NORTHERN GREAT PLAINS NETWORK

Vital Signs Monitoring Plan

NATIONAL PARK SERVICE
March 19, 2004
Draft

SIGNATURE PAGE

_____	_____	_____	_____
Superintendent Agate Fossil Beds National Monument	Date	Superintendent Missouri National Recreational River	Date
_____	_____	_____	_____
Superintendent Badlands National Park	Date	Superintendent Mount Rushmore National Memorial	Date
_____	_____	_____	_____
Superintendent Devils Tower National Monument	Date	Superintendent Niobrara National Scenic River	Date
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Superintendent Fort Laramie National Historic Site	Date	Superintendent Scotts Bluff National Monument	Date
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Superintendent Fort Union Trading Post National Historic Site	Date	Superintendent Theodore Roosevelt National Park	Date
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Superintendent Jewel Cave National Monument	Date	Superintendent Wind Cave National Park	Date
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Superintendent Knife River Indian Villages National Historic Site	Date	Inventory & Monitoring Coordinator Northern Great Plains Network	Date

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CHAPTER 1. INTRODUCTION AND BACKGROUND

The National Park Service's (NPS) enabling legislation directs the agency to "conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 U.S.C. 1). In spite of this clear mandate to conserve natural resources, many park units lack the natural resource information necessary to make sound and defensible management decisions. Due to this shortcoming, the National Parks Omnibus Management Act of 1998 stated that the NPS "shall undertake a program of inventory and monitoring of National Park System resources to establish baseline information and to provide information on long-term trends in the condition of the National Park System resources." This directive to implement a program of inventory and monitoring is echoed in the agencies own policies which state that the agency shall "define, assemble, and synthesize comprehensive baseline inventory data describing natural resources" and "use qualitative and quantitative techniques to monitor key aspects of resources and processes at regular intervals" (National Park Service 2001:31). The intent of such inventory and monitoring programs is to detect or predict changes in natural systems and processes, take remedial action where necessary and feasible, provide reference points for comparison with other environments, and to maintain and restore the integrity of the natural systems in the parks.

The 13 parks in the Northern Great Plains Network (NGPN: Network) have completed, or are in the process of completing, baseline inventories of natural resources, specifically the 12 basic datasets outlined in the NPS National Inventory & Monitoring Program (http://science.nature.nps.gov/im/index.htm). The Network was primarily responsible for completing the baseline inventories for vascular plants and vertebrates, as outlined in the Network Inventory Study Plan (National Park Service 2002). Although the basic inventory projects are generally completed, the Network will continue to develop and refine the baseline inventories.

This document describes in detail the next phase in the Network's inventory & monitoring program, that of monitoring the natural resources in the Network. This plan adheres to NPS guidance for monitoring programs, including the guidance provided by the National Inventory & Monitoring Program (National Park Service 1999, National Park Service 2001). This plan is a collaborative effort among the 13 parks in the Network, developed in coordination and consultation with subject-matter experts, other agencies and organizations, and other expertise within the NPS.

PROGRAM OBJECTIVES

The primary objectives established by the NPS National I&M Program for Vital Signs monitoring are:

- Establish natural resource inventory and monitoring as a standard practice throughout the National Park system that transcends traditional program, activity, and funding boundaries.
- Inventory the natural resources and park ecosystems under National Park Service stewardship to determine their nature and status.
- Monitor park ecosystems to better understand their dynamic nature and condition and to provide reference points for comparisons with other, altered environments.
- Integrate natural resource inventory and monitoring information into National Park Service planning, management, and decision making.
- Share National Park Service accomplishments and information with other natural resource organizations and form partnerships for attaining common goals and objectives.

The Network has adopted these objectives without amendment or modification. This plan outlines the approach the Network will take to achieve these objectives. This study plan also summarizes the work completed to date, the agencies and personnel involved, the anticipated costs to conduct the necessary work, and other relevant issues.

NATIONAL PARK SERVICE MONITORING

National Park managers across the country are confronted with increasingly complex and challenging issues that require a broad-based understanding of the status and trends of park resources as a basis for making decisions to preserve these resources. Knowing the condition of natural resources in national parks is fundamental to the NPS mission to manage resources in a manner that leaves them "unimpaired for the enjoyment of future generations". Protecting and managing a park's natural resources requires a multi-partner, ecosystem approach because parks are open systems with threats such as air and water pollution and invasive species, originating from outside of the park's boundaries. An ecosystem approach is further needed because no single spatial or temporal scale is appropriate for all system components and processes; the appropriate scale for understanding and effectively managing a resource might be at the population, species, community, or landscape level. Consequently, management of key resources may require local, regional, national, or international cooperative efforts.

Natural resource monitoring provides site-specific information needed to understand and identify change in complex, variable, and imperfectly understood natural systems and to determine whether observed changes are within natural levels of variability or indicate undesirable human influences (Figure 2). Monitoring may be used to determine trends in the condition of park resources, to assess the efficacy of management practices and restoration efforts, and to provide early warning of impending threats. Ecological monitoring establishes reference conditions for natural resources from which future changes can be detected. Over the long term, these "benchmarks" help define the normal limits of natural variation, may become standards with which to compare future changes, provide a basis for judging what constitutes impairment, and help identify the need for corrective management actions. Understanding the dynamic nature of park ecosystems and the consequences of human activities is essential for management decision-making aimed to maintain, enhance, or restore the ecological integrity of park ecosystems and to avoid, minimize, or mitigate ecological threats to these systems (Roman and Barrett 1999).

The intent of the NPS monitoring program is to track a subset of physical, chemical, and biological elements and processes of park ecosystems, known as "vital signs," that are identified as the most significant indicators of ecological condition for those specific resources that are of the greatest concern to each park. This subset of vital signs is part of the total suite of natural resources that park managers are directed to preserve "unimpaired for future generations," including water, air, geological resources, plants and animals, and the various ecological, biological, and physical processes that act on these resources. In situations where natural areas have been so highly altered that physical and biological processes no longer operate (e.g., control of fires and floods in developed areas), information obtained through monitoring can help managers understand how to develop the most effective approach to restoration or, in cases where restoration is impossible, to ecologically sound management.

Legislation, Policy, and Guidance

In establishing the first national park in 1872, Congress "dedicated and set apart (nearly 1,000,000 acres of land) as a … pleasuring ground for the benefit and enjoyment of the people" (16 U.S.C. 1 § 21). By 1900 a total of five national parks had been established, along with additional historic sites, scenic rivers, recreation areas, monuments, and other designated units. Each unit was to be administered according to its individual enabling legislation, but had been created with a common purpose of preserving the "precious" resources for public benefit. Sixteen years later the passage of the NPS Organic Act of 1916 (16 U.S.C. 1 § 1) established and defined the mission of the NPS, and through it, Congress implied the need to monitor natural resources and guarantee unimpaired park resources:

"The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified … by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Congress reaffirmed the declaration of the Organic Act vis-à-vis the General Authorities Act of 1970 (16U.S.C. 1a-1a8) and effectively ensured that all park units be united into the 'National Park System' by a common purpose of preservation, regardless of title or designation. In 1978, the NPS's protective function was further strengthened when Congress again amended the Organic Act to state "…the protection, management, and administration of these

areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established…" thus further endorsing natural resource goals of each park. A decade later, park service management policy again reiterated the importance of this protective function of the NPS to "understand, maintain, restore, and protect the inherent integrity of the natural resources" (NPS 2001).

More recent and specific requirements for a program of inventory and monitoring park resources are found in the National Parks Omnibus Management Act of 1998 (P.L. 105-391). The intent of the act is to create an inventory and monitoring program that may be used "to establish baseline information and to provide information on the long-term trends in the condition of National Park System resources." Subsequently, in 2001, NPS management updated previous policy and specifically directed the Service to inventory and monitor natural systems in efforts to inform park management decisions:

"Natural systems in the national park system, and the human influences upon them, will be monitored to detect change. The Service will use the results of monitoring and research to understand the detected change and to develop appropriate management actions" (NPS 2001).

In addition to the legislation directing the formation and function of the National Park System, there are several other pieces of legislation intended to not only protect the natural resources within national parks and other federal lands, but to address concerns over the environmental quality of life in the United States generally. Many of these federal laws also require natural resource monitoring within national parks. As national parks are among some of the most secure areas for numerous threatened, endangered, or otherwise compromised natural resources in the country, the particular guidance offered by federal environmental legislation and policy is an important component to the development and administration of a natural resource inventory and monitoring system. A summary of legislation, policy and executive guidance that have an important and direct bearing on the development and implementation of natural resource monitoring in the NPS is presented in Appendix B.

Government Performance and Results Act

The Government Performance and Results Act (GPRA) guides the management of national parks in outlining measurable performance goals and requiring NPS to demonstrate the attainment of those goals to the U.S. Congress. For the Park Service, four overarching goals provide direction for developing more specific goals.

1. Category I goals preserve and protect park resources.
2. Category II goals provide for the public enjoyment and visitor experience of parks.
3. Category III goals strengthen and preserve natural and cultural resources and enhance recreational opportunities managed by partners.
4. Category IV goals ensure organizational effectiveness.

The HTLN Monitoring Plan assists in meeting numerous Category I goals. The servicewide goal pertaining to Natural Resource Inventories specifically identifies the strategic objective of inventorying the resources of the parks as an initial step in protecting and preserving park resources (GPRA Goal Ib1). The Monitoring Plan will identify the monitoring indicators or "vital signs" of the network and develop a strategy for long-term monitoring to detect trends in resource condition (GPRA Goal Ib3). In addition to the national strategic goals, each park unit has a five-year plan that includes specific park GPRA goals.

By adopting the Service-wide monitoring goals, certain aspects of the HTLN program scope and direction become apparent. The program will include effects-oriented monitoring to detect changes in the status or condition of selected resources, stress-oriented monitoring to meet certain legal mandates (e.g. Clean Water Act), and effectiveness monitoring to measure progress toward meeting performance goals (Noon et al. 1999; NRC 1995). The Service-wide goals also acknowledge the importance of understanding inherent ecosystem variability in order to interpret human-caused change, and recognize the potential role of NPS ecosystems as reference sites for more impaired systems.

OVERVIEW OF PARKS IN THE NORTHERN GREAT PLAINS NETWORK

The Northern Great Plains Network is comprised of a diverse group of NPS units ranging from old to new, primarily cultural to primarily natural, large in area to small, well funded to lightly funded, large staffs to small staffs, and lightly visited to highly visited (Table 1). The Network includes four national monuments (NM), three national historic sites (NHS), four national parks (NP), a national recreation river (NRR), a national scenic riverway (NSR), and a national memorial (NMEM)[1].

Table 1. Overview of Parks in the Northern Great Plains Network

Park	Year Estab-lished[1]	Primary Purpose	Acres[2,4]	Base Funding (FY03)[2]	FTEs (FY02)[3]	Number of Visitors (FY02)[2]
Agate Fossil Beds NM	1965	Cultural/Natural	3,055	$496,000	9	17,634
Badlands NP	1929	Natural	242,756	$3,052,000	68	906,868
Devils Tower NM	1906	Natural	1,347	$768,000	17	407,688
Fort Laramie NHS	1938	Cultural	833	$1,198,000	22	47,641
Fort Union Trading Post NHS	1966	Cultural	444	$631,000	13	21,171
Jewel Cave NM	1908	Natural	1,274	$871,000	19	131,481
Knife River Indian Villages NHS	1974	Cultural	1,758	$657,000	9	31,932
Missouri NRR	1978	Natural	45,350	$539,000	na	na
Mount Rushmore NMEM	1925	Cultural	1,278	$2,529,000	56	2,159,189
Niobrara NSR	1991	Natural	5,993	$695,000	na	na
Scotts Bluff NM	1919	Cultural/Natural	3,003	$739,000	15	113,885
Theodore Roosevelt NP	1947	Natural	70,447	$2,187,000	41	471,210
Wind Cave NP	1903	Natural	28,295	$1,877,000	52	696,402
TOTAL			**410,967**	**$16,239,000**		

[1] I.e., the year originally authorized, proclaimed, or otherwise established. Many units had subsequent expansions, modifications, or redesignations.
[2] From respective park web pages at http://data2.itc.nps.gov/parksearch/atoz.cfm
[3] From http://inside.nps.gov/parks/
[4] Acres are defined as acres within the park boundary, not fee acres owned by the federal government.

Most of the park units are typical in the sense that the federal government owns the land within the park boundaries and those boundaries are clearly marked. However, the Missouri NRR and Niobrara NSR are exceptions. The lands within those parks are primarily owned by private, state, and non-governmental conservation organizations. To achieve their goals and objectives those parks work closely with the landowners and other entities. Badlands NP is also noteworthy in this regard in that approximately half of the park lies within the Pine Ridge Indian Reservation. The park manages the land as a trust resource for the tribe.

The operating budget for several of the parks is increased by non-base funds. For example, approximately half of the parks in the Network are in the Recreational Fee Demonstration program. Although not in that program, Mount Rushmore has a significant concessions program that generates some funds for park management. Parks in the Network also benefit from the resources of the FIREPRO program headquartered at Wind Cave NP and the Exotic Plant Management Team (EPMT) headquartered at Theodore Roosevelt NP. Agate Fossil Beds NM and Scotts Bluff NM benefit from being in the Prairie Cluster Long-term Ecological Monitoring Program (LTEM) headquartered out of Republic, Missouri.

The park units lie in the states of North and South Dakota, the northern half of Nebraska, eastern Wyoming, and extreme eastern Montana (Figure 1: Fort Union Trading Post NHS is bisected by the North Dakota/Montana border).

[1] Definitions of park designations can be found at: http://www.nps.gov/legacy/nomenclature.html.

Several parks, such as Badlands NP, the Missouri NRR, and Theodore Roosevelt NP, consist of discrete and non-contiguous management units.

The Network includes parks from both the Inter-Mountain (Devils Tower NM and Fort Laramie NHS) and Midwest Regions (all the other parks) of the NPS. The Missouri NRR and Niobrara NSR share a superintendent. Supervision of the superintendents of Fort Union Trading Post NHS and Knife River Indian Villages NHS is by the superintendent of Theodore Roosevelt NP. Supervision of the superintendent at Jewel Cave NM is by the superintendent at Wind Cave NP. Supervision of the superintendent at Agate Fossil Beds NM is by the superintendent at Scotts Bluff NM. Many administrative functions, such as contracting, personnel, and information technology are shared by the parks through a structure known as NEKOTA.

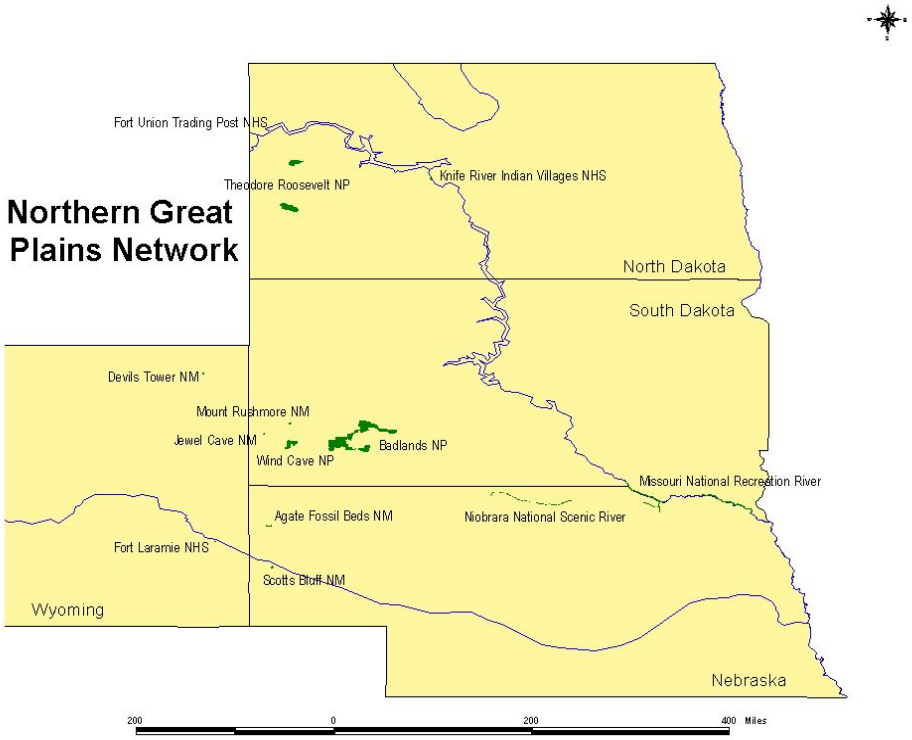

Figure 1. Location of Parks in the Northern Great Plains Network

Every park in the Network has significant natural resources; however, the status and size of natural resource programs in the parks varies considerably, with the larger parks typically having larger programs and staffs (Table 2). Larger staffs are positively correlated with the ability of the parks to procure additional funding for natural resource projects. Natural resource management in the smaller parks is often a collateral duty of a law enforcement (LE) ranger or a superintendent. Table 2 lists the title of the park representative on the Network I&M Technical Committee, who is also typically the primary park contact for natural resources.

