincoln Boyhood National Memorial	Civic Engagement Plan External Scoping news release to media Announcement of availability
Ozark National Scenic Riverways	Civic Engagement Plan External Scoping news release External Scoping stakeholder letters (12) Announcement of availability
Pea Ridge National Military Park	Civic Engagement Plan External Scoping stakeholder letters (27)

Park	Type
	External Scoping news release
	Announcement of availability
	Civic Engagement Plan
Pipestone National Monument	External Scoping news release
	External Scoping stakeholder letters
	Announcement of availability
	Civic Engagement Plan
Tallgrass Prairie National Preserve	civic engagement will only be done for draft availability not External Scoping
	Announcement of availability
	Civic Engagement Plan
Wilson's Creek National Battlefield	External Scoping news release
	External Scoping stakeholder letters
	Announcement of availability

Interested individuals were encouraged to submit external scoping comments through PEPC, to the park, or to the EPMT. Comments received by the park or EPMT were entered into PEPC, when feasible, and analyzed in the comment report. Twenty-four entries were recorded for External Scoping. Results of public comment were analyzed by the EPMT and topics, issues, and alternatives were considered in developing the planning document (Table 5.2.0)

The draft EPMP/EA is sent to key reviewers and the parks in hardcopy or digital format. Announcements are made about the availability of the EA on PEPC to news media and stakeholders, in accordance with the Civic Engagement Plan developed by each park. Interested parties will be referred to PEPC to obtain a copy of the draft and to make comment. The EPMT and parks will send digital copies to all who specifically request a copy and provide an address. Parks receive extra hardcopies and digital versions of the EPMP/EA for local dissemination. Results of public comment are analyzed by the EPMT and included in the final EPMP/EA.

Content Analysis Report (6/1/2012)

Document ID: 34872
Document Title: Heartland Exotic Plant Management Plan External Scoping

Table 5.2.0. Comment distribution by code
(Note: Each comment may have multiple codes. As a result, the total number of comments may be different from the actual comment totals)

Code	Description	Correspondences
TQ0001	Topic Question 1	15
TQ0002	Topic Question 2	13
AE31000	Affected Environment: Water quality karst watershed	3
AE19000	Affected Environment: Other Agencies? Land Use Plans	1
AE12000	Affected Environment: Wildlife And Wildlife Habitat	1
AL5000	Alternatives: Specific recommendations	7
IN100	ISSUES - Natural resource issues	5
KN0001	Knowledge base: knowledge is inadequate to address issue; research is needed	1
MT1000	Miscellaneous Topics: General Comments	3
PN12000	Purpose and Need: Conceptual Support	5
PN10000	Purpose And Need: Issues Eliminated From Further Consideration	1
PN8000	Purpose And Need: Objectives In Taking Action	3
PN13000	Purpose and Need: Support for restoration of native vegetation	2
VN100	VALUES - Value the natural resources or setting (flora, fauna, views, natural quiet, undeveloped areas)	1
WQ4000	Water Resources: Impact Of Proposal And Alternatives	1

Table 5.3.0. Correspondence distribution by correspondence type

Type	Number of Correspondences
Web Form	17
Letter	4
E-mail	2
Other	1
Total	**24**

5.3 List of Reviewers and Prepares

Principal preparers are

Sherry Middlemis-Brown, planning coordinator

Craig Young, EPMT coordinator

The EPMP/EA Interdisciplinary Team

Regional 106 coordinator Midwest Region

Nick Chevance, NEPA specialist, MWRO

Roberta Young, 106 advisor, MWRO

Anne Vawser, archeologist

Cary Wiesner, NEPA specialist, HEHO

Christopher Davis, NEPA specialist, CUVA

Joe Strenfel, NHPA specialist, OZAR

Sarah Allely, natural resource specialist, ARPO

Mike Capps, natural resource specialist, LIBO

Charles Bitting, natural resource specialist, BUFF

Kimberly Houf, natural resource specialist, OZAR

Jesse Bolli, natural resource specialist, HOME

Kristen Hase , natural resource specialist, TAPR

Seth Hendriks , natural resource specialist, PIPE

Lana Henry, natural resource specialist, GWCA

Nolan Moore, natural resource specialist, PERI

Dafna Reiner, natural resource specialist, HOCU

Rodney Rovang, natural resource specialist, EFMO

Stephen Rudd, natural resource specialist, HOSP

Gary Sullivan, natural resource specialist, WICR

Additional NPS Advisors

Meg Plona, natural resource specialist, CUVA

Marla McEnaney, 106 advisor, MWRO

Barbara Wilson, chief of resources, BUFF

Ron Cockrell, NHPA specialist, MWRO

Merrith Baughman, chief of resources, HOME

Jim Nepstad, superintendent, EFMO

Reviewers TBD

Bibliography and Literature Cited

Allely, Sarah. 2012. Integrated Pest Management Plan, Arkansas Post National Memorial. Unpublished plan. 16 pp.