Table 2. Natural Resource Programs in Parks in the Northern Great Plains Network

Park	Primary Contact for Natural Resources	Fulltime Permanent Natural Resource Staff	Natural Resource Budgets (FY04)	NRPP Funds (FY02)[1]
Agate Fossil Beds NM	Superintendent			$20,000
Badlands NP	Chief of Natural Resources	Chief, 2 Biologists, Paleontologist, Generalist, Technician		$288,000
Devils Tower NM	Chief of Natural Resources	Chief		$13,300

Fort Laramie NHS	LE Ranger			$0
Fort Union Trading Post NHS	Superintendent			$0
Jewel Cave NM	Natural Resource Specialist	Cave Specialist		$13,640
Knife River Indian Villages NHS	LE Ranger			$0
Missouri NRR	Natural Resource Specialist	Generalist		$0
Mount Rushmore NMEM	LE Ranger			$0
Niobrara NSR	Natural Resource Specialist	Generalist		$0
Scotts Bluff NM	Natural Resource Specialist	Generalist		$0
Theodore Roosevelt NP	Chief of Natural Resources	Chief, Biologist, Botanist, GIS Specialist		$0
Wind Cave NP	Natural Resource Specialist	Chief, Generalists, Cave Specialist, GIS Specialist, 2 Technicians		$217,400

[1] NRPP=Natural Resource Preservation Program. Amounts include all natural resource projects funded through the Servicewide Comprehensive Call (SCC).

Larger park units tend to have more detailed plans in regards to natural resources (Table 3). The Northern Great Plains EPMT recently completed an Environmental Assessment for the control of exotic plants in the Network parks (with the exception of Badlands NP which had conducted a separate assessment).

Table 3. Status of Natural Resource Plans

Park	GMP	RMP	Fire Plan	Other
Agate Fossil Beds NM	Planned in FY04	2000	In prep	Wildfire Plan 1988
Badlands NP	In prep	Yes	2004	Bighorn sheep in prep Bison in prep Black-footed ferret Wilderness in prep
Devils Tower NM	2002	1998	2004	Climbing Management, expired Exotic Plant in prep
Fort Laramie NHS	1993	Mid-90s	2004	Integrated Pest in prep Vegetation in 2004
Fort Union Trading Post NHS	Yes	In prep	Yes	
Jewel Cave NM	Yes	1999	In prep	Cave in prep Exotic Plant in prep Vegetation in prep
Knife River Indian Villages NHS	Planned for FY05	Old	Old	Prairie Management
Missouri NRR	1999	Planned for FY06		Exotic Plant Numerous plans by other agencies
Mount Rushmore NMEM	1987	91-92	2003	Climbing Management, 1998
Niobrara NSR	In prep	In prep	In prep	Exotic Plant
Scotts Bluff NM	1998	1996	2001	Integrated Pest, 1984
Theodore Roosevelt NP				Elk in prep
Wind Cave NP	1994	In prep	In prep	Bison in prep

				Black-footed ferret in prep Black-tailed prairie dog in prep Cave in prep Elk in prep Vegetation in prep

OVERVIEW OF NATURAL RESOURCES IN THE NORTHERN GREAT PLAINS NETWORK

The Northern Great Plains Network is in a region of the country that is sparsely populated with a strong rural culture. The human population has been declining for decades, especially in the rural areas. Although declining in stature, agriculture is still a significant industry. Mineral and oil development are important locally, although the industries often experience boom and bust periods. Tourism continues to be a significant factor in the economy, especially so for many of the smaller communities near the national park units, a consideration that park managers are keenly aware of. Many wildlife resources are valued by local residents, including some that are exotic (e.g., pheasants). However, some native species are heavily persecuted because of perceived competition with current land use practices (e.g., prairie dogs). These current and historic industries, land uses, and cultural values constitute many of the stressors on park resources.

The Northern Great Plains has a continental climate with hot summers and cold winters. Severely harsh winters with long periods of snow cover occur periodically and can be a significant mortality factor for some wildlife species. Precipitation, which occurs in the form of rain and snow, generally increases from west to east and is moderate compared to other parts of North America. However, the Great Plains regularly goes through multi-year droughts on a cycle that has historically ranged from 10-20 years. This inter-year variability and seasonal bottlenecks can confound efforts to analyze and interpret temporal and spatial trends and identify causative factors. Winds are generally from the west making the Network prone to air quality issues in Montana and Wyoming.

Most scholars and cartographers place the 13 parks in the Network in three to five vegetative biomes (Omernik 1985, Kuchler 1986, Bailey 1995). Bailey's (1995) classification of the region placed seven parks in the shortgrass biome, four in the Black Hills ponderosa pine biome, one in the mixed-grass biome, and one split between mixed-grass and tallgrass biomes (Figure 2). However, the coarse ecological classification should be viewed cautiously since most of the parks in the Network display characteristics or species of multiple biomes and/or ecosystems. Topography, rivers, groundwater, and past land use all greatly effect local vegetation. Fire, along with grazing and weather, is a significant driver in vegetation resources in the region.

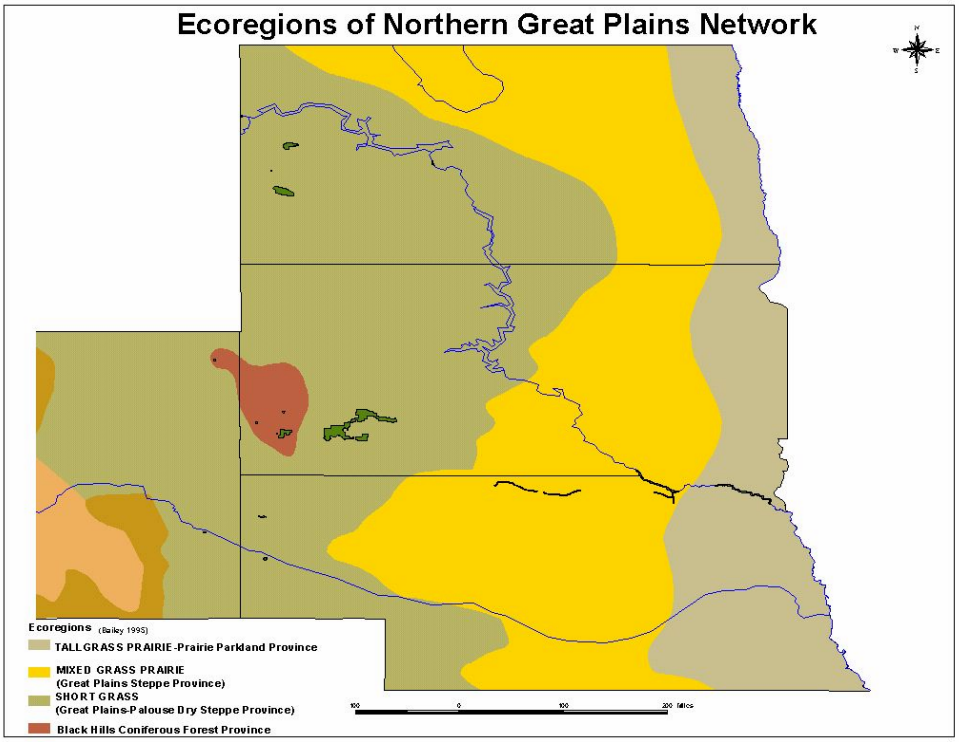

Figure 2. Ecoregions of the Northern Great Plains Network

Based on the USGS-NPS vegetation mapping effort and other data, approximately __% of the total land area of the 13 parks is classified as ___, making it the largest cover type in the Network (Table 3). Some habitat types, such as ponderosa pine forests, may have increased from historic conditions due to the absence of fire. The condition of all the cover types in the parks has been greatly degraded due to suppression of fire, absence of grazers, invasion by exotic plants, past cultivation, and other factors. Detailed descriptions of the vegetation communities for each park are described later in this document.

Table 4. Landcover within Parks in the Northern Great Plains Network

Park	Forest	Shrub	Grass	Barren	Water	Admin.	Other
TOTAL							

The Northern Great Plains historically supported a wildlife community that was typical in structure, processes, and behavioral to grassland wildlife assemblages throughout the world. Grazers and grazing, especially by bison, was an

ecological driver within the system (bison are now replaced by cattle in most areas of the Great Plains). Bison and prairie dogs are often viewed as keystone vertebrate species in the ecosystem, with their relationship being mutualistic (e.g., bison grazing encourages colonization by prairie dogs and prairie dog foraging promotes vegetation high in nutritional value for bison). Due to the lack of trees many of the vertebrates are at least partly fossorial. Many bird species are ground-nesters, making them vulnerable to changes in meso-predator communities.

The wide open terrain prior to European settlement lent itself to gregariousness, nomadicism, and migration, more so than other ecosystems. Many species such as bison, prairie dogs, and migrating waterfowl occurred in almost unfathomable numbers. Other species, such as the wolf, typically occurred in much larger concentrations (i.e., packs) than did their counterparts living in other habitats. This gregariousness and these long distance movements undoubtedly played a major role in shaping the grassland ecosystem. For example, it is generally believe that large numbers of bison grazed an area and then moved on, allowing the vegetation to recover. This behavior created a mosaic of seral stages across the landscape. However, these processes, conditions, and characteristics of the Great Plains have been mostly loss due to habitat fragmentation. NPS policies require park managers to mimic these landscape processes to the best extent possible, a challenge within the small size of the park units.

The Northern Great Plains has comparatively few endangered, threatened, or otherwise imperiled species, especially those that are endemic to the region. This is due in part to the relatively simple ecosystems in the region in terms of species richness (e.g., ponderosa pine forest, mixed-grass prairie). However, some of the extirpated species could be viewed as a keystone species and their loss has a disproportionate ripple effect throughout the ecosystems (e.g., gray wolf at all parks, bison and prairie dogs at many of the parks). Only a few federally-listed species are of significant management importance. Examples are the black-footed ferret at Badlands NP, the interior piping plover at the Niobrara NSR, and the piping plover, interior least tern, and pallid sturgeon at the Missouri NRR. The black-tailed prairie dog is a candidate species; it occurs at five parks in the Network.

Surface water is typically a minor component of the parks in terms of area, however, water plays a disproportionate role at almost all the parks in terms of species richness, diversity, and biomass, ecological function, and visitor use. Water resources have been impacted due to altered hydrographs from dams, irrigation and municipal withdrawals, and other land use changes. In many cases these altered hydrographs have impacted riparian flora and fauna, streambed structure and function, and water quality. Some water quality impacts to park resources are counter to conventional views of water quality. For example, the water on the Missouri River has less turbidity now than under natural conditions, making these “cleaner” waters less healthy from the perspective of many native species (e.g., the endangered pallid sturgeon thrives best in murky waters where predators are less likely to find it).

Air resources in the region are less impacted than many other parts of the country. However, significant oil and gas development is being initiated or proposed in Wyoming and Montana and could affect parks throughout the Network. Also, several parks in the Network, such as Theodore Roosevelt NP and Knife River Indian Villages NHS, have energy development or plants within 10 miles of their boundaries. Due to the wide open country and/or scenic vistas, air quality and atmospheric haze are a concern to many park managers.

Soil resources have been greatly degraded throughout the Great Plains as a result of cultivation and over-grazing, with the most famous event being the Dust Bowl of the 1930s. Although some of the cultivated lands in the Northern Great Plains were returned to federal ownership in the 1940-50s, few of these sites are in national park units (most were designated national grasslands or returned to the Bureau of Land Management). Nevertheless, some tracts of formerly cultivated land do exist in some of the park units.

Geologic resources are very important to several park units. For example, Jewel Cave NM and Wind Cave NP were both established in large part because of the cave formations and limestone geology. Similarly, Badlands and Theodore Roosevelt NPs were recognized early on for their unique and inspiring topography. Geologic resources are also important to several parks as they relate to paleontological resources, e.g., Agate Fossil Beds NM and Badlands NP.

PARKS IN THE NORTHERN GREAT PLAINS NETWORK

Agate Fossil Beds National Monument

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Agate Fossil Beds NM was authorized in 1965. The fossil beds—once part of "Captain" James H. Cook's Agate Springs Ranch—are an important source for Miocene epoch mammal fossils and a primary purpose for the park. Cook's ranch was also a gathering place for Chief Red Cloud and other Oglala Lakota (Sioux) Indian people, and of considerable cultural significance.

Before its designation as a national monument the site was a working cattle ranch and grazed by the Cook, Skavdahl, and Buckley families. Flatter portions of along the Niobrara River were hayed. A small portion of one river terrace was cultivated for one growing season in the 1950s, and other small areas in the park were used as corral areas.

PARK MISSION:
Agate Fossil Beds NM preserves and interprets internationally significant paleontological resources of the Miocene epoch, as well as nationally significant remains of Native American life at the closing of the frontier. The park also preserves and interprets other significant natural and cultural resources.

GENERAL DESCRIPTION:
Located along the Niobrara River in northwestern Nebraska, Agate Fossil Beds NM consists of 3,055 acres (however, only 2,270 acres are federal fee land). The park lies in a very remote and sparsely populated region where ranching is the primary industry. Limited cultivation can be found, especially near the Niobrara and other streams.

Park visitation is light and primarily in the summer months. Many visitors hike the trail to the fossil sites, but otherwise do not stray far from established routes. There is no overnight camping, hunting, or trapping. A very limited amount of shoreline fishing takes place in the river.

Agate is an internationally recognized fossil site. Two hills, known as Carnegie and University Hills, are the most famous paleontological sites, although fossils can be found elsewhere in the park. The mammalian fossils come from the Miocene epoch, approximately 20 million years ago. The rich abundance of fossils at the park is most likely due to a severe drought period and animals congregating and dieing near the ancient Niobrara River. The first scientific exploration for fossils took place in 1892. The site was later visited by the famous paleontologists Edward Cope and Othniel Marsh, as well as many others. There are no significant excavations going on at this time.

Agate has a rich cultural history as well. Human evidence at the site ranges back 2,500 years. There is evidence that at least 31 currently recognized tribes may have used the site at one time or another. Dr. Elisha Graham selected the site for a ranch in 1879, and his son-in-law, James Cook, acquired the ranch in 1887. Cook soon made many changes to the ranch, including the planting of trees by the hundreds (National Park Service 1980). Cook hosted many Sioux Indians including Red Cloud and American Horse, and was often an intermediary between Native Americans and whites. Cook's son, Harold, was instrumental in establishing the site as a national park unit.

The park's "Cook Collection" of American Indian artifacts reflects years of gifts brought by the Indians during visits to the ranch from the 1880's through the early 1900's, and is widely recognized as a valuable resource. Structures within the park are listed on the National Register of Historic Places.

DESCRIPTION OF NATURAL RESOURCES:
Significant and characteristic natural resources of the park are the prairie ecosystem, the Niobrara River and associated wetlands, and the fossils. The scenic vistas and natural soundscape are also important. The park is significant regionally because it is a non-grazed prairie, whereas most other lands in the region are heavily grazed.

The park was a prototype in the NPS/USGS vegetation mapping program (Aerial Information Systems, 1998a), with field work being completed in 1996-97. The following vegetation information comes from that effort. The park includes 13 vegetation types, the most common of which is Sand Bluestem - Prairie Sandreed Prairie. Needle-and-thread – Blue Gram Mixedgrass Prairie is also common. The only vegetation type considered globally vulnerable or worse is the Baltic Rush Wet Meadow, which contains some "unusual, disjunct" species. The Cottonwood - Peachleaf Willow Floodplain Woodland along the Niobrara River may also be globally vulnerable; however, there is no regeneration of the trees that characterize this vegetation type within the park and the trees that exist now may have been escapes from plantings of the Agate Springs Ranch.

Although most of the previously cultivated areas have been seeded with native prairie species and are in fair shape, the former corral areas remain in somewhat disturbed condition and are characterized by weeds. Other than these sites, the upland vegetation is in relatively good shape and mostly free of invasive species. However, the riparian vegetation is considerably more compromised by exotics, specifically Canada Thistle and Yellow Flag Iris. The potential status of the Yellow Flag Iris as a cultural resource (historical aspect of the Agate Springs Ranch) needs to be considered, however.

Wildlife species are typical of the region. Graetz et al. (1995) found 92 species of birds, 21 species of mammals, 16 species of reptiles, and 6 species of amphibians at the park. The park also provides habitat for 10 fish species, including the Iowa darter and plains topminnow, both species of concern in Nebraska. Non-native brown and rainbow trout occur in the river. Species no longer found at the park include bison, wolves, and elk, although the latter can be found just a short distance away. Pronghorn are transient in the vicinity of the park. Rattlesnakes are common.

The park does not support any resident federally-listed threatened or endangered species. It's possible that whooping cranes and bald eagles may pass through the park, but there are no recent records. Ten plant species on the Nebraska Plants of Concern list (http://www.natureserve.org/nhp/us/ne/plants.html) have been confirmed as occurring in the park. They are: Limestone Rockcress, Narrowleaf Goosefoot, Smooth Goosefoot, Spotted Mission Bells, Sidesaddle Bladderpod, Nuttall Desert-parsley, Stemless Nailwort, Spearhead Phacelia, Small-flowered Sand Verbena, Prairie Ground Cherry, and Huron Green Orchid. The Lesser Yellow Lady's-slipper is on the Forest Service Rocky Mountain Region sensitive species list. There are no known state-listed animal species at the park.

The sweeping views and unaltered horizons are also a significant resource and characteristic of the park. Noise pollution is almost non-existent except for the east-west road through the park, hence the soundscape is very important to the visitor experience.

NATURAL RESOURCE GOALS AND OBJECTIVES:
A primary management goal of Agate Fossil Beds NM is to contribute to the conservation of biological diversity in northwest Nebraska.

NATURAL RESOURCE ISSUES:
A partial list of natural resource issues at the park includes exotic plants, the absence of grazing and fire, altered river flows within the Niobrara, and degraded water quality. Management of these issues is confounded by the park's small budget and lack of staff.

Exotic plants such as Canada Thistle and Yellow Flag Iris are a top management issue for the park. The park has an active program to try and control these plants. The park would like information on the effectiveness of exotic plant control.

No prescribed fires have occurred at the park since its authorization (and probably before while in ranch status). This may have had a detrimental effect on the fire-evolved upland vegetation (although casual observation does not reveal a uniformly dense litter layer that would suggest this). Likewise, the absence of grazing may be an issue. A prescribed burn program is scheduled to be implemented in the near future, and the return of grazing is in the park's long-term plans. The park would like information on the effects of these activities.

The park would like to reintroduce bison and grazing processes. There is some evidence that white-tailed deer are replacing mule deer at the park, perhaps due to landscape changes in the region. Chronic wasting disease and its effect on deer is of concern to park management.

Maintaining the fishery is of high importance to the park. Upstream irrigation withdrawals threatens this resource and activity.

The park is concerned about the effect that visitors are having on geological resources.

The risk of foliar injury due to ozone is considered to be low for the park.

The park has an active plant, bird, and water quality monitoring program as a result of it being within the Prairie Cluster LTEM program (see the discussion later in this chapter). It is anticipated that this monitoring effort will continue until the Network is ready to begin field operations.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES:
The park is mandated to monitor the fossils and geology at the park. There are no other specific directives or mandates in regards to monitoring natural resources. Local government entities would like the park to (control and) monitor noxious weeds. The paleontological community would like monitoring of the fossil resources.

ADDITIONAL INFORMATION:
Detailed information on the park can be found at http://www.nps.gov/agfo/index.htm and other NPS web sites, in an administrative history of the park (Cockrell 1986), and the official NPS handbook for the park (National Park Service 1980).

Map of park

Veg Map

Map of monitoring sites

Badlands National Park

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Congress authorized Badlands National Monument in 1929 to preserve the scenic and scientific value of a portion of the White River Badlands for the benefit and enjoyment of the people. The original monument was 111,000 acres. A significant expansion occurred in 1968 when a South Unit (a.k.a., Stronghold Unit) of 133,000 acres was designated within the Pine Ridge Indian Reservation. Congress intended for the park to manage the site in cooperation with the Oglala Sioux Tribe. In 1976 a 64,000-acre Wilderness Area was designated within the North Unit of the park. The site was re-designated as a national park in 1978.

Prior to establishment of the park, some of the land, particularly the flat tablelands, was plowed and/or hayed by homesteaders in the early 1900's. The remainder was most likely grazed by cattle prior to the establishment of the area as a national monument. Cattle grazing continued in parts of the park until a fence was built in 1963 when bison were re-introduced to the western portion of the North Unit. Cattle and horse grazing continue in the South Unit of the park and are generally managed by the Bureau of Indian Affairs and the tribe.

PARK MISSION:

GENERAL DESCRIPTION:
Located in sparsely populated southwestern South Dakota, Badlands National Park consists of 242,756 acres of sharply eroded buttes, pinnacles, and spires situated within the largest protected mixed-grass prairie in the United States. The park has three distinct management units; they being the North Unit and the South Unit, which are connected by a narrow corridor, and the disjunct Palmer Unit.

The North Unit receives by far the highest visitor use and is where most of the administrative and developed areas exist (especially on the east end of the Unit). The Sage Creek Wilderness Area in the western part of the North Unit covers 64,250 acres, and is generally sympatric with the range of bison within the park. The Wilderness Area is commonly recognized as the largest protected, roadless area in the Great Plains. Special considerations are necessary for management and studies in this unit (e.g., no motorized vehicles).

The South Unit and the Palmer Unit are noteworthy because they are located in the Pine Ridge Indian Reservation and are co-managed with the Oglala Sioux Tribe under a Memorandum of Agreement. The South Unit also contains the culturally significant sites of the 1890s Ghost Dances. The South Unit is extremely rugged with poor access, although motorized vehicles are allowed on the few dirt roads in the unit.

Remote camping is allowed in the Wilderness Area, and two designated campgrounds are established in the park. Hunting and trapping are not allowed in the park. There are no fishable waters within the park.

DESCRIPTION OF NATURAL RESOURCES:
The fossils and geologic resources are viewed as one of the most significant natural resources in the park. The mixed-grass prairie ecosystem is recognized as being significant to the park. Grazing animals, including bison and prairie dogs, are important ecologically and because of high interest by visitors. Clean air, the night sky, and the soundscape are also viewed by park staff as significant resources. At a regional scale, the park is significant because of the large prairie dog complexes, relatively undegraded prairie, and the existence of fire. The existence of the black-footed ferret is important nationally as is the genetic purity of the bison herd.

The badlands formation was formed by wind and water eroding volcanic ash and sediment to create the multi-banded, multi-colored needles, razor-thin ridges, and wrinkled slopes. These stark formations are largely devoid of vegetation and continue to change under the forces of erosion. Almost half of Badlands NP is comprised of these sparsely vegetated or barren badlands formations.

Although the park was established primarily for its outstanding fossil resources and the badlands formations that contain them, the park also contains the largest tract of mixed-grass prairie in NPS holdings. Using the National Vegetation Classification System, a 1997 study (Von Loh et al., 1999) identified 32 vegetation types in the park.

Eighty-two percent of the park's area falls into two vegetation categories: Badlands Sparse Vegetation (46%) and Western Wheatgrass Herbaceous Vegetation Alliance (36%). Seven of the vegetation types mapped at the park are globally vulnerable or worse: Green Ash - Elm Woody Draw, Sand Sage / Prairie Sandreed Shrubland, Switchgrass Wet-Mesic Tallgrass Prairie, Prairie Sandreed - Sedge Prairie, Ill-scented Sumac / Thread-leaved Sedge Shrub Prairie, Prairie Cordgrass - Sedge Wet Meadow, and Common Rabbitbrush / Bluebunch Wheatgrass Shrubland. Five more vegetation types found in the park may be globally vulnerable. Other vegetation types that are important park resources but are too small to be captured by the vegetation mapping effort include plant communities around the CCC Springs on the west edge of the North Unit, as well as juniper slumps. Many of the slumps are relects of eroding hillsides and are isolated from fire.

The majority of the vegetation types in the park (98% of the park's area) are characterized by native species. However, previous land use, invasion by non-native species, and alteration of the grazing and fire regimes have taken their toll on the native vegetation. In particular, some non-native species – such as annual brome grasses and Yellow Sweetclover – are pervasive throughout many vegetation types in the park. In addition, approximately 8,000 acres of Canada Thistle have been mapped in the park. Areas that were plowed have recovered to mostly native vegetation, although the diversity of plant species is lower than that of unplowed areas. Despite these problems, most of the park is relatively intact and natural in regards to plant communities.

Badlands NP still contains many wildlife species associated with badlands formations and mixed-grass prairie habitat, including several species that are often missing in other areas outside the park. For example, bison were reintroduced in 1963 and now number about 500-700 animals. Bighorn sheep were reintroduced in 1964 and number around 50-100. Swift fox were reintroduced in the fall of 2003 with subsequent releases planned. Likewise, the federally-listed black-footed ferret was reintroduced into the park and adjoining National Grasslands. Mountain lions have apparently re-colonized the park on their own accord. Mammalian species that were historically found in the vicinity of the park but are now extirpated include the wolf and elk. Absence of the former may continue to have a ripple effect throughout the ecosystem, e.g., coyote numbers may be artificial high due to the absence of wolves. Although cattle have been removed from the North Unit of the park, they still graze in the South Unit.

No federally-listed threatened, endangered, or candidate plant species occur at the park, but the park does support six species on the South Dakota rare plant list. They are Barr’s Milkvetch, Silver-mounded Candle Flower, Dakota Buckwheat, Sidesaddle Bladderpod, Easter Daisy, and Largeflower Townsend-Daisy. For the most part these species occur in the badlands sparse vegetation type, with Dakota Buckwheat being an exception. Of these six, only Barr's Milkvetch and Dakota Buckwheat are considered globally vulnerable and endemic to the area (for the other plants South Dakota is at the edge of their range). A survey for locations and approximate population sizes of these plants and three other species was conducted in 2003 and 2004.

The park supports a small population (about a dozen animals, but part of the much larger Conata Basin metapopulation) of the federally-listed endangered black-footed ferret. The black-tailed prairie dog is a candidate for federal listing. Bald eagles are occasionally observed in the park, but do not nest there. Several state-listed animal species are found in the park including the regal fritillary and Dakota skipper butterflies, the swift fox and mountain lion, and a fish.

Badlands National Park contains the world's richest Oligocene epoch fossil beds, dating 23 to 35 million years old. Active paleontological studies continue to this day.

NATURAL RESOURCE GOALS AND OBJECTIVES:

As part of strategic and General Management Plan planning efforts, Badlands NP has developed “purpose” statements which essentially describe the goals of the park and the natural resource program. The purpose of the park is to:

- Protect the unique landforms and scenery of the White River Badlands for the benefit, education, and inspiration of the public
- Preserve, interpret, and provide for scientific research the paleontological and geological resources of the White River Badlands
- Preserve the flora, fauna, and natural processes of the mixed-grass prairie ecosystem
- Preserve the Badlands Wilderness Area and associated wilderness values

- Interpret the history of the Sioux Nation

The goals can be refined into more specific objectives for natural resources:

- Preserve and/or restore the native mixed-grass prairie plant communities through invasive non-native plant control, seeding with native seed, native ungulate grazing and wildland and prescribed fire.
- Restore bighorn sheep populations to levels sufficient for long-term viability.
- Restore black-footed ferrets to self-sustaining population as part of the Conata Basin/Badlands Recovery Area; restore prairie dog communities to pre-European levels and complexity.
- Manage the bison herd, within constraints of available habitat, in as close an approximation of a free-ranging herd as possible throughout all habitat in the park. Remove animals from the herd only when necessary, and in a manner that preserves genetic diversity, age classes, and appropriate sex ratio of the herd.
- Monitor, long-term, key indicators of ecosystem health; manage data and conduct analysis to provide a scientifically sound basis for management decisions.
- Conduct a comprehensive parkwide survey of significant fossil resources. Preserve in situ where appropriate, and salvage, preserve and curate in an appropriate storage facility where necessary.
- Manage Native Americans traditional uses of the South Unit to protect ecosystem integrity.

NATURAL RESOURCE ISSUES:

Currently, non-native plants such as crested wheatgrass (Agropyron cristatum), Kentucky bluegrass (Poa pratensis), smooth brome (Bromus inermis), and yellow sweetclover (Melilotus officinalis) are a particular problem in the North Unit. Controlling these species is a high management priority. The park uses fire as a management tool to control exotic plants and to meet other management goals (the park would like to expand the fire program to include all burnable areas in the park). The park also uses herbicides and biological control for some exotics.

The park has numerous wildlife issues and needs. The park is the only unit in the NPS that supports the endangered black-footed ferret. The park has a an active and base-funded ferret management program; however, ferret numbers remain low at the park. The park currently supports approximately 4,500 acres of black-tailed prairie dogs; they would like to increase the acreage in the future in part for ferret recovery. However, prairie dog management is contentious with neighbors and requires significant time of behalf of park staff.

Bison management requires significant attention because surplus animals need to be culled every few years to maintain the population at desired levels. There are concerns about the effects of this practice on herd genetics and viability. The park would like to expand the bison herd to all suitable habitat in the park (including the South Unit). There is some desire to increase the density of bison within the current range, however, limited water resources preclude this. A potential boundary expansion may alleviate this problem. The park would like to remove cattle from the South Unit and replace them with bison; however, this requires support from the tribe.

Significant amounts of resources and staff time are spent managing the bighorn sheep population. More sheep reintroductions are planned to augment the current population. Poaching continues to be a concern, especially in the South Unit.

Aquatic resource issues are a minor compared to other resources; however, there are a few exceptions. The park is concerned about the CC Spring in the west portion of the North Unit. This spring originates in uplands that receive high loads of pesticides and fertilizers. The park currently maintains stock ponds within the bison range for bison watering. They would like to reduce the number of maintain sites to the minimum needed for bison watering, but currently lack information on what sites should be preserved and which ones restored to natural drainages.

A large portion of the North Unit is designated Wilderness. Maintaining wilderness values such as clean air, natural vistas and horizons, and natural soundscape is an important goal.

Air quality is a concern due to Powder River Basin energy development in Wyoming. Railroad development south of the park is also a concern. Park staff are concerned about climate change on park resources. Many mesic plants are on the periphery of their range and tolerance levels in the hot dry climate of the park.

More visitation, pressure by the state to increase tourism related businesses, and the potential for increased bed-and-breakfast establishments around the park boundary are all issues of concern to park staff. Trail rides, a potential Rails-to-Trails project along Highway 44, and air helicopter tours are all of concern to park staff.

The park needs to and wants to closely integrate and coordinate its management with the adjoining Buffalo Gap National Grasslands wherever possible. The two agencies already have a close working relationship with ferrets and other wildlife species such as the swift fox.

The park has several opportunities to expand the park boundary and/or acquire some inholdings within the current boundary. Park staff would like to be in a position to monitor and track changes to these potential acquisitions.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES:
Implicit in the park legislative history is the mandate to protect and monitor the fossil resources. The park is a Class I airshed so it must monitor air quality. The park has a Wilderness mandate and the monitoring that is associated with that.

The State of South Dakota would like an IMPROVE station for monitoring air quality. The state would also like monitoring of the recently reintroduced swift fox population, as well as monitoring of prairie dogs, ferrets, and grasshoppers (the latter when a potential pest issue). Local governments want (control and) monitoring of noxious weeds.

Basic Map

Veg Map

Map on monitoring sites

Devils Tower National Monument

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Devils Tower NM was proclaimed in 1906 as the nation's first national monument under the Antiquities Acts as "a natural wonder and object of great scientific interest… to reserve, preserve, and protect the lofty isolated rock and surrounding reserved public lands as an object of historic and scientific interest for the public benefit." A boundary change occurred in 1955.

PARK MISSION:

GENERAL DESCRIPTION:
Devils Tower NM is in northeastern Wyoming in the western-most part of the Black Hills. Devils Tower (Tower), a monolith made of igneous rock, commands attention due to the many symmetrical joint columns rising from a ponderosa pine forest. At 867 feet high, and 1,267 feet above the Belle Fourche River, it is a dominant landmark in the region, and the primary attraction at the 1,347 acre park.

The Tower is sacred to many native peoples and figures prominently in the belief systems and narratives of numerous tribes. At least 20 tribes are known to have a cultural affiliation with the Tower. Known by several northern plains tribes as Bears Lodge, the Tower is a sacred site of worship for many. Prayer offerings (bundles and cloths), sweatlodge ceremonies, and vision quests are just a few of the cultural practices associated with the Tower.

The Tower is also known as a place that aliens landed, and therefore a significant cultural resource to modern people.

The Tower is one of the premiere rock climbing areas in North America and boasts a colorful 100-year climbing history. Several thousand climbers attempt to scale the Tower each year. The park carefully regulates and manages climbing activities. Partial closures are sometimes enacted to protect nesting falcons and voluntary closure is in place in June out of respect for Native American culture.

Hunting and trapping are not allowed at the park, but do occur just outside the boundary. The park is in the process of abolishing a campground in the Belle Fourche floodplain.

DESCRIPTION OF NATURAL RESOURCES:
The park is situated on the border of the Red Valley and Hobback geomorphic features. The Tower dominates natural resources and resource management at the park; however, significant and diverse other resources occur as well. They include a ponderosa pine forest, deciduous woodlands, prairie grasslands including an extensive prairie dog town, and the Belle Fourche River. Mountain and plains species meet at the park in the ecological mix distinctive of the Black Hills.

The park contain some good examples of northern Black Hills vegetation, including Ponderosa Pine forests and mixed grasslands of more mesic nature than most represented in other NPS holdings in the Black Hills. The vegetation of the park was mapped according to National Vegetation Classification System standards in 1996-1997, yielding seventeen vegetation types in the park (Salas and Pucherelli, 1998a). Four of these are considered globally vulnerable or worse, but the ranking is certain for only the Ponderosa Pine / Bur Oak Woodland. The other three are Ponderosa Pine / Oregon Grape Forest, Ponderosa Pine / Bluebunch Wheatgrass Woodland, and Prairie Cordgrass - Bulrush Wet Meadow. Five other vegetation types may also be considered vulnerable.

The park experienced a burn that killed many of the ponderosa pines, creating a mosaic of habitats. The ungrazed structure and late seral stage of the grasslands also makes the site regionally valuable.

The Black Hills Community Inventory (Marriot et al., 1999) evaluated the condition of all seventeen vegetation types mapped at the park. One of these (Black Hills Granite - Metamorphic Rock Outcrop) was ranked as "A" (where A has the highest integrity on a scale of A to F), ten others as "AB", two as "B", and the remaining four as "BC" or "C". Because of the good condition of many of the plant communities, the park was considered a possible

exemplary site by the study; however, the small size of most of the communities and the poor condition of the riparian vegetation types precluded the park's inclusion as an exemplary site. In the riparian areas, a disrupted flood regime and possible herbicide residue have resulted in a lack of recruitment of cottonwood trees. Exotic species, particularly Leafy Spurge, are also a problem in the riparian zone. In the uplands, annual brome grasses, Smooth Brome, Houndstongue, Common Mullein, Bulbous Bluegrass, and Kentucky Bluegrass are problematic. Kentucky Bluegrass is particularly widespread in grassland areas, and this species is the dominant in one of the vegetation types.

The top of the Tower supports a small grassland community. It is not known if any of the plants or animals on top of the tower are genetically unique or otherwise significant.