Asher, J. A., and D. W. Harmon. 1995. Invasive exotic plants are destroying the naturalness of U.S. Wilderness areas. International Journal of Wilderness 1:35-37.

Bahr Vermeer Haecker Architects. 2004. Tallgrass Prairie National Preserve Cultural Landscape Report. National Park Service, Midwest Regional Office. Omaha, Nebraska. Contract Number 1443C6000990002. 448 pp.

Bailey, Robert G. 1985. Descriptions of the Ecoregions of the United States, 2d ed. Rev. and expanded (1st ed. 1980). USD Agriculture, Miscellaneous Publication 1391 (rev.), Washington, D.C. 108 pp. with separate map at 1:7,500,000.

Bearss, Edwin C. 1971. The Hoover Houses and Community Structures Historic Structures Report. Herbert Hoover National Historic Site, West Branch, Iowa. Unpublished. National Park Service.

Benn, David and Stadler, Scott. 2007. Effigy Mounds National Monument archaeological overview and assessment. FINAL ed. Cresco, Iowa: Bear Creek Archeology, Inc. Unpublished report for Midwest Archeological Center, Lincoln, Nebraska.

Benson, Forrest M. and Donald S. Libbey. Unknown date. History of Hot Springs National Park. Unpublished report. 55pp.

Bitting, Charles J. and Michael E. Slay, 2004. An inventory of endangered bats of the Lower Buffalo Wilderness, Buffalo National River.

Bowles, D. E. 2009. Aquatic invertebrate monitoring at Pipestone National Monument: 2005-2007 trend report. Natural Resource Technical Report NPS/HTLN/NRTR—2009/241. National Park Service, Fort Collins, Colorado.

Bowles D. E., H. R. Dodd, and J. A. Luraas. 2010. Aquatic invertebrate Monitoring at Herbert Hoover National Historic Site, 2008. Natural Resource Data Series NPS/HTLN/NRDS—2010/053. National Park Service, Fort Collins, Colorado.

Bozell, John R. 2005. An archeological overview and assessment of Homestead National Monument of America, Gage County, Nebraska. Contract Completion Report for Midwest Archeological Center, Lincoln, Nebraska, National Park Service.

Carlson-Drexler, C.G. D. D. Scott and H. Roeker. 2008. "The Battle Raged…with Terrible Fury:" Battlefield Archeology of Pea Ridge National Military Park. National Park Service, Midwest Archeological Center. Lincoln, Nebraska. Technical Report No. 112: 170 pp.

Cornell University Cooperative Extension, http://ipmguidelines.org/Turfgrass/content/CH01/default.asp, accessed October 27, 2010.

Cornell University Cooperative Extension, Pesticide Information Profile. 1994. http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html Accessed October 27, 2010.

Cribbs, J.T. and D.G. Peitz. 2007. White-tailed Deer Monitoring at Pea Ridge National Military Park, Arkansas: 2007 Status Report. Natural Resource Technical Report NPS/HTLN/NRTR—2007/026. National Park Service, Fort Collins, Colorado.

Cribbs, J.T., C.C. Young, J.L. Haack, and H.J. Etheridge. 2007. Invasive exotic plant monitoring at George Washington Carver National Monument: Year 1 (2006). Natural Resource Technical Report NPS/HTLN/NRTR—2007/017. National Park Service, Fort Collins, Colorado.

Cribbs, J.T., C.C. Young, J.L. Haack, and H.J. Etheridge. 2007. Invasive exotic plant monitoring at Lincoln Boyhood National Memorial: Year 1 (2006). Natural Resource Technical Report NPS/HTLN/NRTR—2007/021. National Park Service, Fort Collins, Colorado.

Cribbs, J.T. and D.G.Peitz. 2008. White-tailed Deer Monitoring at Wilson's Creek National Battlefield, Missouri: 2008 Status Report. Natural Resource Technical Report NPS/HTLN/NRTR—2008/102. National Park Service, Fort Collins, Colorado.

Cribbs, J.T. and D.G. Peitz. 2008a. White-tailed Deer Monitoring at Arkansas Post National Memorial, Arkansas: 2008 Status Report. Natural Resource Technical Report NPS/HTLN/NRTR—2008/103. National Park Service, Fort Collins, Colorado.

Cribbs, J.T. and D.G. Peitz. 2008b. White-tailed Deer Monitoring at Pea Ridge National Military Park, Arkansas: 2008 Status Report. Natural Resource Technical Report NPS/HTLN/NRTR—2008/104. National Park Service, Fort Collins, Colorado.

DeBacker, M.D., C.C. Young (editor), P. Adams, L. Morrison, D. Peitz, G.A. Rowell, M. Williams, and D. Bowles. 2005. Heartland Inventory and Monitoring Network and Prairie Cluster Prototype Monitoring Program Vital Signs Monitoring Plan. National Park Service, Heartland Inventory and Monitoring Network and Prairie Cluster Prototype Monitoring Program, Wilson's Creek National Battlefield, Republic, Missouri, 104 pp. plus appendices.

Djuren, C.M. and C.C. Young. 2007. Invasive exotic plant monitoring at Cuyahoga Valley National Park: Year 1 (2007). Natural Resource Technical Report NPS/HTLN/NRTR—2007/063. National Park Service, Fort Collins, Colorado.

Dodd, H. R., 2010. Personal communication.

Dodd, H. R., L. W. Morrison, and D. G. Peitz. 2010. Fish community monitoring at Tallgrass Prairie National Preserve: 2001-2008 trend report. Natural Resource Technical Report NPS/HTLN/NRTR—2010/325. National Park Service, Fort Collins, Colorado. (EPA 2003) in NGP EA as USEPA 2003

Dodd, H. R., L. W. Morrison, and D. G. Peitz. 2010a. Fish community monitoring at Pipestone National Monument: 2001-2008 summary report. Natural Resource Technical Report NPS/HTLN/NRTR—2010/366. National Park Service, Fort Collins, Colorado.

Dodd, H. R., D. E. Bowles, and S. K. Mueller, and M. K. Clark. 2011. Fish community monitoring at Wilson's Creek National Battlefield: 2006-2007, 2010 status report. Natural Resource Data Series NPS/HTLN/NRDS—2011/176. National Park Service, Fort Collins, Colorado.

Ehrenfeld, J.G. 2003. The effects of exotic plant invasions on soil nutrient cycling processes. Ecosystems 6:503-523.

EPA. Integrated Pest Management (IPM) Principles. http://www.epa.gov/pesticides/factsheets/ipm.htm#setaction. Accessed 6 April 2011.

EPA. Pesticide Product Labels. www.epa.gov/pesticides/regulating/labels/product-labels.htm. Accessed 6 April 2011.

Executive order 13112. 1999. Federal Register, Vol. 64, No. 25, Monday, February 8, 1999, Presidential Documents. p.6183

Finney, Fred A. 2002. Calumet, canal, and Cuyahoga: An archaeological overview and assessment of the Cuyahoga Valley National Park, Ohio. Contract Completion Report No, 22 from Upper Midwest Archaeology, St. Paul Minnesota and St. Joseph, Illinois. Unpublished, prepared for Midwest Archeological Center; Lincoln, Nebraska, National Park Service.

Finney, Fred A. 2005. An Archeological Overview and Assessment of the Herbert Hoover National Historic Site, West Branch, Iowa. Contract Completion Report, No. 41 from Upper Midwest Archeology, St. Paul Minnesota and St. Joseph, Illinois. Unpublished, prepared for Midwest Archeological Center; Lincoln, Nebraska, National Park Service.

Finney, Fred A. 2006. An archeological overview and assessment of the Ozark National Scenic Riverways, Missouri. Contract Completion Report, No. 62, from Upper Midwest Archeology, St. Paul Minnesota and St. Joseph, Illinois. Unpublished, prepared for Midwest Archeological Center; Lincoln, Nebraska, National Park Service.

Frost, Forest and Scott Stadler, 2000. Intensive Archeological Resource Inventory of Lincoln Boyhood National Memorial, Spencer County, Indiana, 1997-1999: Results and Recommendations. Technical Report No. 64, U.S. Department of Interior, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Fitzgerald, Kathleen. 2007. Pipestone National Monument: Ethnographic Landscape Report. Unpublished report. National Park Service.

Forest Service. 2006. 2,4-D Human Health and Ecological Risk Assessment Final Report. U. S. Department of Agriculture, Arlington, VA. 245 pp.