Prairie dogs are the most prominent wildlife resource at the park in terms of visitor appreciation and ecological significance. The park has about ___ acres of prairie dogs. Park staff believe that the park has a high density of porcupines; whether these populations are unnaturally high is not known. Yellow-bellied marmots are also common at the park, perhaps more so than areas outside the park. Prairie falcons are a significant wildlife resource because of their uniqueness, appreciation by the public, and potential affect to climbing activities. Prairie falcons are known to nest on the Tower. Peregrines have been observed, but are less common. There is also evidence of goshawk nesting in the park.

The park has no federally-listed threatened or endangered plant or animal species. Six species on the current Wyoming list of Plant of Special Concern (http://uwadmnweb.uwyo.edu/wyndd/Plants/plant_species.htm) occur at the park (Fertig, 2000). All of these are considered globally secure although state critically imperiled, primarily because they are on the periphery of their range at the park. The species are: Whorled Milkweed, Emory's Sedge, Hairy Wild-rye, Dakota Mock Vervain, Plains Frostweed, and Prairie Violet. Two of these (Hairy Wild-rye and Dakota Mock Vervain) were historically located in the park, but were not found in the most recent survey (1999). One of these (Whorled Milkweed) has its only known Wyoming occurrence in at the park. The black-tailed prairie dog is a candidate species for federal listing. Bald eagles are occasionally observed in the vicinity of the park and sometimes winter there, but are not known to nest there. Whooping cranes may occasionally fly over.

In addition to the unique geology of the Tower, the park also contains a Slot Canyon site that provides a unique micro-community and geologic feature.

NATURAL RESOURCE GOALS AND OBJECTIVES:
Management objectives at Devils Tower NM include:

- Restore and maintain the health and diversity of the Monument's natural systems
- Preserve archeological, historic, and ethnographic values
- Interpret the significant and varied themes of Devils Tower
- Balance educational, spiritual, and recreational uses of the Tower and its surrounding landscape to provide meaningful visitor experiences

NATURAL RESOURCE ISSUES:
Management issues at Devils Tower NM include management of the prairie dog town. In recent years the colony expanded into a campground and administrative area; however, that is less of an issue now that the campground is proposed for abolishment. However, prairie dogs will likely continue to be a management issue due to concerns by neighbors, interactions with visitors, and the potential for a plague epizootic. The latter would be a concern from both the perspective of human health and for the viability of the prairie dog population.

Deer numbers are a minor concern for park staff. Exclosures were established at the park to help assess the impacts of deer herbivory. Livestock trespass is an ongoing problem.

The park actively manages for a natural patchiness within the park, specifically, a good mixture of meadows and forest.

The invasion of non-native plants is expected to be a long-term issue at the park.

The health of the vegetation in the Belle Fourche riparian corridor, specifically the loss of natural regeneration of cottonwoods (Populus deltoides) and willows (Salix spp.) is a concern to management. It is unclear how much of the lack of regeneration can be attributed to the altered hydrograph of the river, how much to pesticide residue (e.g., Tordon), and how much to other factors.

Water quality and quantity of the Belle Fourche is an issue. An upstream dam has altered the natural hydrograph of the river. The land across the river from the park is rangeland; the associated activities of that may affect water quality. Herbicide use, from both within and outside the park, is of concern to park management. The park has at least 3 springs and maintaining natural water conditions is of concern to park management.

Various aspects of the climbing program are of concern for park management. For example, the park restricts climbing of the Tower until at least March 15 to provide an opportunity for nesting by falcons. There are concern about climber impacts to vegetation and soil on top of the Tower. Climbing affects the integrity of the Tower (e.g., things falling off, impacts from bolts and hangers, audio impacts).

Air quality may become an increasing issue due to current and future energy development further west.

Increased visitation may have an affect on numerous resources. Overflights may affect park resources (e.g., sound) as well as visitor experiences.

Potential development, especially along the south border could have impacts to park resources and visitor experiences. The GMP may result in some development and changes that could impact park resources, .e.g., the new GMP proposes a new transportation system within the park. The current park infrastructure may also have some impacts on park resources.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES
There is no specific mandates or legislation in regards to monitoring per se. Park neighbors would like the park to monitor for chronic wasting disease of cervids, West Nile disease, and exotic plants (specifically noxious weeds).

Basic map

Veg Map

Monitoring map

Fort Laramie National Historic Site

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Fort Laramie NHS was proclaimed a national monument in 1938, and redesignated in 1960. Boundary changes occurred in 1960 and 1978. The proclamation creating the park said it was for the purpose of improving, preserving and conducting such lands and structures as a public historical site.

Fort Laramie has a rich history in westward expansion from 1842-1890. Major fur trading posts occurred at the site from 1834-1849. From 1849-1890, Fort Laramie was an important military fort on the western frontier and played a vital role in the westward overland migrations of over 350,000 pioneer emigrants. A number of High Plains Indian campaigns were launched or supported by troops from Fort Laramie during the Indian Wars. Two important Indian peace treaties, the Treaty of 1851 and the Treaty of 1868, were signed at the fort. Fort Laramie closed in 1890, the same year the frontier was declared gone. Between the abandonment of the fort in 1890 and the park's establishment, the area was essentially a country village (Mattes, 1980).

At the time of European settlement the Platte River was a murky river full of suspended sediments and typical of many Great Plains streams. In contrast, the Laramie River was more of a clear mountain stream. At the same time, the valley to the east of the confluence of the two rivers was almost devoid of trees and sagebrush; what few cottonwoods existed were quickly cut down by settlers (an 1858 photo shows the vicinity of the fort mostly treeless). To the west sagebrush was common with juniper and ponderosa pines on the rising slopes of the mountains (Lavender 1983).

PARK MISSION:

GENERAL DESCRIPTION:
Fort Laramie National Historic Site (FOLA) lies in southeastern Wyoming at the confluence of the North Platte and Laramie Rivers.

The surviving buildings at the park are from the major military post that existed there (the fur trading posts no longer survives). They are the centerpiece of the park. The lands around the buildings and historic area are kept mowed.

The park monitors for law enforcement purposes a nearby federal property administered by the Bureau of Land Management (BLM). Although there have been discussions of having the site transferred to NPS administration, that does not seem imminent.

DESCRIPTION OF NATURAL RESOURCES:
Fort Laramie NHS has a large diversity of habitats for such a small site. This is due in large parts to the two rivers that meet within the park boundary, and the topography that ranges from riverbed to upland areas outside of the floodplain, and the location of the park near the edge of the Great Plains and Rocky Mountains. Species can be found in the park that are typically associated with eastern ecosystems as well as species associated with western ecosystems.

The natural vegetation of the area includes short- and mixed-grass prairie, sparse pine woodlands, and riparian floodplain forest and herbaceous vegetation. The park’s vegetation was mapped according to NVCS standards in 1996-1997 (Aerial Information Systems, 1998b). Thirteen vegetation types were identified in the park, two of which are considered globally vulnerable or worse. These are: Cottonwood / Western Snowberry Woodland, and Prairie Cordgrass - Bulrush Wet Meadow (with the latter being questionable). One additional vegetation type, Western Wheatgrass Mixedgrass Prairie, may be globally vulnerable but its current status is not well understood .

Habitat for the federally threatened Ute Ladies’-tresses may occur in or near the park, but the species has not been found within the park's boundaries (National Park Service, 2003). The majority of a plant inventory for the park

was completed in 2003, though more work will be done in 2004. This inventory (Heidel, 2003) provides the following information: Four species on the Wyoming Natural Heritage Species of Concern list have been documented within the boundaries of the park. These species are Slender False-foxglove, Shining Flatsedge, Great Blue Lobelia, and Indian Grass. All of these species are globally secure, and all are rare in Wyoming because they are at the edge of their range. One species of concern, Showy Prairie Gentian, was previously collected in the vicinity of the park but its presence within park boundaries has not been confirmed. Two additional species on the state's list of concern (Golden Prairie-clover and Six-angle Spurge) occur in the northern BLM tract that the park patrols for law enforcement reasons only (i.e., no management involvement).

Bald eagles occasionally occur in the park. The park has habitat for the endangered Preble's jumping mouse, however, a 2003 small mammal inventory at the park failed to locate the species.

At least 25% of the park's area was classified as one of three disturbed vegetation types. Historical records and current vegetation suggest that the majority of the park's non-riparian acreage was cultivated and/or severely grazed at one time. Restoration efforts have been attempted in some of these areas, but the success of these efforts has not been quantitatively assessed. As a result, exotic and sometimes invasive species such as Cheat Grass, Japanese Brome, Smooth Brome, Kochia, and Canada Thistle are common in the park. Riparian vegetation along the Laramie River is generally in better condition (less invasive plant presence, more cottonwood regeneration) than along the North Platte River.

The park has no native large ungulate grazers, but it does provide "winter" (September - April/May) pasture for pack horses from Rocky Mountain National Park. The herd size varies from 6 to 32 animals, depending on season and year. Stocking rates were developed by the County based on park objectives. The park developed a bat house for the purpose of keeping bats from occupying the historic structures. The bat colony is now one of the more widely promoted natural resources within the park and is important to regional biological diversity. The rivers remain open in the winter months which attracts waterfowl and raptors in comparatively large numbers.

The river ecosystems are significant natural resources within the park. There are still relicts of the natural river flows such as river oxbows. Many of the rare species listed above are associated with the river habitats.

NATURAL RESOURCE GOALS AND OBJECTIVES:

NATURAL RESOURCE ISSUES:

The surrounding landscape is important to park management. Isolation, vast open spaces characteristic of the west, clear views of distant landscapes such as Laramie Peak, are all important in maintaining the integrity of the park and visitor experience. The lack of modern intrusions, a rural landscape, open space, low noise levels, and good air quality all help to define and interpret the environment experienced by Native Americans, fur trappers, traders, emigrants, and soldiers assigned to the isolated post.

Exotic plants continue to be a significant management issue in all habitats in the park. There is an active program to control the exotics (the NGP EPMT), but no systematic monitoring of the effectiveness of the program. The absence of fire remains a concern. Although the area is grazed by horses, there are questions about the level of grazing and the impacts it is having on park resources.

The irrigation canal affects park resources through seepage and other hydrological affects. The future status of the canal is uncertain. It is closely linked to the farm economy.

The potential occurrence of Preble's jumping mouse and Ute lady's tresses will remain an issue. Although not found in recent inventory work, neither study was conclusive.

Chronic wasting disease and West Nile virus are of concern to management. Canada geese numbers have increased in recent years and may be at unnaturally high levels and/or having impacts on park resources. Carp are an especially harmful exotic in the rivers.

The dams on the Laramie and North Platte Rivers continue to impact the riverine ecosystems within the park.

Herbicides are used both within and around the park.

In the future there may be increased development from Cheyenne and elsewhere in the vicinity of the park.

The nearby power plants may be affecting air quality.

The nature trails within the park are being promoted more. There is concern about the impacts that hikers are having on park resources.

The park is concerned about the affect of night lights on the night sky and visitor experiences. They are also concerned about the soundscape, especially from a nearby railroad track and National Guard helicopters.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES

There are no specific mandates in the park's legislative history that require monitoring of natural resources. Local governments and others would like the park to (control and) monitor noxious weeds. They would also like the park to monitor for chronic wasting disease and West Nile virus. The Wyoming Natural Heritage Database would like the park to monitor the species on the state Watch list. The Fish and Wildlife Service would like the park to continue to monitor for the presence of the Preble's jumping mouse. The BLM would like the park to continue to monitor the status of the lands near the park (primarily in regards to law enforcement issues).

Basic Map

Veg Map

Monitoring Map

Fort Union Trading Post National Historic Site

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Fort Union Trading Post NHS was authorized in 1966, with a boundary change in 1978. The park was created to commemorate the trading post and it's role in American history.

The American Fur Company established Fort Union Trading Post in 1828. During its operation from 1828-1867, Fort Union employed up to 200 people who traded cloth, guns, and other goods to Native American tribes for bison robes. In 1867, the U.S. Army bought the post and removed much of the building materials to construct Fort Buford, located a few miles from Fort Union. After the building materials were removed, a Hidatsa band occupied the area for about 15 years. Much of the park site was also farmed during this period. In 1941 the State Historical Society of North Dakota took over the site and administered it as a State Historic Park. It would remain in that status until 1966 when it was transferred to NPS. Local interest was instrumental in authorized the site as a national park unit.

PARK MISSION:

GENERAL DESCRIPTION:
The 442-acre Fort Union Trading Post NHS straddles the Montana/North Dakota border, with most of the park being located in the latter state. The site is near the junction of the Missouri and Yellowstone Rivers.

A large portion of the post has been reconstructed as it was in the 1850s.

The park is located within an agrarian landscape. The local farm economy is suffering, as is typical throughout much of the Great Plains. Farm consolidation is occurring.

DESCRIPTION OF NATURAL RESOURCES:
The two most significant natural resources to park management are the river and the prairie, although the river channel per se is not within park jurisdiction. The land within the park boundaries is comprised of two distinct vegetative zones: the ancient floodplain on which the fort is located, i.e., the prairie, and the active floodplain along the Missouri River (Fort Peck Dam in central Montana now regulates river flows).

The natural vegetation of the area would be riparian floodplain forest and herbaceous vegetation, as well as northern mixed-grass prairie. Historical photographs and paintings suggest that there were few trees on the park side of the Missouri River (some show no trees in the vicinity of the fort), although there were extensive forests in the floodplains on the south side of the river. By the 1930s the site was mostly treeless, but it's unclear how much of this was natural and how much was due to cutting of the trees.

Thick stands of trees and shrubs interspersed with grassland and willow (Salix spp.) thickets occur in the active floodplain. Dominant species include cottonwood (Populus deltoides), ash (Fraxinus spp.), elm (Ulmus spp.), and sedge (Carex spp.: Willard 1980). The more upland area (i.e., the ancient floodplain) is generally a mixture of native and exotic grasses typical of the present mixed-grass prairie. Prior to NPS ownership, the area immediately surrounding the fort was farmed. It is presently being restored to native prairie vegetation. The Bodmer Overlook—a 40-acre parcel that overlooks the fort—is less disturbed and is primarily native vegetation. Dominant species at the overlook site include needle-and-thread (Hesperostipa comata), western wheatgrass (Pascopyrum smithii), blue grama (Bouteloua gracilis), and prairie coneflower (Ratibida spp.: Willard 1980).

Park vegetation was mapped according to National Vegetation Classification Standards in 2002-2003, yielding fourteen vegetation types (Salas and Pucherelli, 2003a). Only one of these types, Green Ash - Elm Woody Draw, ranked as at least globally vulnerable. However, the vegetation mapping report notes that the understory forb layer in this community within the park has a considerable amount of exotics, including Smooth Brome, Kentucky Bluegrass, Alfalfa, and Crested Wheatgrass. The Cottonwood - Peachleaf Willow Floodplain Woodland type might also be globally vulnerable. The understory of this community is also often dominated by exotics.

The park has no federally-listed threatened or endangered plant species. So far, only one species on the North Dakota Natural Heritage Rare Plants list has been confirmed in the park. This is White Locoweed, which occurs in mixed grass prairie. Bald eagles, least terns, and piping plovers are all federally-listed bird species that occur in the vicinity of the park. The eagle occasionally roosts in the park, especially in the winter, while the other two species are primarily found on sandbars within the current river channel. The endangered pallid sturgeon is found in the reach of the Missouri that passes the park.

Much of the area within the park's boundaries was cultivated. This, combined with the long use of the site for grazing and other uses, has had serious impacts on much of the vegetation. Three of the park's vegetation types are semi-natural (dominated by non-native species) or recently planted prairie restorations. These three types comprise more than half of the vegetation in the park. Native vegetation occurs primarily in the Missouri River riparian zone, but small amounts (<25 acres) of natural prairie occur in the uplands. The restoration efforts, the earliest of which began in 1993, have planted primarily native grasses (very few forbs) in previously cultivated areas. Two invasive grasses, Crested Wheatgrass and Smooth Brome, are a problem in these restored areas. Leafy Spurge and Canada Thistle also occur in the park, and exotics are not uncommon in the understory of riparian woodlands.

The mixture of woodland and prairie vegetation provides habitat for a variety of vertebrate species. Woodpeckers, raptors, owls, bats, and mice are likely inhabitants of the woodlands while meadowlarks, sparrows, ground squirrels, and deer use the upland prairie habitat. Mosquitoes are noted as being particularly nettlesome at the park; a condition which was observed along the Missouri River as far back as Lewis and Clark. Vertebrate species no longer found at the park include wolves, bison, elk, mountain lions, and grizzly bears. In light of the parks small size, history of land use, and isolation from healthy natural habitats, it's likely that some invertebrate species have been extirpated from the site as well.

The former extensive forest in the floodplain on the south side of the river are now in cultivation. Bank erosion, probably exacerbated by the removal of these trees, is affecting these fields.

NATURAL RESOURCE GOALS AND OBJECTIVES:

NATURAL RESOURCE ISSUES:
Maintaining and re-creating the 1850s vistas and natural scenery of Fort Union Trading Post is a primary issue of management concern. A project is underway to restore the uplands, within practical limits, to the vegetation found in the mid-1800s. A prescribed fire program and exotic weed control program are elements of the restoration project. Contributing to the protection of Missouri River resources, such as the federally listed pallid sturgeon, is also of management concern at Fort Union Trading Post NHS.

Exotic plants are a significant issue at the park, and one that will likely continue into the future (exotics are common in lands bordering the park). Potential future exotics include purple loosestrife and tamarisk. The changes in riparian vegetation and natural succession are a concerned to park management due to the affects of the dam on the Missouri River. The lack of grazing is of concern to management because of its ecological affects and from a cultural perspective (i.e., because grazing was common during the historic period the post was in operation) The park would like to see woody vegetation established on the south side of the river.

Herbicides, including those from within the park, are a concern to park management. External pesticides, specifically those from aerial spraying of sugar beets, are also a problem. The pesticides may include insecticides as well as herbicides.

The Ft. Peck dam upstream on the Missouri River continues to affect the integrity of park resources due to it's altering the natural hydrograph of the river. Riverbank erosion (which was a natural process prior to dam construction) is a concern to park management in part because of the potential affect on cultural resources. Erosion control actions along the river may impact resources, such as the endangered pallid sturgeon.

Park staff have observed a fair amount of wildlife mortality due to vehicle collisions on the main road.

The small size of the park will continue to limit management options and result in a high level of external threats to park resources. Surrounding ownership and land use is varies, making coordination and agreement difficult. Cattle trespass into the park occurs occasionally.

There are special events at the park, typically associated with cultural resources, that may affect natural resources in the park, e.g., visitor trampling of vegetation.

Energy development occurs in the vicinity of the park, affecting the viewscape and potentially affecting air quality.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES:
There are no specific mandates for the park to monitor natural resources. Neighbors would like the park to (control and) monitor exotics, including tamarisk. Erosion control actions may require monitoring of pallid sturgeon.

Basic Map

Veg Map

Monitoring Map

Jewel Cave National Monument

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Jewel Cave National Monument was proclaimed in 1908. Administration was transferred from the U.S. Forest Service to the NPS in 1933, and a boundary change occurred in 1965 to better oversee the new cave routes that had been discovered in the interim. The enabling legislation recognized the scientific value and public interest in the cave, as well as the need for adequately protecting the land surface above the cave.

Jewel Cave was discovered in 1900 by Frank and Albert Michaud when they noticed air blowing out of a small hole in the rimrock above Hell Canyon. The soon returned with dynamite and tools to enlarge the entrance. That same year the brothers made a mining claim on the site. The brothers soon started developing and promoting the site as a tourist attraction. Following the proclamation of the site as a national monument, the Michaud brothers sold their claim to the site to the federal government. Cave tours at the historic entrance continued mostly uninterrupted until 1972 when the new visitor center and entrance was completed.

PARK MISSION:

GENERAL DESCRIPTION:
The park lies in the southwestern Black Hills near the border of the Limestone Plateau and Minnelusa Foothills formations in southwestern South Dakota. Ponderosa Pine forest and woodland interspersed with mixed-grass prairie meadows dominate the landscape. In August 2000, the 83,503-acre Jasper Fire burned through a large portion of the western Black Hills, drastically changing the vegetation and appearance of the ecosystem. Within the park, 1,279 acres burned.

Guided cave tours occur year round. The most common tour is a ½ mile loop along a paved route. A spelunking, candle lantern, and discovery (i.e., introductory) tour is also offered on a limited basis.

The original entrance to the cave is now gated off to prevent entrance. The new entrance to the cave is through sealed elevator shafts.

There are two-self guided hiking trails within the park and other trails on the neighboring Black Hills National Forest. There is a small historic area that includes a CCC cabin built in 1935.

DESCRIPTION OF NATURAL RESOURCES:
Jewel Cave lies in the southwestern portion of the Black Hills. When the uplift of the Black Hills occurred about 60 million years ago, a multitude of cracks and fissures were created in the underlying layers of limestone. When the water table subsequently rose and fell, water filled the cracks and dissolved the limestone creating the cavity known as Jewel Cave. With more than 129 miles surveyed, Jewel Cave is recognized as the third longest cave in the world. Airflow within its passages indicates a vast area yet to be explored. The cave contains a wide variety of formations including speleothems, stalactites, stalagmites, draperies, frostwork, flowstone, boxwork and hydromagnesite balloons. Jewel Cave exists under about three square miles of surface area, but only two-thirds of this area lies within the boundaries of the park.

The uplands are largely dominated by Ponderosa pine (Pinus ponderosa) forest. However, recent vegetation mapping identified 13 distinctive vegetation types. In addition to six types dominated by Ponderosa pine, stands of boxelder (Acer negundo), aspen (Populus tremuloides), and chokecherry (Prunus virginiana) are found along drainage bottoms. Western snowberry (Symphoricarpos occidentalis) shrublands are also present. Herbaceous openings in the forest are dominated by western wheatgrass (Pascopyrum smithii), little bluestem (Schizachyrium scoparium), side-oats grama (Bouteloua curtipendula), blue grama (Bouteloua gracilis), and thread-leaved sedge (Carex spp.). Despite the pervasiveness of ponderosa pine, the flora of Jewel Cave NM is relatively diverse due in part to microhabitats such as springs and seeps (Marriot 1985).

JECA's vegetation was mapped according to NVCS standards in 1996-97, yielding ten vegetation types in the park and two more in the park's surroundings (Salas and Pucherelli, 1998b). Only one of the vegetation types mapped as

in the park's boundaries is considered globally vulnerable or worse – Ponderosa Pine / Mountain Ninebark Forest. Three others might also be globally vulnerable, these are: Ponderosa Pine / Sedge Woodland, Ponderosa Pine / Little Bluestem Woodland, and Northern Great Plains Little Bluestem Prairie.

The Jasper Fire drastically changed the vegetation from how it was mapped in 1996-1997. Prescription fires in some portions of the park prior to the Jasper Fire successfully reduced fuel loads so that the fire was cooler in these areas and tree mortality was relatively low. Higher fuel loads in the remaining majority of the park resulted in significant tree mortality, thereby changing forest and woodland structure and composition. Despite this disturbance, it is likely that most of the vegetation types mapped still occur at the park, but their distribution has been altered. In general, Ponderosa Pine forest and woodland is now less extensive and the area of meadows with herbaceous vegetation has increased. Vegetation types not mapped in the park prior to the fire may appear now that the canopy cover has been reduced. Even before the fire the park had a comparatively high density of snags and large trees due to the absence of logging.

There are no federally-listed threatened or endangered plants or animals at the park. A 1986 vegetation survey (Marriott and Hartment, 1986) listed four South Dakota rare plant species (http://www.state.sd.us/gfp/DivisionWildlife/Diversity/rareplant2002.htm) that are either suspected to be or are confirmed as in the park: Hopi Tea and Hooker's Townsend-Daisy are confirmed in the park (though Marriott and Hartment suspected that Hopi Tea had been planted near the visitor center), and the geography and habitat are correct for Sleepy Grass and Easter Daisy. The park's plant list also includes Smallflower Columbine, a USDA Forest Service sensitive species monitored in the Black Hills National Forest. The Nature Conservancy's Black Hills ecoregional conservation plan (Hall *et al.*, 2002) states that the area of the park and the surrounding Forest Service lands is known to house Muskroot, or Moschatel, a secondary plant target. This species has not been documented in the park, however. Bald eagles are occasionally seen in the vicinity of the park. Four of the bat species (M. thysanodes, M. volans, M. ciliolabrum, and C. townsendii) are designated by the U.S. Fish and Wildlife Service as species of concern. Black-backed Woodpeckers (TNC secondary animal target), which prefer recently burned conifer forest with abundant snags, and Tawny Crescent butterflies (TNC primary animal target), which may depend on the Smooth Blue Aster as its host plant, are also known to occur in the area.

The current state of the vegetation is difficult to evaluate given the large disturbance of the Jasper Fire since the latest vegetation mapping effort. Invasive plants, primarily Canada Thistle, do occur at the park, and other troublesome exotic species such as Prickly Lettuce seem to have increased since the Jasper Fire in some areas. Despite this disturbance, Marriot et al. (1999) considered Jewel Cave and surrounding Forest Service property in and around Hell Canyon as a potentially exemplary site in their evaluation of Black Hills plant communities due to the generally good condition of the ecosystem and the existing protection of the area. The condition of all but one of the native vegetation types was ranked as “B”, the exception being Ponderosa Pine / Common Snowberry Forest, which was ranked “AB”. Finally, some very small (<5 acres) areas of the park apparently were never logged, and therefore are unusual in the Black Hills for their old growth trees.

Of all of the wildlife species at the park, bats are the most studied and of most concern to management. Nine species of bats use Jewel Cave at some point during the year. The cave is a hibernaculum for five species of Myotis and one species of Corynorhinus (Townsend’s big-eared bat). In 2004 investigators found 457 Myotis, 886 Corynorhinus, and 2 Eptesicus (Big brown bat) hibernating in the cave. The Corynorhinus is especially noteworthy since it’s one of the largest hibernating colonies in the western United States and a species of concern in South Dakota. There is some evidence that nursery sites for this species may be in the vicinity of the park. Although Big brown bats are common in the Black Hills and use the cave as a summer night roost, they do not typically hibernate there. All these species also use the cave during the warm months for roosting. The value of the cave to hibernating and roosting bats is due in part to the diversity of micro-climates within the cave. Hoary bats and silver-haired bats use the ponderosa pine trees in the park for daytime roosts, but do not regularly use the cave (they migrate south in the winter). Many pregnant Myotis can be found in nursery colonies in ponderosa pine, snags, rock crevices, and sometimes, buildings. Although the bat use of the cave is likely of recent origin and a result of anthropogenic disturbances, the site is recognized of having high regional biodiversity value and hence, protected and managed for by park staff. Mountain lions or their sign are occasionally observed at the park and of high interest to visitors and park staff. The tawny crescent butterfly is a rare species that may occur at the park. Over sixty species of birds have been documented at Jewel Cave during the breeding season, including the Cassin’s finch, brown creeper, Lewis’

woodpecker, and common poorwill, all rare species in South Dakota. Jewel Cave NM is the only park in the NGP Network that does not have any fish habitat.

Other than a wastewater treatment pond, there is no permanent surface water at the park. Surface water can be found in Hell Canyon and other drainages in the park during wetter periods. There are 3-4 springs in the park with moist soil and associated plants.

NATURAL RESOURCE GOALS AND OBJECTIVES:
Management objectives for Jewel Cave NM are:

- To monitor, maintain, restore, and protect the natural systems and conditions that exist in the Monument
- To plan and manage surface resources and developments in order to maintain, restore, and protect natural systems and conditions within the Monument
- To work with the Black Hills National Forest and neighboring landowners to ensure that land uses adjacent to the Monument do not threaten portions of the cave system that extend beyond park boundaries
- To identify, document, and protect significant plant and wildlife resources within the Monument

NATURAL RESOURCE ISSUES:
Visitors transport foreign objects into the cave such as lint, hair, and skin cells. The sometimes touch and/or break cave features. The park has concern about the use of paraffin lanterns for special tours. More than 40% of the known cave is outside the park boundary. Impacts to the integrity of the cave from neighboring landowners remains a concern for the park. The continued mapping of the cave is a high priority for park staff.

Approximately 80-90% of Jewel Cave NM burned during the Jasper Fire in 2000. Recovery of vegetation has occurred in some sites, but not others. Exotic plants will continue to be a management issue throughout the park, affecting the integrity of the plant communities. The affects of control, such as the use of herbicides, is an issue for management. The use of prescribed fire will remain a management issue. The park would like to maintain some of the meadows in an open condition.

A gate is placed at the entrance to the cave used by bats. There are questions about the affects this may have on bats and its effectiveness. Feral cats have been a problem at the park, specifically at the entrance to the caves where they are suspected of taking bats. There is a potential for microbial life in the cave.

Some housing development may occur in the area approximately 1 mile east of the park.

Visitation issues such as transportation, infrastructure, and cave tours will continue to be a management concern.

The sewage system is of concern to park management because of its affects on the environment and the potential for leaks and overflow.

A significant road realignment may occur on the highway passing through the park, including a new bridge over the Hell Canyon area.

Air quality is a concern, especially from current and proposed energy development in Wyoming. A proposed State of South Dakota cement quarry in lower Hell Canyon could affect air quality at the park.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES
The are no specific legislative mandates for natural resource monitoring at the park.

Basic Map

Veg Map

Monitoring Map

Knife River Indian Villages National Historic Site

ENABLING LEGISLATION/HISTORICAL CONTEXT:
The park was authorized in 1974, with a boundary change in 1990. Enabling legislation suggests the park should be reminiscent of the period of Lewis and Clark. The park consist of 1,758 acres, with approximately 164 non-federal acres within the park boundary.

PARK MISSION:
The site preserves historic and archaeological remnants of the culture and agricultural lifestyle of the Northern Plains Indians.

GENERAL DESCRIPTION:
Knife River Indian Villages NHS lies in central North Dakota, on the west side of a free-flowing stretch of the Missouri River. The park encompasses both sides of the Knife River at its confluence with the Missouri

The history of land use in the vicinity of the park begins 10,000 years ago with Native Americans who traversed the area while hunting and gathering. The area was a trading hub established by the earth-lodged Hidatsa and Mandan tribes. It was an important place where Native American culture and agriculture developed. After the smallpox epidemic in 1837 the Hidatsa and Mandan tribes abandoned their villages at the site. During the second half of the 19th Century steamboats frequented the area and created "wood yards" on the Missouri River bottomlands, with the largest of these yards occurring at the present day site of the park. Permanent settlement by European-Americans occurred in 1882 when the nearby village of Stanton was established.

DESCRIPTION OF NATURAL RESOURCES:
Two physiographic zones exist within the park, and represent the park's most significant natural resources (along with the rivers per se). The first and lowest of these is the floodplain found immediately adjacent to the Knife and Missouri Rivers. Historically, the floodplain was scoured and inundated during spring runoff or large rainstorms. Today, the area is covered by established woodlands known as the Missouri River bottomlands. Dominant tree species include green ash (Fraxinus pennsylvanica), boxelder (Acer negundo), American elm (Ulmus americana), and peach-leaved willow (Salix amygdaloides). The second physiographic zone is the "terrace" (i.e., the older and higher floodplain). This zone is usually separated from the lower floodplain by a distinct scarp or edge. The terrace is a mosaic of native mixed-grass prairie, old agricultural fields, and restored prairie. The native prairie is dominated by grasses such as needle-and-thread (Hesperostipa comata), western wheatgrass (Pascopyrum smithii), blue grama (Bouteloua gracilis) and green needlegrass (Nassella viridula). Smooth brome (Bromus inermis), alfalfa (Medicago sativa), and yellow sweetclover (Melilotus officinalis) are common in the old fields (Lenz 1993).

The park's vegetation was mapped according to NVCS standards in 2002, yielding 14 vegetation associations (Salas and Pucherelli, 2003b). Only three of these are considered globally vulnerable or worse. Northern Plains Transition Bluestem Prairie is a western outlier of tallgrass prairie and occurs in the Big Hidatsa Pasture in the park. Green Ash - Elm Woody Draw is the most common woodland type in the park area, but only one occurrence of this type in the park's boundaries has a shrub component. Cottonwood - Green Ash Floodplain Forest (G2G3) probably existed to a greater extent at one time at the park site, but flood control on the Missouri River and heavy Smooth Brome cover in the understory has hindered cottonwood regeneration. In addition to these vegetation types, four small areas of vegetation were noted in two previous vegetation surveys for their diversity or uniqueness. Clambey (1985) and Lenz (1993) noted a small collection of low stabilized dunes just east of the Knife River where sandy soils provided habitat for vegetation different from the rest of the park. Lenz (1993) also noted (1) a narrow woodland along the bottom of a low escarpment at the edge of the old river terrace where the trees were tall and well-formed (compared to stunted trees elsewhere in the park) and tree regeneration was occurring; (2) very steep wooded bluff of the Missouri River, which has some of the highest plant species richness in the park; and (3) at the bottom of this bluff, a mixture of communities that may represent relatively undisturbed floodplain vegetation. Also noteworthy is that some of the cottonwoods are very old and large; one tree in the park is believed to be the 3rd largest in the state.

As implied above, very little of the park's vegetation is in good condition. Three of the vegetation associations are characterized by invasive species (Smooth Brome, Canada Thistle, and Crested Wheatgrass Semi-Natural

Herbaceous Vegetation Types), and four of the vegetation map units were planted with native or non-native perennial species when the park was established. Many of the areas planted with native species have been severely invaded by Smooth Brome and Crested Wheatgrass. Together, these units comprise 42% of the vegetated area of the park. Smooth Brome and Leafy Spurge occur extensively in floodplain woodlands, and localized infestations of Absinth Wormwood are also problematic.

The park does not support any federally-listed threatened or endangered plant species. A search for North Dakota-listed rare plant species at the park (Lenz, 1993) found none, which the author expected due to the highly disturbed nature of most of the park's vegetation. Bald eagles are commonly observed in the vicinity of the park. Although nesting is suspected, it has not been confirmed within park boundaries (active nesting does occur elsewhere in the Missouri River floodplain). Piping plovers and least terns both use sandbars in the Missouri River and may fly over the park. The pallid sturgeon is in the Missouri River with some individuals likely moving short ways up the Knife River.

Wildlife species at the park includes white-tailed deer, bald eagle, striped skunk, various owls and raptors, wild turkey, badger, coyote, beaver , sharp-tailed grouse, pheasant, waterfowl, raccoon, ground squirrels, and rabbits, among others. The forested area is especially noteworthy for it’s very high richness of bird species (Panjabi 2002, 2003). The river reaches within the park provide habitat for at least 26 species of mollusks and nine species of fish.

Surrounding land uses are agrarian or residential, making the park an island of protected land within a highly altered and developed landscape.

NATURAL RESOURCE GOALS AND OBJECTIVES:

NATURAL RESOURCE ISSUES:
The recent history of anthropogenic disturbance has contributed to many of the natural resource issues at the park. Invasion by non-native species is of particular concern. Leafy spurge (Euphorbia esula) is found scattered throughout the park, primarily in wooded areas. Smooth brome has completely dominated the understory in much of the woodland areas (Lenz 1993). In addition, heartrot fungus and Dutch elm disease have had a large impact on the trees at the site (Lenz 1993). There is also concern over the lack of cottonwood (Populus deltoides) regeneration within the park due primarily to altered hydrographs on the Missouri River. The altered hydrograph likely has other impacts as well such as changes to rates of shoreline erosion. In the uplands, prairie restoration on the formerly cultivated lands is significant resource issue. The lack of grazing is also a concern to park staff; however, it is viewed as less of an issue than exotic plants and restoring the cultivated prairies.