Gray, H.R.A. and L.L.C. Pope. 2002. The Evolution of a Sanctified Landscape: A Historic Resource Study of the Lincoln Boyhood National Memorial. Prepared for National Park Service. Contract No. P6300000125.

Hartzler, Bob. Department of Agronomy, Iowa State University, http://www.weeds.iastate.edu/mgmt/, accessed October 27, 2010.

James, K. 2008. Forest Community Monitoring Baseline Report, Pea Ridge National Military Park. Natural Resource Technical Report NPS/HTLN/NRTR—2008/082. National Park Service, Fort Collins, Colorado. Jenkins 1996 BUFF

Jones, Bruce A. 1999. Archeological Overview and Assessment for Tallgrass Prairie National Preserve, Chase County, Kansas.

Kansas Department of Wildlife and Parks, Strategic Plan 1991-1996. Sixth Edition.

Knight KS, Long RP, and Rebbeck J. 2007. Predicting emerald ash borer-induced changes in forest tree species composition. In: Mastro, Victor; Lance, David; Reardon, Richard; Parra, Gregory, comps. Proceedings, Emerald ash borer and Asian longhorned beetle research and technology development meeting. pp. 25-26. Cincinnati, OH 29 Oct. – 2 Nov. 2006. FHTET-2007-04. Morgantown, WV: U.S. Department of Agriculture, Forest Service, Forest Health.

Larrabee, Edward M. 1967. Preliminary Excavations at the Cabin Site, Lincoln Boyhood National Memorial, Lincoln City, Indiana. Report on file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Larrabee Edward and Susan Kardas, 1968. Test Excavations for the Proposed Garden Area, Lincoln Boyhood National Memorial, Lincoln, City, Indiana. Report on file, National Park Service, Midwest Archeological Center, Lincoln, Nebraska.

Mauck, Jeffrey G. and Henry S. McKelway. 1996.An Archeological Overview and Assessment of Lincoln Boyhood National Memorial, Spencer County, Indiana. Contract Completion Report by Cultural Resource Analysis, Inc. Lexington, KY. Unpublished, prepared for Midwest Archeological Center; Lincoln, Nebraska, National Park Service.

McCrea, Jerry and Carol L.J. DiSalvo. 2001. Integrated pest management: What is it? What has it done for the National Park System? From Crossing Boundaries in Park Management: Proceedings of the 11th Conference on Research and Resource Management in Parks and on Public Lands, edited by David Harmon (Hancock, Michigan: The George Wright Society, 2001).

McEnaney, Marla. 2001. The Noble Avenue: Lincoln Boyhood National Memorial Cultural Landscape Report. Unpublished National Park Service.

Mlekush, Karola, and M.D. DeBacker. 2003. Forest Inventory of Vascular Plants at Homestead National Monument of America and Annual Plant Community Monitoring Results, 2002. Heartland Network Inventory and Monitoring Program, unpublished report. National Park Service.

Morse, L.E., J.M. Randall, N. Benton, R. Hiebert, and S. Lu. 2004. An Invasive Species Assessment Protocol: Evaluating Non-Native Plants for Their Impact on Biodiversity. Version 1. NatureServe, Arlington, Virginia.

National Register of Historic Places Registration Form. 1986. Arkansas Post National Memorial.

NPS. Unknown date. Historic Resource Study and Administrative History. George Washington Carver National Monument, Missouri. Unpublished. 114 pp.

NPS. Unknown date. Hopewell Cultural National Historical Park. Cultural Landscapes Inventory – Hopewell Mound Group. 41 pp.

NPS. 1985. Land Use Plan, Cultural Landscape Report, Buffalo, Boxley Valley: Buffalo National River, Harrison, Arkansas. National Park Service. 72 pp.

NPS. 1986. Arkansas Post National Memorial. National Register of Historic Places Registration Form.

NPS. 1987. Menard-Hodges Site. National Register of Historic Places Inventory – Nomination Form. U.S. Dept. of Interior. 28 pp.

NPS. 1989. Arkansas Post National Memorial. National Register of Historic Places Registration Form, Osotuoy Unit. U.S. Department of Interior.

NPS. 1991. Natural Resources Management Guideline, NPS-77.

NPS. 1995. Herbert Hoover National Historic Site: Cultural Landscape Report. Unpublished report of NPS Midwest Region, Omaha, Nebraska and Land and Community Associates, Dunbar/Jones Partnership; Snyder & Associates, Inc.; John Milner Associates; and Andropogon Associates, Ltd. Omaha, Nebraska, NPS, Midwest Region.