Numerous coal-fired powerplants are in the vicinity of the park, e.g., there are 11 plants within 25 miles of the park. New power plants are being built, or proposed for building within the region. On a larger scale, the park has concerns about the impacts of global warming on park resources.

Water quality, especially on the Knife River, is a concern. The upstream reaches of the river flow through an agrarian landscape where pesticides are commonly used.

The park is concerned about the effects of deer herbivory on vegetation. Although hunting is allowed outside the park boundaries, many deer appear to seek refuge within the park boundaries.

Park staff are concerned that small mammals, such as ground squirrels, are contributing to the degradation of the archeological resources (e.g., burrowing exposes artifacts which makes them prone to theft).

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES:

Basic Map

Veg Map

Monitoring Map

Missouri National Recreational River

ENABLING LEGISLATION/HISTORICAL CONTEXT:
The park was authorized in 1978 and expanded in 1991. The 1978 action established the 59 mile eastern segment and the 1991 action established the 67 mile western segment. These areas were designated to preserve the free-flowing nature of these river sections and the wildlife dependent upon them.

PARK MISSION:

GENERAL DESCRIPTION:
The Missouri National Recreational River comprises 33,389 acres consisting of two sections: a 59-mile eastern reach (aka, 59-mile District) designated in 1978 and a 39-mile western section (aka, 39-mile District) designated in 1991. The eastern reach stretches from Gavins Point Dam near Yankton, South Dakota. to near Ponca, Nebraska. The western section, also known as the upper reach, occurs between Lewis and Clark Lake and Fort Randall Dam. This section of the park also includes 20 miles of the lower Niobrara River and 8 miles of Verdigre Creek in Nebraska.

The park is unconventional in that it does not own property, the exception being the recently acquired 100-acre Bow Creek site that contains bottomland and oxbow habitat. The park achieves its mission and management goals by coordinating and collaborating with a myriad of federal, state, and local jurisdictions and private landowners. In the future a 60-acre island in the Missouri River known as Goat Island may be transferred to the park (administration currently rests with the Bureau of Land Management). The forested island is well established and may have been present at the time of Lewis and Clark. Significant natural areas within the park under the administration of other agencies are Niobrara, Ponca, and Spirit Mounds state parks and the Carl Mundt National Wildlife Refuge.

DESCRIPTION OF NATURAL RESOURCES:
Less than one-third of the Missouri is undammed and unchannelized; therefore, these sections of river within the park are considered some of the best remaining examples of the river in its natural state. Features of the historic and dynamic river can still be found in the form of sandbars, islands, chutes, and snags. Native floodplain forests, bluffs, and tallgrass and mixed-grass prairies can also be found in some areas.

Limited information on the vegetation specific to what falls within the boundaries of the park is available. The vegetation has not been mapped by the USGS/NPS vegetation mapping program yet, and a plant inventory specific to the park has not been completed. In general, the vegetation of the park is dominated by central plains riparian forest. Numerous other types of vegetation occur in the park, however, including native and restored tallgrass prairie, oak woodland and forest, pastures, plowed fields, and residential areas. The Network is currently working on determining which species, including rare species, occur within park boundaries. Because the park encompasses such a long, narrow area, the condition of the vegetation varies considerably. In Ponca State Park native vegetation dominates. Outside of protected areas like this, however, much of the native vegetation has been impacted by agriculture, grazing, and alteration of the water flow regime of the river. Invasive species such as Russian Olive and Purple Loosestrife are problematic in areas.

The park contains several federally-listed endangered and threatened species, the management of which is contentious and complex. For example, the shifting sandbars in the river provide essential nesting habitat for the threatened Great Plains population of the piping plover and endangered interior least tern. The presence and operations of the dams directly affects the creation of the sandbar habitat needed by the birds. The river also supports the endangered pallid sturgeon. Wetlands and backwater chutes are especially important to the species because they provide warm calm waters preferred by the species. Although comparatively less contentious, the bald eagle can be found throughout the park and in all seasons. Carl Mundt Refuge, in the upper reaches of the park, is especially noteworthy of the presence of bald eagles. Topeka shiners may be in the park, but are not documented as currently being there. Whooping cranes could potentially occur during migration. Ospreys are a state listed species that have been reintroduced to the park.

NATURAL RESOURCE GOALS AND OBJECTIVES:

NATURAL RESOURCE ISSUES:
Unnatural flow regimes in the Missouri River continues to be one of the most significant issues to the park. The altered hydrograph and dams have numerous negative effects on the natural conditions and health of the river. For example, the dams and altered flows result in unnatural sediment transport in the river, and the lack of formation of sandbar habitat. Similarly, snags are not as common of a feature in the river as under natural conditions. Likewise, the loss of peak flows and floods of the bottomlands may be affecting cottonwood regeneration. The levels of bank erosion continue to be a concern, as does the most commonly used solution to bank erosion, rip rap. The reduction in backwater and oxbow habitats may be affecting amphibians and other wildlife. Water pollution from agricultural pesticides is a concern to the park. There are many other issues of concern to park staff, as expected in a highly developed and altered system. Exotic plants rank near the top of these other issues.

The park has acquired a 100-acre floodplain area, and hopes to acquire more sites. The park would like to monitor these sites to see if they meet management goals of natural ecosystems and communities. These sites may be managed using conventional agency tools such as exotic plant control methods and prescribed fire.

The park works closely with state and private entities to conserve resources wherever possible. For example, the park tries to assist state parks in managing their lands. There are many questions about the health of these natural areas (e.g., are the restored prairies at Niobrara and Spirit Mound state parks approaching natural conditions) and the agencies would like the park to assist with monitoring their resources. The park anticipates establishing easements for purposes of conserving natural resources. These sites will need to be monitored for compliance.

A continuing challenge for the natural resource staff at the park is to determine how the park can be most effective with the myriad of other agencies and entities have responsibilities, missions, and interests on the river. Park staff also struggle with understanding the complexities of the numerous entities, projects, and issues of the river.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES:

Basic Map

Veg Map

Monitoring Map

Mount Rushmore National Memorial

ENABLING LEGISLATION/HISTORICAL CONTEXT:
In 1925, legislation was passed to authorize the carving of the southeastern face of Mount Rushmore as, "a memorial….commemorative of our national history and progress" , under the authority of the Mount Rushmore National Memorial Commission. In 1939 management of the site was transferred to the National Park Service. Boundary changes occurred in 1940 and 1949. There are currently 40 non-federal acres within the 1,278-acre park.

PARK MISSION:

GENERAL DESCRIPTION:
Mount Rushmore sets in the central Black Hills in southwestern South Dakota. The park is the most heavily visited unit in the Network. It is arguably also the unit where visitors pay the least attention to natural resources. Essentially all visitation to the park is for purposes of seeing the carved mountain and associated visitor facilities, and the ponderosa pine forests and granite outcroppings provide a backdrop for those features. A very small amount of visitation does occur for purposes of rock climbing, nature observation, and hiking. Some horse riding occurs on the Blackberry Trail which connects to the larger trail system within the surrounding Black Hills National Forest.

DESCRIPTION OF NATURAL RESOURCES:
The topography of the park is rugged and steep with rocky outcroppings. There are three drainages at the park; Lafferty Gulch in the north central area, Starling Basin along the western and southern edges, and Grizzly Creek along the eastern side. These drainages contribute greatly to the diversity of the park, especially in regards to flora richness.

The dominant vegetation of the park is Ponderosa Pine forest and woodland, although); paper birch (Betula papyrifera), beaked hazel (Corylus cornuta), and bur oak (Quercus macrocarpa) do occur.. The vegetation of the park was mapped according to NVCS standards in 1996-1997 (Salas and Pucherelli, 1998c). Eight vegetation types were described for the park, two of which are globally vulnerable or worse. These are Paper Birch / Beaked Hazel Forest and Ponderosa Pine / Bur Oak Woodland. The vulnerability of Ponderosa Pine / Little Bluestem Woodland, Ponderosa Pine / Rough-leaf Rice Grass Woodland and Woolly Sedge / Bluejoint Herbaceous Vegetation is not certain because their global extent is unknown. The Nature Conservancy's Black Hills Community Inventory (Marriot *et al.*, 1999) considered all but one of the vegetation types in MORU to be in grade "B" condition, the exception being the Ponderosa Pine / Bearberry Woodland, which was given a grade of "AB." This generally good condition is reflected in the relatively low amount of invasive species, at least in intact vegetation. Disturbed areas such as roadsides and around developed areas have significant levels of annual brome grasses, as well as patches of Canada Thistle, Houndstongue, Leafy Spurge, and Spotted Knapweed. Much of the park appears to have been logged prior to its establishment, but portions of the Starling Basin and the Lafferty Gulch area in the northern portion of the park may harbor old growth Ponderosa Pine. This stand of old-growth ponderosa pine in the Starling Basin is estimated to be over 200 years old (Hoffman and Hansen 1986). Since much of the surrounding Black Hills National Forest has been logged, this old-growth stand is a unique and valuable resource. Recent thinning operations elsewhere in the park have reduced the density of young pine stands, but the long period of fire suppression in the area has undoubtedly affected the diversity and composition of the vegetation.

MORU is home to no federally listed threatened or endangered plant species. It is not certain to what extent the park harbors species on the South Dakota rare species list. However, Great-spurred Violet, a species on the South Dakota rare species list (http://www.state.sd.us/gfp/DivisionWildlife/Diversity/rareplant2002.htm), and a primary plant target in The Nature Conservancy's Black Hills ecoregional conservation plan (Hall *et al.*, 2002) and a USDA Forest Service sensitive species (R. Crook, pers. comm.), does occur in the Starling Basin in the southwest portion of the park (M. Pflaum, pers. comm.). There are no resident federally-listed endangered or threatened species in the park. There is a chance for the rare visit by bald eagles. Mountain lions or their sign are regularly observed in the park; they are on the state species of concern list.

Very little wildlife research has been done at the park outside of the inventories conducted by the Network I&M Program. The park has a population of introduced mountain goats that is commonly observed by visitors.

NATURAL RESOURCE GOALS AND OBJECTIVES:
Natural resource management goals at Mount Rushmore include the "protection, restoration or maintenance of ecosystems, rare plant and animal populations…relevant to the purpose and/or significance of the memorial" (NPS 2000). Developing protection and management strategies with neighboring landowners is also a high priority of the Memorial.

NATURAL RESOURCE ISSUES:
Exotic plants are a concern to park staff. Although not as obvious a problem as at other parks (especially those with a history of cultivation), exotic plants are present, including noxious ones such as Canada thistle and leafy spurge.

The pine beetle, although native to the Black Hills, is often viewed as a serious pest. The species can quickly kill entire stands of pines, especially very dense stands such as those that develop in the decade or two following clearcuts. Trees stressed for other reasons (e.g., drought) are also susceptible.

There are about 100 acres of land at the park that were disturbed as the result of development activities. These acres are in need of native plant restoration. In addition, exotic plants have invaded almost 200 acres of the park Mapping the spread of these species and containing at least a portion of them is a concern to park staff. The non-native mountain goats are a issue to park staff because their presence conflicts with NPS management policies, and to a lesser extent because they may be having deleterious impacts to park vegetation and can be a safety issue to visitors and vehicle traffic. Bighorn sheep are native to the Black Hills and occasionally occur in the vicinity of the park; studies from elsewhere suggests that mountain goats can displace bighorn sheep from areas.

Fire management is a high concern to park staff. Parts of the park, and some of the adjoining properties, consist of dense stands of pole size ponderosa pine. Mechanical thinning (under the direction of the FirePro office at Wind Cave NP) is currently occurring in some of these areas. The natural fire regime has been greatly impacted by decades of suppression. The park would like to conduct prescribed burns, but current conditions makes that very risky and challenging.

Both water quality and quantity are an issue, primarily as a result of the high numbers of visitors and the associated infrastructure. Surface water runoff from the parking lot and elsewhere is a concern. The park's waste system is approaching capacity, but a new treatment system is in the planning stages. The fresh water supply needed for visitors may also be approaching capacity and is of concern to park staff.

Climbers may have some impacts to park resources. There is some potential and evidence of falcon (especially prairie falcons) nesting in the park, but current visitation patterns may preclude that.

Protecting the integrity of the Starling Basin (i.e., the area with the old growth ponderosa pine) is a concern for park staff. Park staff also have interest in the Black Elk Wilderness in the Black Hills National Forest being expanded to include the old growth area.

Air quality is a concern to park staff in large part because it could affect visibility of the mountain. Western energy development may degrade views and air quality in the region. Aerial flights affect the soundscape and may have some impacts to wildlife resources (e.g., falcon nesting).

Development continues in the vicinity of the park, especially at the town of Keystone near the east entrance to the park.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES:
The enabling legislation does refer to the forest setting and visibility, but there are no specific directives for monitoring. The state requires the park to continue to monitor water quality in regards to the wastewater treatment facilities. The Forest Service would like monitor of forest fuels.

Basic Map

Veg Mpa

Monitoirng Map

Niobrara National Scenic River

ENABLING LEGISLATION/HISTORICAL CONTEXT:
The Niobrara National Scenic River was authorized in 1991 and was added to the nation's Wild and Scenic River System in the same year.

PARK MISSION:

GENERAL DESCRIPTION:
The 21,035-acre (76 mile long) park is located in rural northcentral Nebraska. There are only 790 federally owned acres in the park, although small parcels may be acquired in the future to accommodate visitors and/or for resource protection.

Most of the land within the park is owned by private landowners or The Nature Conservancy. The locally-owned ranches along the river help retain the valley's rural flavor. The park achieves its mission and management goals by coordinating and collaborating with a myriad of federal, state, and local jurisdictions and private landowners.

Enjoyed by tens of thousands of canoeists yearly, the upper reach of the Niobrara is noted as one of the country's outstanding canoeing rivers. A portion flows through a federally designated wilderness.

DESCRIPTION OF NATURAL RESOURCES:
Significant natural resources include the natural free-flowing river Niobrara River, the internationally significant paleontological resources, the rural landscape of the valley, and the unique assemblage of plant communities. The park is widely known for being at an ecological crossroads where six distinct ecosystems and their associated flora and fauna mix. The ecosystems are boreal forest, eastern woodland, Rocky Mountain forest types, tallgrass prairie, Sandhills prairie, and mixed-grass prairie. Biological diversity is high due to this juxtaposition of ecosystems. Many species, particularly those associated with the forests, reach their western, southern, or eastern limits along this stretch of Niobrara River. Hybridization of species is comparatively common at the park.

The vegetation of NIOB has not been mapped according to the NVCS, but Kantak (1995) described the plant communities of the area and outlined the general position of the communities with respect to the river. The condition of the vegetation varies drastically depending on the owner of the property, so generalizations are difficult to make. Invasive species, particularly Purple Loosestrife, and woody encroachment into prairie are problematic.

Wildlife abounds: animals such as white-tailed deer, coyote, beaver, mink, bull snakes, soft-shelled turtles, turkeys, herons, and sandpipers are commonly sighted. A lone moose has been recently observe within the park, including observations and photographs by park staff. It’s unclear where the animal originated from since the nearest established population is well over a hundred miles away. The presence of otters is noteworthy because of their rarity in the state. Rare butterflies are also present in the park.

The Fort Niobrara National Wildlife Refuge and The Nature Conservancy's Niobrara Valley Preserve, portions of which lie within park’s boundaries, have potential habitat for two federally threatened plant species: Western Prairie Fringed Orchid and Ute Lady's Tresses. Neither of these have been confirmed in the park, however. Twenty-eight plant species on the Nebraska Plants of Concern (http://www.natureserve.org/nhp/us/ne/plants.html) list have been found on TNC's preserve, but which ones fall within the park per se is not clear. The Network is currently working on resolving this. The bald eagle may nest within park boundaries. Least terns and piping plovers occur in the park are actively monitored by park staff.. Whooping cranes may stop at the park during migrations. Pallid sturgeon may be present. Black-tailed prairie dogs are in the vicinity of the park, such as at The Nature Conservancy site. The river otter is a state-listed species.

The river is swift and shallow over much of its length, cutting through bedrock forming riffles, rapids and waterfalls. Natural features of the river include sandbars and snags.

The spring branch canyons and tributaries are a significant resource in the park.

The western third of the park is home to over ninety waterfalls. The highest is Smith Falls which cascades seventy feet from a Sand Hills cliff.

NATURAL RESOURCE GOALS AND OBJECTIVES:

NATURAL RESOURCE ISSUES:
The loss of a natural hydrograph due to an upstream dam is a major concern to the park. The altered hydrographs can affect cottonwood regeneration, can affect geomorphology, backwater habitats, and cause unnatural levels of erosion. The park is concern about birch regeneration in the steep drainages along the tributaries.

Of particular interest to management are the federally-listed interior least tern, piping plover, and whooping crane that use the habitats protected in the park.

Water quality and quantity remain a serious concern for park staff. Center pivot irrigation continues to increase in the uplands. Non-point pollution from cattle is a concern, and more feedlots and point pollution may occur in the future. Some pollution may occur as a result of the high number of canoeist and other recreationists on the river, with visitor use anticipated to increase in the future.

Monitoring at a USGS station on the Niobrara may be discontinued. The park would like to see monitoring continue at the station.