NPS. 1995a. Ozark National Scenic Riverways Resource Management Plan. Unpublished strategic plan. National Park Service.

NPS. 1995b. National Register of Historic Places Registration Form. Wilson's Creek National Battlefield.

NPS. 1998. Arkansas Post National Memorial. National Register of Historic Places – Registration Form (update of 1960 nomination). U.S. Dept. of Interior. 16 pp.

NPS. 1999. CVNRA Rare Plant Monitoring. Unpublished report. National Park Service.14 pp.

NPS. 1999a. Hopewell Cultural National Historical Park. Cultural Landscapes Inventory – Hopetown Earthworks.

NPS. 1999b. Hopewell Cultural National Historical Park. Cultural Landscapes Inventory – Mound City Group. 34 pp.

NPS. 1999c. Hopewell Cultural Resource Management Plan. Unpublished strategic plan. National Park Service. 35 pp.

NPS. 2000. Homestead National Monument of America Cultural Landscape Report. Unpublished. 294 pp.

NPS. 2000a. Tallgrass Prairie National Preserve General Management Plan. 2000. Unpublished plan. National Park Service.

NPS. 2001. CUVA deer study impact to bottomland forest. Unpublished report.

NPS. 2001a. Director's Order 12: Conservation Planning, Environmental Impact Analysis, and Decision-making. Handbook effective date: January 8, 2001. 127 pp.

NPS. 2003. Final General Management Plan/Environmental Impact Statement of Arkansas Post National Memorial.

NPS. 2003b. Prairie Management Plan. Herbert Hoover National Historic Site. Unpublished plan. 44 pp.

NPS. 2004. Cultural Landscape Report, Part I and II. Wilson's Creek National Battlefield, Republic, Missouri, Prepared for National Park Service, Midwest Regional Office, Omaha, Nebraska. Prepared by John Milner Associates, Inc., Charlottesville, Virginia; Rivanna Archaeological Consulting, Charlottesville, Virginia; Conservation Design Forum, Elmhurst, Illinois; Bahr Vermeer & Haecker, Architects, Lincoln, Nebraska. 385 pages.

NPS. 2004a. Fire Management Plan for Ozark National Scenic Riverways. Unpublished plan. National Park Service.

NPS. 2004b. Fire Management Plan for George Washington Carver National Monument. Unpublished plan. National Park Service.

NPS. 2004c. Fire Management Plan for Hopewell Cultural National Historic Park. Unpublished plan. National Park Service. 138 pp.

NPS. 2004d. Fire Management Plan for Wilson's Creek National Battlefield. Unpublished plan. National Park Service. 222 pp.

NPS. 2004e. Homestead National Monument of America: Vegetation Management Action Plan 2004-2014. Unpublished internal document. National Park Service.

NPS. 2005. Arkansas Post National Memorial, Gillett, Arkansas, Cultural Landscape Report: Parts I and II. National Park Service, Internal Reports 1443CX600094014/ 1443PX605097811. 543 pp.

NPS. 2005a. Degraded Wetland Restoration Plan. Cuyahoga Valley National Park. Unpublished plan. National Park Service. 23 pp.

NPS. 2005b. Fire Management Plan: Environmental Assessment, Hot Springs National Park, Hot Springs, Arkansas, 2005. Unpublished. National Park Service.

NPS. 2005c. Integrated Pest Management Plan. Hopewell Cultural National Historic Park. Unpublished plan. National Park Service. 21 pp.

NPS. 2005d. Pea Ridge National Military Park Fire Management Plan and Environmental Assessment. Unpublished. National Park Service.

NPS. 2005e. Northern Great Plains Exotic Plant Management Plan and Environmental Assessment. Unpublished plan. National Park Service. 364 pp.

NPS. 2006. Environmental Impact Methodologies and Thresholds. Unpublished guidance March 23, 2006. National Park Service.

NPS. 2006b. Final Hoover Creek Stream Management Plan and Environmental Impact Statement. Herbert Hoover National Historic Site, Iowa. National Park Service. 277 pp.

NPS. 2006c. Herbert Hoover National Historic Site Cultural Landscape, Inventory Unit Summary and Site Plan. Unpublished. National Park Service. 37 pp.

NPS. 2006d. NPS Management Policies 2006. National Park Service, US Department of Interior. pp. 180.

NPS. 2006e. Terrestrial Habitat Management Plan and Environmental Assessment. Buffalo National River, Arkansas. Unpublished plan. National Park Service.

NPS. 2008. Effigy Mounds National Monument Ecological Condition Assessment, v.2. Unpublished report prepared by Missouri Resource Assessment Partnership, University of Missouri for National Park Service. 162 pp.

NPS. 2009. Director's Order 12 Handbook Interim Guidance, Director's Order 12 Categorical Exclusions. Replaces DO-12 Handbook Chapter 3, Sections 3.3, ¾, and 3.5. 13 pp.

NPS. 2009a. Integrated Pest Management Plan. Pipestone National Monument. Unpublished plan. 123 pp.

NPS. 2010. George Washington Carver National Monument Cultural Landscape Inventory. Unpublished. 18 pp.

NPS. 2010a. Hot Springs National Park Cultural Landscape Report and Environmental Assessment. Prepared by Quinn Evans, Mundus Bishop Design, and Woolpert, Inc. under TO # Q6068060019, unpublished report. 707 pp.

NPS. 2011. NPS » Explore Nature » Air » Permits » ARIS » I & M Networks » HTLN. http://www.nature.nps.gov/air/Permits/aris/networks/htln.cfm?CFID=7343740&CFTOKEN=34424057. Accessed May 20, 2011.

Ohio DNR. 2010. Ohio Department of Natural Resources Endangered Species List. http://www.dnr.state.oh.us/tabid/6005/default.aspx, accessed April 18, 2011.

Ohio EPA. 1999. 3745-1-32 Ohio river standards, rules 3745-1-01 to 3745-1-07 of the Administrative Code, and rules 3745-1-34 to 3745-1-36 of the Administrative Code. http://www.epa.state.oh.us/portals/35/rules/01-32.pdf%20, accessed April 11, 2011.

Pavlovic, Noel B. and Mark White. 1989. Forest Restoration of Lincoln Boyhood National Memorial: Presettlement, Existing Vegetation, and Restoraion Management Recommendations. National Park Service Research/Resources Management (NPS MWR-15 1989).

Peitz, D.G. 2009. Bird monitoring at Pea Ridge National Military Park, Arkansas 2008 status report. Natural Resource Technical Report NPS/HTLN/NRTR—2009/194. National Park Service, Fort Collins, Colorado.

Peitz, D.G. 2009b. Bird monitoring at Wilson's Creek National Battlefield, Missouri 2008 status report. Natural Resource Technical Report NPS/HTLN/NRTR—2009/195. National Park Service, Fort Collins, Colorado.

Peitz, D. G. 2010. Bird community monitoring at Pipestone National Monument, Minnesota: 2009 status report. Natural Resource Data Series *NPS/HTLN/NRDS--2010/045*. National Park Service, Fort Collins, Colorado.

Peitz, D. G. 2010b. Bird community monitoring at Homestead National Monument of America, Nebraska: 2009 status report. Natural Resource Data Series NPS/HTLN/NRDS--2010/046. National Park Service, Fort Collins, Colorado.

Peitz, D. G. 2010c. Bird community monitoring at Herbert Hoover National Historic Site, Iowa: 2005 – 2010 status report. Natural Resource Data Series NPS/HTLN/NRDS—2010/102. National Park Service, Fort Collins, Colorado.

Peitz, D. G. 2010d. Bird Community Monitoring at Effigy Mounds National Monument, Iowa: 2009 - 2010 status report. Natural Resource Data Series NPS/HTLN/NRDS—2010/111. National Park Service, Fort Collins, Colorado.

Peitz, David G. 2011. Bird community monitoring at Arkansas Post National Memorial, Arkansas: Status report. Natural Resource Data Series NPS/HTLN/NRDS—2011/209. National Park Service, Fort Collins, Colorado.

Peitz, D. G. 2011a. Bird community monitoring at Lincoln Boyhood National Memorial, Indiana: Status report. Natural Resource Data Series NPS/HTLN/NRDS—2011/210. National Park Service, Fort Collins, Colorado.

Peitz, D. G. 2011b. Bird community monitoring at Tallgrass Prairie National Preserve, Kansas: 2001- 2010 status report. Natural Resource Data Series NPS/HTLN/NRDS—2011/165. National Park Service, Fort Collins, Colorado.