Park staff would like to conduct prescribed burns within the park. Doing so would require working closely with current landowners.

Park staff are concerned about wildlife populations such as invertebrates and herpetofauna and their status in the park.

Recreational development in the form of cabins and second homes will likely increase.

Park staff fell that the location of the park—at the periphery of the range of many species and communities—may make the park an important site for monitoring, especially in regards to global climate change.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES
The Wild and Scenic River Act commits the park to insure water quality, which implies some level of monitoring. The state would like the park to monitor birch and aspen within the park boundaries and The Nature Conservancy would like monitoring of the waterfalls and spring branch canyons. The Fire Learning Network would like fire monitoring within the park.

Basic Map

Veg Map

Monitoring Map

Scotts Bluff National Monument

ENABLING LEGISLATION/HISTORICAL CONTEXT:
The 1919 Presidential Proclamation establishing Scotts Bluff National Monument identifies the significance of the site as being a landmark to immigrants and frontiersmen traveling the Overland Trail on their journey to the west. The enabling legislation also recognizes the unique geology of the bluff and surrounding terrain.

PARK MISSION:

GENERAL DESCRIPTION:
A prominent natural landmark for emigrants on the Oregon Trail, Scotts Bluff, Mitchell Pass and the adjacent prairie lands are set aside in a 3,000 acre national monument. This site preserves the memory of the historic Oregon, California and Mormon Trails. The monument museum contains exhibits about the human and natural history of the area and also holds a unique collection of watercolor paintings by the frontier photographer and artist William Henry Jackson.

DESCRIPTION OF NATURAL RESOURCES:
The North Platte River runs along the northern border of the Monument. The riparian woodland habitat is dominated by cottonwood (Populus deltoides), boxelder (Acer negundo), willow (Salix spp.), American elm (Ulmus americana), and green ash (Fraxinus pennsylvanica). Much of the Monument is covered with mixed-grass prairie comprised of needle-and-thread grass (Hesperostipa comata), western wheatgrass (Pascopyrum smithii), prairie sandreed (Calamovilfa longifolia), and side-oats grama (Bouteloua curtipendula). Scotts Bluff, as well as the south bluff along the southern edge of the Monument, are dotted with ponderosa pine (Pinus ponderosa) and Rocky Mountain juniper (Juniperus scopulorum: Cox and Franklin 1989).

NATURAL RESOURCE GOALS AND OBJECTIVES:
The purpose of Scotts Bluff NM is to preserve the existing remains of the trail and trail experience, the natural resources including associated flora and fauna, the geology of the bluff including the fossils of the area, and the scenic views one has from the summit of Scotts Bluff.

NATURAL RESOURCE ISSUES:
The park has recently completed an Environmental Assessment on a proposed trail through the park that would connect the cities of Gering and Scotts Bluff. The trail may impact wetland and upland communities.
The small size of the park and its proximity to urban areas limits its ability to implement prescribed fire and to restore large grazing animals such as bison.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES

Basic Map

Veg Mpa

Monitoring Map

Theodore Roosevelt National Park

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Theodore Roosevelt National Memorial Park was established in 1947 as a memorial to its namesake, who made significant contributions to the conservation movement and the development of the West. The natural resources of the region played a significant role in shaping the life of Theodore Roosevelt, which consequently influenced his role as a conservationist while President of the United States. In 1978, Congress reestablished the park as Theodore Roosevelt National Park including the Theodore Roosevelt Wilderness.

PARK MISSION:

GENERAL DESCRIPTION:
"I never would have been President if it had not been for my experiences in North Dakota," Theodore Roosevelt once remarked.
Roosevelt first came to the badlands in September 1883 on a hunting trip. While here he became interested in the cattle business and invested in the Maltese Cross Ranch. He returned the next year and established the Elkhorn Ranch.

Whenever he managed to spend time in the badlands, he became more and more alarmed by the damage that was being done to the land and its wildlife. He witnessed the virtual destruction of some big game species, such as bison and bighorn sheep. Overgrazing destroyed the grasslands and with them the habitats for small mammals and songbirds. Conservation increasingly became one of Roosevelt's major concerns. During his Presidency, Roosevelt established the US Forest Service and signed the 1906 Antiquities Act under which he proclaimed 18 national monuments. He also established 5 national parks, 51 wildlife refuges and 150 national forests.

Here in the North Dakota badlands, where many of his personal concerns first gave rise to his later environmental efforts, Roosevelt is remembered with a national park that bears his name and honors the memory of this great conservationist.

Theodore Roosevelt National Park is in the colorful North Dakota badlands and is home to a variety of plants and animals, including bison, prairie dogs, and elk.

DESCRIPTION OF NATURAL RESOURCES:
Lying in the Little Missouri Badlands of western North Dakota, the 70,446-acre park is divided into a North Unit (24,030 acres), a South Unit (46,200 acres), and a Elkhorn Unit (220 acres). There are 19,410 acres of wilderness in the North Unit and 10,510 acres in the South Unit. A central unifying feature of the park is the free-flowing Little Missouri River which winds its way through the South and North Units and forms the eastern boundary of the Elkhorn Unit. The highly eroded soils of the badlands ridges, slopes, and hills are sparsely vegetated. Areas where the soils are deeper, such as the plains and valleys, support mixed-grass prairie vegetation. Dominant grass species include blue grama (Bouteloua gracilis), western wheatgrass (Pascopyrum smithii), and needle-and-thread grass (Hesperostipa comata). Shrublands and woodlands, of both evergreen and deciduous trees, occur throughout the park in major drainages, draws, and hillsides, although they tend to be taller within the river floodplain. Rocky Mountain juniper (Juniperus scopulorum) is quite common on draws and hillsides, whereas cottonwood (Populus deltoides), green ash (Fraxinus pennsylvanica), elm (Ulmus americana), silver sagebrush (Artemisia cana), chokecherry (Prunus virginiana), and aspen (Populus tremuloides) are more common along the Little Missouri River floodplain.

The fauna of Theodore Roosevelt NP is typical of the mixed-grass prairie ecosystem. The black-tailed prairie dog, a candidate species under the Endangered Species Act, is abundant at the park. The Park also has a full complement of prairie ungulates including bison, elk, white-tailed and mule deer, bighorn sheep, and pronghorn, as well as a herd of wild horses. Amphibian diversity is limited somewhat by a lack of water; however, species are found near the Little Missouri River and the natural springs during the summer months. Several species of fish inhabit the Little Missouri River, with plains minnows and white suckers particularly common. The U.S. Fish and Wildlife Service is trying to restore the sturgeon chub, another candidate species, to the river.

NATURAL RESOURCE GOALS AND OBJECTIVES:
Theodore Roosevelt NP is managed to protect and interpret the badlands ecosystem surrounding the Little Missouri River and the cultural resources associated with human habitation of the area. Of primary importance are maintenance and restoration of the natural environment, and protection and interpretation of human history with special emphasis on Theodore Roosevelt. The goal of resource management in the park is to restore and/or maintain to the extent feasible, the cultural, physical, and biological resources and processes which interact to form the park's ecosystem.

NATURAL RESOURCE ISSUES:
Management issues of particular concern include degradation of park resources due to exotic species such as leafy spurge (Euphorbia esula) and Canada thistle (Cirsium arvense). Issues related to significant oil drilling around the Park, and water and air pollution are also of concern.

The Park will soon be preparing a wildlife management plan that will identify management objectives and needs for bison, elk, mule and white-tailed deer, bighorn sheep, pronghorn, horses, and other wildlife. Horses are not native to the park but are viewed by some as a cultural resource. The Park currently supports about 850 acres of black-tailed prairie dogs, a federal candidate species.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES:

Basic Map

Veg Map

Monitoring Map

Wind Cave National Park

ENABLING LEGISLATION/HISTORICAL CONTEXT:
Wind Cave National Park was established in 1903 to preserve and protect the cave, the first National Park to be established for such a purpose. Wind Cave is one of the largest and most complex caves in the world and is known for its "boxwork," a unique cave formation. In 1912, the Wind Cave National Game Preserve was established on a portion of Wind Cave NP and adjoining lands. Bison, elk, and pronghorn were shipped to the preserve. The Preserve ultimately became part of Wind Cave NP and under the management of the Park's natural resource program. Since 1903, Wind Cave NP has grown from its original size of 10,532 acres to its present size of 28,295 acres.

PARK MISSION:

GENERAL DESCRIPTION:
One of the world's longest and most complex caves and 28,295 acres of mixed-grass prairie, ponderosa pine forest, and associated wildlife are the main features of the park. The cave is well known for its outstanding display of boxwork, an unusual cave formation composed of thin calcite fins resembling honeycombs. The park's mixed grass prairie is one of the few remaining and is home to native wildlife such as bison, elk, pronghorn, mule deer, coyotes, and prairie dogs.

DESCRIPTION OF NATURAL RESOURCES:
The vegetation of Wind Cave is a mixture of woodlands, shrublands, and mixed-grass prairie vegetation. Ponderosa pine (Pinus ponderosa) covers approximately 30% of the park and generally occurs at higher elevations. Drainages may have mixes of hardwoods and shrubs such as boxelder (Acer negundo), green ash (Fraxinus pennsylvanica), elm (Ulmus americana), and mountain mahogany (Cercocarpus montanus). From west to east across the park the vegetation changes from primarily woodlands to mixed-grass prairie (Cogan et al. 1999). Common mixed-grass prairie species include western wheatgrass (Pascopyrum smithii), little bluestem (Schizachyrium scoparium), green needlegrass (Nassella viridula), and side-oats grama (Bouteloua curtipendula). Twenty-eight vegetation types have been identified at the park (USGS/BRD).

Wind Cave NP is managed to create an environment that resembles pre-European settlement. Many of the wildlife components of the mixed-grass prairie ecosystem occur at the park. These include large ungulates such as bison, elk, and deer. The black-tailed prairie dog—a keystone prairie species—is common. Predators, such as coyotes, bobcats, skunks, and rattlesnakes—which were part of a historical eradication program—are present and recognized as valuable components of the ecosystem. There are over 100 species of birds that nest at Wind Cave NP, as well as several fish species and nearly 20 species of amphibians and reptiles.

NATURAL RESOURCE GOALS AND OBJECTIVES:
Wind Cave NP has many resource management objectives that it incorporates into its daily operations. The following objectives are relevant to the inventory and monitoring effort:

- To preserve the surface and subsurface resources and protect them from threats originating within and outside the park boundary, and to increase public awareness of natural systems and to conduct and encourage scientific study
- Preserve the surface resources (vegetation, wildlife, geological, and paleontological resources) that are representative of the prairie and Black Hills environment
- To maintain healthy plant and animal populations; to maintain wildlife populations at a level that is in harmony with the maintenance of natural communities and to use management-ignited prescribed fire as a tool to perpetuate native plant and animal species and communities

DESCRIPTION OF NATURAL RESOURCE ISSUES:
The Park has an active fire management program. Bison are culled annually for purposes of reducing grazing pressure. The pronghorn population has declined dramatically from past levels with the cause of the decline unknown. The Park may soon begin managing for an increase in prairie dog acreage, partly in hopes of reintroducing black-footed ferrets.

PARK-SPECIFIC DIRECTIVES AND MANDATES TO MONITOR NATURAL RESOURCES

Basic Map

Veg Map

Monitoring Map

BACKGROUND ON MONITORING PLANNING ACTIVITIES TO DATE

The Northern Great Plains Network is last in the NPS monitoring funding priority list (although it may get full funding as part of a last group of networks). The Network received $150,000 in startup funds in FY03 and FY04. The Network used the funds to pay for a Network Coordinator, a Data Manager, and several other technician level positions. The Network also used the funds to establish agreements with other entities to develop portions of this document.

OVERVIEW OF MONITORING IN AND NEAR NETWORK PARKS

Northern Great Plains Network parks …

DATA MINING

The NGP Network identified data mining as a high priority in preparation of this phase I plan. Reports, data, and other information from park files have been compiled and, when appropriate, entered into national databases. For example, as of September 2001, over 5,700 records from the NGP Network have been entered into NPSpecies. The Network has expanded its data mining efforts beyond just park-housed information by conducting Internet searches, coordinating with subject-matter experts, and contacting other agencies and organizations (see Appendix D).
The results of this data mining have been extremely successful. For example, …
The NGP Network will continue to mine for additional information relevant to the monitoring objectives of the I&M Program.

SUMMARY OF EXISTING INFORMATION

Table 2. Overview of Northern Great Plains Network inventory projects.

Park	Birds	Fish	Herps	Mammals		Plants		
Agate Fossil Beds NM						X		
Badlands NP								
Devils Tower NM	X		X	X	X	X		
Fort Laramie NHS	X		X	X	X	X		
Fort Union Trading Post NHS			X		X	X	X	
Jewel Cave NM	X			X	X	X		
Knife River Indian Villages NHS			X		X	X		
Missouri Nat. River and Recreation Area						X	X	
Mount Rushmore NMEM	X		X	X	X			
Niobrara NSR								
Scotts Bluff NM	X		X	X				
Theodore Roosevelt NP								
Wind Cave NP	X			X				

More detailed information on the dates, methods, and costs of these projects can be found in Appendix A.

CHAPTER 2. CONCEPTUAL ECOLOGICAL MODELS

CHAPTER 3. PRIORITIZATION AND SELECTION OF VITAL SIGNS

CHAPTER 4. SAMPLING DESIGN

CHAPTER 5. SAMPLING PROTOCOLS

CHAPTER 6. DATA MANAGEMENT

Data management is a priority for the NGP Network. This had been demonstrated by the network's progress toward data mining and transferring most existing inventory data into NPSpecies, NRBib (i.e., NPBib), and other national databases.

WASO I&M has focused much effort on developing tools to archive and manage data (e.g., NPSpecies, Dataset Catalog, Theme Viewer) at the national level. Additionally, excellent data management guidance regarding collection, handling, and validation is contained in the NPS data management protocols. The NGP Network data management system will use these resources to assist in the collection and handling of inventory data. Further, by focusing on collection and handling, the work of the NGP Network may contribute to the larger data management efforts by supplementing existing information and tools.

MicroSoft Access has and will be used to develop relational databases and user interfaces. A centralized Access database will incorporate one shared set of tables used to identify site, event, and taxon that are linked to individual data sets. For organizational purposes, standardized site, event, and taxon codes will be applied consistently from the field data sheet through the summary report. Tabular data will be associated with related protocols and reports using the NRBib identification number. The structure of the database will allow data summaries at the site, park, and network level. Information will also be available for regional and national summaries as needed. A relational database structure will also ensure data integrity. Table definitions will include a description of each field. Standard forms will be developed for use and drop-down menu format will be incorporated in the structure to allow easy input of data to the various databases, and to prevent transcription errors. Key elements of the data management system include: 1) standardized data fields to promote relatedness among data; 2) data verification and validation requirements including minimum accuracy standards for contracts; 3) a database design that utilizes table relationships to maintain referential integrity between data and metadata; 4) a system design that encourages data exploration through inter-relating data through time, space, and taxa; and 5) a long-term data archival strategy. Principle investigators of the field inventories will be responsible for delivering raw data in MS Access format.

The creation and maintenance of metadata is a critical element to the success of the biological inventory project. Metadata are used to provide documentation for data products, by answering questions about who, what, when, why, and how the data were created and about the process. Additionally, metadata help publicize and support the data that will be collected, compiled, and distributed. The NGP Network will require investigators to assist in the development of these metadata by documenting the standard operating procedures used during the course of the study. Documentation should describe step-by-step the procedure used for data collection, including any modifications or adjustments made to accommodate field conditions, the precision of instruments, etc.. To facilitate complete data collection, standardized data forms that cue investigators to record pertinent data in an appropriate sequence will be developed. Where appropriate, the Access databases will include standard "report" formats for printing field forms, complete with sample site coordinates and attributes.

Each project will identify the type of metadata required from each principal contractor. In addition to documentation of standard operating procedures, metadata requirements include whom, where, when and the methods employed. Furthermore, metadata should include ancillary information about weather conditions, vegetation phenology, unique situations (e.g., illness, injury, equipment trouble), verification and validation results, data edit log, etc.. Metadata are critical to verifying the accuracy of the data and must be intrinsically secured to the data itself. Data and metadata will be linked using database management tools (e.g., key fields, join types, and referential integrity).

Appropriate archiving and dissemination of the data is the final step toward ensuring accessibility to the data and maintaining data quality. All inventory data and reports will be incorporated into the national NPS databases (e.g., NPSpecies, NPBib, Dataset Catalog) by either the Network Coordinator or the Network Data Technician (or under their supervision and oversight). The Dataset Catalog, available from WASO, contains metadata about datasets available. Only GIS layers are currently entered in the Dataset Catalog, but as information about other datasets from the various NGP Network parks becomes available, it will be added. This catalog will be brought up to date over the next few years as more information can be identified, verified, and compiled. Original field data sheets will be stored in the NGP Network office, with a copy stored at the park. Copies of digital data, metadata, reports, and summaries will be distributed to the parks and Regional I&M Coordinator. Final reports will be distributed to relevant parks, the Network Coordinator, the Regional I&M Coordinator, and the WASO I&M Program Manager.

Lastly, the NGP Network anticipates working closely with other federal agencies, specifically, the U.S. Forest Service. The Network will to the extent practicable assure that data collected can be integrated with Forest Service databases (e.g., FAUNA).