Peitz, D. G. 2011c.White-tailed Deer Monitoring at Pea Ridge National Military Park, Arkansas: 2005-2011 interactive report found at http://science.nature.nps.gov/im/units/htln/library/Wildlife/Deer/PERI_Deer_2011_r.pdf

Peitz, D. G. 2011d.White-tailed Deer Monitoring at Wilson's Creek National Battlefield, Missouri: 2005-2011 interactive report found at http://science.nature.nps.gov/im/units/htln/library/Wildlife/Deer/WICR_Deer_2011_r.pdf

Peitz, D. G. 2011e.White-tailed Deer Monitoring at Arkansas Post National Memorial, Arkansas: 2005-2011 interactive report found at http://science.nature.nps.gov/im/units/htln/library/Wildlife/Deer/ARPO_Deer_2011_r.pdf

Peitz, David G. and J. Tyler Cribbs. 2005. Summary Report:(2001-2004) Fish Community Monitoring in Prairie Park Streams with Emphasis on Topeka Shiner (Notropis topeka). Heartland I&M Network, Wilson's Creek National Battlefield, Missouri, National Park Service, unpublished.

Peitz, D. G., M. M. Guck, and J. M. James. 2009. Bird monitoring at Tallgrass Prairie National Preserve, Kansas: 2001-2008 status report. Natural Resource Technical Report NPS/HTLN/NRTR—2010/318. National Park Service, Fort Collins, Colorado.

PIF 2002. Partners in Flight. http://www.partnersinflight.org/ (accessed 5-22-2012). Bird Species Assessment Database.

Reiner, Dafna. 2011. Personal communication by telephone and email. Biologist, Hopewell Cultural National Historical Park.

Rejmanek, M., and M. J. Pitcairn. 2002. When is eradication of exotic pest plants a realistic goal? Pages 249-253 in C. R. Veitch and M. N. Clout, editors. Turning the Tide: the Eradication of Invasive Species. IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Rudd, Stephen. 2011. Personal communication by telephone. Natural Resource Program Manager, Hot Springs National Park.

Scott, Douglas D. 2000. Archeological Overview and Assessment for Wilson's Creek National Battlefield, Greene and Christian Counties, Missouri. Technical Report No. 66. Midwest Archeological Center, Lincoln, Nebraska. National Park Service.

Scott, Douglas D., Harold Roeker, and Carl G. Carlson-Drexler. 2008. "The fire upon us was terrific:" Battlefield archeology of Wilson's Creek National Battlefield, Missouri. Midwest Archeological Center Technical Report; 109. Lincoln, Nebraska, National Park Service.

Scott, Douglas D., Thomas D. Thiessen, Jeffrey J. Richner, and Scott Stadler. 2006. An archeological inventory and overview of Pipestone National Monument, Minnesota. Occasional Studies in Anthropology #34, Midwest Archeological Center, Lincoln, Nebraska. National Park Service.

Short, M. F., C. C. Young, C. S. Gross, and J. L. Haack. 2010. Invasive exotic plant monitoring at Big Spring Pines Natural Area, Chubb Hollow, Long Bay Field and Long Bay at Ozark National Scenic Riverways: Year 1 (2010). Natural Resource Technical Report NPS/HTLN/NRTR—2010/290. National Park Service, Fort Collins, Colorado.

Short, M. F., C. C. Young, C. S. Gross, and J.L. Haack. 2010a. Invasive exotic plant monitoring at Hot Springs National Park: Year 1 (2010b). Natural Resource Technical Report NPS/HTLN/NRTR—2010/288. National Park Service, Fort Collins, Colorado.

Tappe, Philip A. 2004. A Songbird Inventory of Arkansas Post National Memorial. Technical Report NPS/HTLN/ARPO/H7110B10001.

Trauth, Stanley E., and Malcolm L. McCallum. 2003. A Herpetofaunal Inventory of Arkansas Post National Memorial. Technical report NPS/HTLN/P6370010459.

Tu, M., Hurd, C. & J.M. Randall. 2001. Weed Control Methods Handbook, The Nature Conservancy, version: April 2001. 219 pp.

USDI. 1992. Cultural landscapes, as defined by the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes**.** Codified as 36 CFR Part 68 in the 12 July 1995 Federal Register (Vol. 60, No. 133) with an "effective" date of 11 August 1995. The revision replaces the 1978 and 1983 versions of 36 CFR 68 entitled *The Secretary of the Interior's Standards for Historic Preservation Projects*.

USFWS. 1998. Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. Unpublished. U.S. Fish &Wildlife Service and National Marine Fisheries Service. 315 pp.

USGS. 2000. Invasive Species Science Strategy for Department of the Interior Lands in the USGS Central Region: USGS-National Wetlands Research Center Technology & Information Branch, Little Rock, Arkansas.

Washington State Deparment of Transportation. 2005. Environmental Impact Statement, Final Draft for Roadside Vegetation Management Herbicide. Appendix B, Chapters 2 and 3. 168 pp.

Washington State Deparment of Transportation. 2006. Fluroxypyr: Roadside Vegetation Management Herbicide Fact Sheet. http://www.wsdot.wa.gov/NR/rdonlyres/767D2219-C458-4CCA-A5DC-3F185580580F/0/fluroxypyr.pdf accessed December27, 2011.

Weber, Melanie and Craig Young. 2007. Working Draft, Invasive Exotic Plant Management Recommendations for CUVA. Unpublished strategy.

Weed Science Society of America. 2002. http://wssa.net/, accessed October 27, 2010.

Wilcove, D. S., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. Bioscience 48:607–615.

Winstel, Jeffrey. 2000. Cuyahoga Valley National Recreation Area Cultural Landscape: Thematic Overview and Methodology Guide. NPS unpublished document. April 2000. 42 pp.

Young, C.C., J.L. Haack, L.W. Morrison, and M.D. DeBacker. 2007. Invasive Exotic Plant Monitoring Protocol for the Heartland Network Inventory and Monitoring Program. Natural Resource Report NPS/HTLN/NRR-2007/018. National Park Service, Fort Collins, Colorado.

Young, C.C, J.L. Haack, J.T. Cribbs, and H.J. Etheridge. 2007a. Invasive exotic plant monitoring at Arkansas Post National Memorial: Year 1 (2006). Natural Resource Technical Report NPS/HTLN/NRTR—2007/016. National Park Service, Fort Collins, Colorado.

Young, C.C, J.T. Cribbs, and J.L. Haack. 2007b. Invasive exotic plant monitoring at Effigy Mounds National Monument: Year 1 (2006). Natural Resource Technical Report NPS/HTLN/NRTR—2007/022. National Park Service, Fort Collins, Colorado.

Young, C.C, J.T. Cribbs, J.L. Haack, and H.J. Etheridge. 2007c. Invasive exotic plant monitoring at Pea Ridge National Military Park: Year 1 (2006). Natural Resource Technical Report NPS/HTLN/NRTR—2007/019. National Park Service, Fort Collins, Colorado.

Young, C.C, J.L. Haack, J.T. Cribbs, and H.J. Etheridge. 2007d. Invasive exotic plant monitoring at Tallgrass Prairie National Preserve: Year 1 (2006). Natural Resource Technical Report NPS/HTLN/NRTR—2007/014. National Park Service, Fort Collins, Colorado.

Young, C.C., J.L. Haack, and H.J. Etheridge. 2007e. Invasive exotic plant monitoring at Wilson's Creek National Battlefield: Year 1 (2006). Natural Resource Technical Report NPS/HTLN/NRTR—2007/013 National Park Service, Fort Collins, Colorado.

Young, C.C., J.L. Haack, and M.S. Weber. 2008. Invasive exotic plant monitoring at Hopewell Culture National Historical Park: Year 1 (2008). Natural Resource Technical Report NPS/HTLN/NRTR—2008/148. National Park Service, Fort Collins, Colorado.

Young, C. C., M. F. Short, L. W. Morrison, C. S. Gross, and J. L. Haack. 2010a. Invasive exotic plant monitoring at Herbert Hoover National Historic Site: Year 2 (2010). Natural Resource Technical Report NPS/HTLN/NRTR—2010/289. National Park Service, Fort Collins, Colorado.

Young, C. C., M. F. Short, L. W. Morrison, C. S. Gross, and J. L. Haack. 2010b. Invasive exotic plant monitoring at Homestead National Monument of America: Year 2 (2009). Natural Resource Technical Report NPS/HTLN/NRTR—2010/304. National Park Service, Fort Collins, Colorado.

Young, C. C., M .F. Short, L. W. Morrison, C. S. Gross, and J. L. Haack. 2010c. Invasive exotic plant monitoring at Pipestone National Monument: Year 2 (2009). Natural Resource Technical Report NPS/HTLN/NRTR—2010/294. National Park Service, Fort Collins, Colorado.

Young, Roberta. 2012. Written communication and document review. February 22, 2012.

Zedeño, M. N. and N. Laluk. 2008. Cultural Affilliation Statement, Buffalo National River, Arkansas. National Park Service: J6068050087 UAZ-176. 152 pp.