GIS AND SPATIAL DATA

Geographic Information Systems (GIS) will be used in the NGP Network I&M Program to support study design, data analysis, interpretation, and decision making. In many ways, data mining for GIS information is as important as data mining for species presence. GIS can effectively support the I&M Program by transforming data (independent records and measures) into information (the meaning of data, including contextual and spatial relationships derived from analysis and/or mapping). GIS does not stand alone, but rather is an integrated tool for NPS operations. The NPS Strategic Plan requires that "management decisions about resources and visitors are based on adequate scholarly and scientific information" and that acquiring outstanding data sets is necessary. These data sets can only be properly applied through the use of an adequately maintained and integrated GIS system that is available to and supported by the parks and I&M Program. The following text identifies the GIS program development needed to satisfy and support the NGP Network.

From the perspective of individual park operations, the current decentralized nature of GIS development and use in the NGP Network is effective. Problem solving within the context of individual parks is facilitated by the flexibility inherent in GIS software and databases. At the Network level, however, the lack of consistency in database definitions and structure decreases the value of combinations of park data. When feature form (i.e., point, line, polygon) differs from park to park it becomes necessary to re-process data sets to a common structure to enable analysis and across-park comparisons. Even when feature form is consistent, differences in attribute definition (e.g., character strings vs. numbers or dates, or the number of characters in a character string) make merging data sets time consuming and problematic. Although incompatible data can be "massaged" to get data sets to complement each other, the quality (e.g. accuracy) of data is often degraded.

Analyzing information at the Network level on discontinuous park units of varying sizes requires a comprehensive, compatible, and highly accurate set of data. A centralized, integrated GIS database will provide the ability to relate park resource data to each other in ways not possible with paper maps or numeric databases. A centralize GIS database will require a significant investment and commitment by the NGP Network. A less-than substantial investment can result in disastrous consequences. The NPS Inventory and Monitoring Program Draft Data Management Protocol states that:

"data can be lost through accident or disaster, corrupted through mishandling or neglect, rendered legally indefensible because of inadequate documentation and quality assurance, or found to be useless beyond a narrow purpose…the ultimate cost of poorly managed data can be astronomical, but most major problems can be avoided with good data management practices, procedures, and policies."

GIS data development, documentation, handling, and analysis requires a long-term commitment of attention to detail and data stewardship. The NGP Network intends to make that commitment. All GIS products produced during these inventories will be compatible with the ArcView GIS Theme Manager and have FDGC-compliant metadata. NGP Network personnel will review products for compliance. All spatial data will be stored in Universal Transverse Mercator (UTM) coordinates, North American 1983 (NAD83) datum.

Problems of multi-park data integration have been partially rectified through the use of Microsoft Access™ databases like NPSpecies. As increasing numbers of parks come online with GIS, and as those GIS programs independently normalize and document legacy data sets, the volume of data available to the I&M Program will increase. A plan for creating a Network-wide GIS program is a high priority.

Purposes of the NGP Network GIS program are:

- To outline the long-term goals of GIS in the I&M Program
- To associate those goals with the long-term goals of the parks
- To identify elements for a functional, Network-wide GIS program
- To organize the development of a multi-park data handling program
- To encourage NPS staff to discover the benefits of GIS

To support the I&M Program two primary classes of GIS data need to be developed and maintained. The first of these are base-map data, consisting of park boundaries, roads and trails, contour lines, and hydrographic features. The other class of data is thematic, consisting of topic-specific data sets like nest and burrow locations, species locations and ranges, survey sites, etc.. As the GIS program evolves, additional derived data will be created as products of analyses and mapmaking projects.

At present, limited GIS data are available for most parks in the Network. Availability, however, does not necessarily mean compatibility between park data sets.

Table 3. GIS data layers and programs in Northern Great Plains Network parks.

	AGFO	BADL	DETO	FOLA	FOUS	JECA	KNRI	MNRR	MORU	NIOB	SCBL	THRO	WICA
Boundary	X	X	X	X	X	X	X	X			X	X	X
Hydrography	X	X		X	X	X	X				X	X	X
Elevation		X	X	X	X	X	X				X		X
Soils	X	X								X	X	X	X
Geology	X	X								X		X	X
Wetlands		X						X			X		X
Vegetation	X	X	X	X				X			X	X	X
Exotic plants	X	X	X	X				X			X		X
Wildlife	X	X									X	X	X
T&E species											X		X
Prescribed fire		X	X		X			X					X
Roads	X	X	X	X	X	X	X			X	X	X	X
Trails	X	X	X	X	X		X			X	X	X	X
Structures			X	X	X			X			X		X
Hardware	X	X	X	X		X	X	X			X	X	X
GIS Program	X	X	X	X							X		X

A more thorough NGP Network GIS assessment will be completed over the next couple years. In parks where GIS is currently in use, an assessment should be either a confirmation that data development and use are progressing satisfactorily, or an assessment of needs not being met. For parks where GIS is not currently in use the assessment can help to identify ways that parks can share facilities and staff, or where the I&M Program might need to act as a service-center.

The GIS assessment should include an evaluation of existing spatial data in any form (maps, tables, databases with coordinates, or other location data), metadata, personnel, computing and software resources, GPS, and data conversion tools (e.g., digitizing tablets, scanners, etc.). The assessment is also an opportunity to engage the regional GIS support office, and to evaluate the local or regional community for access to college or university departments willing to become involved in mapping in parks. Recommendations coming from the assessment process should enable decision makers to budget for improvements or resource sharing, when appropriate.

The collection, storage, and analysis of spatial data will be critical to the success of the NGP Network. Data management is essential to evaluate change over space and time. Making data accessible, in a form useful by park decision makers is paramount. The following goals are proposed:

1. Network data assessment
   a. conduct needs assessment at park and network levels
   b. inventory data available at park level
   c. assess status of metadata for data relevant to the I&M Program
   d. assist parks in developing metadata
   e. determine data quality

f. document data assessment

2. Evaluation of data relevant to I&M Program
a. assess available data for utility in I&M Program
b. code data for quality (some data may have low positional accuracy yet are of value)
c. evaluate the cost of maintaining data (e.g., satellite imagery, etc.)
d. document data evaluation

3. Develop network database
a. utilize NPS theme manager data structure
b. organize data for access by multiple tools (e.g., Synthesis)
c. ensure all data projected into common projection and datum
d. document NGP Network database structure

4. Develop data security and distribution protocols
a. identify sensitive data (e.g., exempt from FOIA) and establish protections
b. develop data inspection/update/documentation schedule
c. develop backup and archiving procedures and schedules
d. develop and implement data distribution back to parks and to data clearinghouses
e. develop and implement data distribution tracking and auditing system
f. document security and distribution protocols

5. Develop software/data orientation and training program
a. evaluate staff training levels in NGP Network parks
b. develop topic-specific “short-courses” for on-site or electronic delivery
c. schedule and offer/deliver training
d. develop and implement training update schedule
e. document orientation and training program

6. Determine budget and staffing needs and physical location for I&M Network GIS program

7. Plan evaluation and update schedule
a. schedule annual/biannual NGP Network GIS program evaluation and update.

Many parks in the Network are actively upgrading their GIS capabilities. Currently, GIS programs range from state-of-the-art at some parks to non-existent at others. It is anticipated that the NGP Network will hire a fulltime information manager with strong GIS expertise once it enters the monitoring phase.

CHAPTER 7. DATA ANALYSIS AND REPORTING

CHAPTER 8. ADMINISTRATION/IMPLEMENTATION OF MONITORING PROGRAM

From inception, the Northern Great Plains Network has had regular meetings to define priorities, review data and products, identify future tasks, and disseminate information. Each park in the Network has at least one representative that regularly participates in the I&M process (see Section 6). The Network Coordinator is responsible for communicating and coordinating with park representatives. Monthly newsletters have been issued by the Network Coordinator since October 2000. These newsletters ensure clear communication and coordination between all Network parks.

A Steering Committee was established early on for the Network (see National Park Service 2002).

The primary policy and national contact for the NGP Network Coordinator will be the Midwest Region I&M Coordinator. The NGP Coordinator will work closely with the Regional Coordinator in all facets of the I&M Program. The Regional Coordinator facilitates regular coordination between all three networks in the Midwest Region.

The NGP Network works closely with the Northern Great Plains and Rocky Mountain Cooperative Ecosystems Studies Units (CESU). Numerous Network projects have been funded through the CESUs.

The NGP Network has coordinated and collaborated with other agencies, organizations, and individuals involved in inventorying and monitoring natural resources. A detailed record of these efforts and partnerships is presented in Appendix D. Of primary importance is the relationship with the U.S. Forest Service. Nine of the 13 parks in the NGP Network adjoin U.S. Forest Service properties. The NGP Network will work closely with the Forest Service in the selection of survey methods, identification of species of management concern, ways to reduce costs, and all other facets of inventory and monitoring.

As of September 30, 2001, the Northern Great Plains Board of Directors consisted of:

Bill Supernaugh	Superintendent	BADL	
Ruthann Knudson	Superintendent		AGFO
Andy Banta	Superintendent		FOUS
Phyllis Adams	Midwest Region I&M Specialist	MWRO	
Dan Licht	NGP Network I&M Coordinator		NGPN

Table 4. Park representatives in the Northern Great Plains Network

CONTACT	TITLE	PARK	ADDRESS	PHONE #
Ruthann Knudson	Superintendent	AGFO	301 River Road Harrison, NE 69346	308-668-2211
Brian Kenner	Chief of Nat Resources	BADL	PO Box 6 Interior, SD 57750	605-433-5260
Sandee Dingman	Nat Res Specialist	BADL	PO Box 6 Interior, SD 57750	605-433-5262
Eddie Childers	Wildlife Biologist	BADL	PO Box 6 Interior, SD 57750	605-433-5263
Bill Supernaugh	Superintendent	BADL	PO Box 6 Interior, SD 57750	605-433-5280
Jim Cheatham	Chief of Nat Resources	DETO	PO Box 10 Devils Tower, WY 82714	307-467-5283
Ted Benson	Ranger	FOLA	HC 72 Box 389 Ft. Laramie, WY 82212	307-837-2221
Tammy Benson	Chief Ranger	FOLA	HC 72 Box 389 Ft. Laramie, WY 82212	307-837-2221
Andy Banta	Superintendent	FOUS	15550 Hwy 1804 Williston, ND 58801	701-572-9083
Audrey Barnhart	Curator	FOUS	15550 Hwy 1804 Williston, ND 58801	701-572-9083
Mike Wiles	Chief Res Management	JECA	RR 1 Box 60AA Custer, SD 57730	605-673-2061x1226
Todd Suess	Superintendent	JECA	RR 1 Box 60AA Custer, SD 57730	605-673-2061
John Moeykens	Chief Ranger	KNRI	PO Box 9 Stanton, ND 58571	701-745-3234
Lisa Eckert	Superintendent	DETO	PO Box 10 Devils Tower, WY 82714	307-467-5283
Wayne Werkmeister	Res Mngmt Spec	MNRR	PO Box 591 O'Neil, NE 68763	402-336-3970
Mike Pflaum	Chief Ranger	MORU	PO Box 628 Keystone, SD 57751	605-574-2523x113
Eric Nelson	Ranger	MORU	PO Box 628 Keystone, SD 57751	605-574-2523x125
Bruce Weisman	Curator	MORU	PO Box 628 Keystone, SD 57751	605-574-2523x168
Carmen Blausey	Res Mngmt Spec	NIOB	PO Box 591 O'Neil, NE 68763	402-336-3970
Bob Manasek	Res Mngmt Spec	SCBL	PO Box 27 Gering NE 69341	308-436-4340

Ralph Moore	Superintendent	SCBL	PO Box 27 Gering NE 69341	308-436-4340	
Penny Knuckles	Chief of Nat Resources	THRO	PO Box 7 Medora, ND 58645	701-623-4466	
Valerie Naylor	Superintendent	THRO	PO Box 7 Medora, ND 58645	701-623-4466	
Dan Roddy	Nat Res Specialist	WICA	RR 1 Box 190 Hot Springs, SD 57747	605-745-1157	
Barb Muenchau	Bio Tech-wildlife	WICA	RR 1 Box 190 Hot Springs, SD 57747	605-745-4600	
Marie Curtin	Bio Tech-plants	WICA	RR 1 Box 190 Hot Springs, SD 57747	605-745-1179	
Ed Delaney	GIS Specialist	WICA	RR 1 Box 190 Hot Springs, SD 57747	605-745-4600	

Note - Bold text indicates representative is also on the Northern Great Plains Network Steering Committee

The NGP Network has enlisted the assistance of numerous outside experts. The involvement of these subject matter experts has ranged from attendance at scoping meetings, review of expected species list, identification of park-specific management issues, and assistance in project design, among others.

Table 5. Non-NPS subject-matter experts and others who have assisted the NGP Network

NAME	TAXON	ADDRESS	PHONE
Dr. Jack Butler	PLANTS	Denver Federal Center, Bureau of Rec., Bldg 56 Denver CO 80025	303-445-3619
Walt Fertig	PLANTS	WY Natural Diversity Database, U of WY, PO Box 3381 Laramie WY 82070	307-766-3020
Dr. Jack Norland	PLANTS	ND State Univ, Box 5727, Hultz Hall, Fargo ND 58105	701-231-9428
Jim von Loh	PLANTS	Denver Fed Center, Bureau of Rec., Bldg 56 Denver CO 80025	303-445-2283
Steve Rolfsmeier	PLANTS	402-474-0163	
Cindy Reed	PLANTS	PO Box 461, Cascade Rd, Hot Springs SD 57747	605-745-3397
Gerry Steinauer	PLANTS	NE Natural Heritage Program	402-694-2498
Diane Larson	PLANTS	USGS-Univ of MN	612-625-9271
Dr. Steve Chipps	FISH	South Dakota State Univ, Coop Unit, Brookings SD 57007	
Dr. Rick Stasiak	FISH	UN-Omaha, Dept of Biol., 62 & Dodge, Omaha NE 68182	402-554-2295
Fred Rychman	FISH	ND Game & Fish Dept, 13932 W Front St, Williston ND 58801	701-774-4320
Dr. Robert White	FISH	Montana State Univ, PO Box 173460, 301B Lewis Hall, Bozeman MT 59717	406-994-4549
Wade King	FISH	USFWS, 3425 Mirriam Ave, Bismarck ND 58501	701-250-4413
Dr. Royce Ballinger	HERPS	UNL, School of Biological Sciences, Lincoln NE 68588	402-472-8946
Dr. Robert Newman	HERPS	UND, Biology Dept. , Box 9019, Grand Forks ND 58202	701-777-4290
Dr. Brian Smith	HERPS	Black Hills State Univ, Dept of Biology, USB#9044, Spearfish SD 57799	605-642-6879
Dr. Steve Corn	HERPS	USGS Missoula Field Station, 790 E Beckwith, PO 8089, Missoula MT 59807	406-542-4191
Richard Peterson	BIRDS	PO Box 118, Wewela SD 57578	605-842-2017
Dr. Doug Johnson	BIRDS	USGS Northern Prairie Wildlife Res. Ctr, 5711 37th St, Jamestown ND 58401	701-253-5539
Wayne Mollhoff	BIRDS	402-441-8012	
John Dinan	BIRDS	NE Game Fish and Parks, PO 30370, Lincoln NE 68503	402-471-5440
Dr. Hugh Genoways	MAMMALS	UNL, Nebraska State Museum, W435 Nebraska Hall, Lincoln NE 68588	402-472-2012
Dr. Rick Sweitzer	MAMMALS	UND, Biology Dept. Box 9019, Grand Forks ND 58201	701-777-4676
Joel Tigner	MAMMALS	2416 Cameron Dr., Rapid City SD 57702	
Dr. Glen Sargeant	MAMMALS	USGS Northern Prairie Wildlife Res. Ctr, 5711 37th St, Jamestown ND 58401	701-253-5528
Doug Backlund	MAMMALS	SD Natural Heritage Program	605-773-4345
Mark Vieira	OTHER	Colorado Division of Wildlife, 317 W. Prospect, Ft. Collins CO 80526	790-472-4452
Dr. Kathy Tonnesson	OTHER	Intermountain CESU coordinator	406-243-4449

1 Some subject-matter experts have expertise in more than one taxon, or in areas not specific to a taxon. For example, Dr. Glen Sargeant specializes in population dynamics and assessment. In such cases, the taxon associated with the subject-matter expert is their primary area of interest or experience, the taxon group they represented at the subject-matter experts workshop, or the taxon list they reviewed.

CHAPTER 9. SCHEDULE

CHAPTER 10. BUDGET

CHAPTER 11. LITERATURE CITED

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GLOSSARY

AGFO	Agate Fossil Beds National Monument
BADL	Badlands National Park
CE	Categorical Exclusion
CESU	Cooperative Ecosystems Studies Unit
DETO	Devils Tower National Monument
EA	Environmental Assessment
EIS	Environmental Impact Statement
FOLA	Fort Laramie National Historic Site
FONSI	Finding of No Significant Impact
FOUS	Fort Union Trading Post National Historic Site
FWS	U.S. Fish and Wildlife Service
FY	Fiscal Year
I&M	Inventory and Monitoring
JECA	Jewel Cave National Monument
KNRI	Knife River Indian Villages National Historic Site
MNRR	Missouri National Recreational River
MORU	Mount Rushmore National Memorial
NEPA	National Environmental Policy Act
NGP	Northern Great Plains
NHS	National Historic Site
NIOB	Niobrara National Scenic River
NM	National Monument
NMEM	National Memorial
NP	National Park
NPS	National Park Service
NVCS	National Vegetation Classification System
ROD	Record of Decision
SCBL	Scotts Bluff National Monument
TACS	Time/area Constrained Searches
THRO	Theodore Roosevelt National Park
USGS	United States Geological Survey
VCP	Variable Circular Plots
WASO	Washington Office, National Park Service
WICA	Wind Cave National Park

APPENDICES

The