Appendix A. Summary of federal legislation and policy related to inventory and monitoring.

PUBLIC LAWS	SIGNIFICANCE TO INVENTORY AND MONITORING
National Park Service Organic Act (16 USC 1 et seq. [1988], Aug. 25, 1916).	The 1916 National Park Service Organic Act is the core of park service authority and the definitive statement of the purposes of the parks and of the National Park Service mission. The act establishes the purpose of national parks: "…. 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."
General Authorities Act of 1970 (16 USC 1a-1—1a-8 (1988), 84 Stat. 825, Pub. L. 91-383	The General Authorities Act amends the Organic Act to unite individual parks into the 'National Park System'. The act states that areas of the National Park System, "though distinct in character, are united through their inter-related purposes and resources into one national park system as cumulative expressions of a single national heritage; that individually and collectively, these areas derive increased national dignity and recognition of their superb environmental quality through their inclusion jointly with each other in one national park system preserved and managed for the benefit and inspiration of all the people of the United States…"
National Parks Omnibus Management Act, 1998 (P.L. 105-391)	Requires Secretary of Interior to continually improve NPS' ability to provide state of-the-art management, protection, and research on NPS resources. Section 5939 states that the purpose of legislation is to: (1) Enhance management and protection of national park resources by providing clear authority and direction for the conduct of scientific study in the National Park System and to use the information gathered for management purposes; (2) Ensure appropriate documentation of

	resource conditions in the National Park System; (3) Encourage others to use the National Park System for study to the benefit of park management as well as broader scientific value; and (4) Encourage the publication and dissemination of information derived from studies in the NPS.
National Historic Preservation Act of 1966, as amended (16 USC 470 et seq.)	Congress set forth in NHPA includes preserving 'the historical and cultural foundations of the Nation' and preserving irreplaceable examples important to our national heritage to maintain 'cultural, educational, aesthetic, inspirational, economic, and energy benefits.' NHPA established the National Register of Historic Places composed of places and objects 'significant in American history, architecture, archeology, engineering, and culture.' NHPA requires federal agencies to account for effects of actions on historic (state and federal) properties.
National Environmental Policy Act of 1969 (42 USC 4321-4370)	The purposes of NEPA include encouraging 'harmony between [humans] and their environment and promote efforts which will prevent or eliminate damage to the environment… and stimulate the health and welfare of [humanity].' NEPA requires a systematic analysis of major federal actions that includes a consideration of all reasonable alternatives as well as an analysis of short-term and long-term, irretrievable, irreversible, and unavoidable impacts. Within NEPA the environment includes natural, historical, cultural, and human dimensions. Within the NPS emphasis is on minimizing negative impacts and preventing "impairment" of park resources as described and interpreted in the NPS Organic Act. The results of evaluations conducted under NEPA are presented to the public, federal agencies, and public officials in document format (e.g. EAs and EISs) for consideration prior to taking official action or making official decisions.
Clean Water Act	The Clean Water Act, passed in 1972 as

(33 USC 1251-1376)	amendments to the Federal Water Pollution Control Act, and significantly amended in 1977 and 1987, was designed to restore and maintain the integrity of the nation's water. It furthers the objectives of restoring and maintaining the chemical, physical and biological integrity of the nation's waters and of eliminating the discharge of pollutants into navigable waters by 1985. Establishes effluent limitation for new and existing industrial discharge into U.S. waters. Provides an enforcement procedure for water pollution abatement. Requires conformance to permit required under S404 for actions that may result in discharge of dredged or fill material into a tributary to, wetland, or associated water source for a navigable river.
Clean Air Act (42 USC 7401-7671q, as amended in 1990)	Establishes a nationwide program for the prevention and control of air pollution and establishes National Ambient Air Quality Standards. Under the Prevention of Significant Deterioration provisions, the act requires federal officials responsible for the management of Class I Areas (some national parks and wilderness areas) to protect the air quality related values of each area and to consult with permitting authorities regarding possible adverse impacts from new or modified emitting facilities. Establishes specific programs that provide special protection for air resources and air quality related values associated with NPS units. The EPA has been charged with implementing this act.
Endangered Species Act of 1973, as amended (ESA) (16 USC 1531-1544)	The purposes of the ESA include providing "a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved. According to the ESA 'all federal departments and agencies shall seek to conserve endangered species and threatened species ' and '[e]ach federal agency shall…insure that any action authorized, funded, or carried out by such agency…is not likely to jeopardize the continued existence of any endangered

	species or threatened species.' The effects of any agency action that may affect endangered, threatened, or proposed species must be evaluated in consultation with either the USFWS (non-marine species) or the National Marine Fisheries Service (all marine species) as appropriate.
Wilderness Act of 1964 (16 USC 1131 et seq.)	Establishes the National Wilderness Preservation System. Wilderness Areas designated by Congress are made of existing federal lands that have retained a wilderness character and meet the criteria found in the act. Federal officials are required to manage Wilderness Areas in a manner conducive to retention of their wilderness character and must consider the effect upon wilderness attributes from management activities on adjacent lands.
Federal Advisory Committee Act	Creates a formal process for federal agencies to seek advice and assistance from citizens. Any council, panel, conference, task force or similar group used by federal officials to obtain consensus advice or recommendations on issues or policies fall under the purview of FACA.
Government Performance and Results Act (GPRA)	Requires the NPS to set goals (strategic and annual performance plans) and report results (annual performance reports). The NPS Strategic Plan contains four GPRA goal categories: park resources, park visitors, external partnership programs, and organizational effectiveness all focused on measurable outcomes.
Other Related Public Laws & Executive Orders	Redwood National Park Act (16 USC 79a-79q (1988), 82 Stat. 931, Pub. L. 90-545; Environmental Quality Improvement Act of 1970 (42 U.S.C. 56 § 4371); Off-Road Vehicle Use (Executive Orders 11644 and 11989); Floodplain Management (Executive Order 11988); Protection of Wetlands (Executive Order 11990); and Executive Order 13112 on Invasive Species
NPS Management Policies – 2001 (NPS Directives System)	This is the basic NPS service wide policy document. The Directives System is designed to provide NPS management and staffs with clear and continuously

	updated information on NPS policy and required and/or recommended actions, as well as any other information that will help them manage parks and programs effectively.
NPS Directors Orders	Directors Orders serve a vehicle to clarify or supplement *Management Policies* to meet the needs of NPS managers. Relevant Directors Orders: DO-2.1 Resource Management Planning DO-12 Environmental Impact Assessment DO-14 Resource Damage Assessment & Restoration DO-24 Museum Collections Management DO-41 Wilderness Preservation & Management DO-47 Sound Preservation & Noise Management DO-77 Natural Resource Protection
NPS Handbooks and Reference Manuals	These documents are issued by Associate Directors and provide NPS field employees with a compilation of legal references, operating policies, standards, procedures, general information, recommendations and examples to assist them in carrying out *Management Policies* and Director's Orders. Level 3 documents may not impose any new service-wide requirements, unless the Director has specifically authorized them to do so. Relevant Handbooks and Reference Manuals: NPS-75 Natural Resources Inventory & Monitoring NPS-77 Natural Resources Management Guidelines NPS Guide to Fed. Advisory Committee Act Website: Monitoring Natural Resources in our National Parks, http://www.nature.nps.gov/im/monitor

Appendix B. Designation of National Park System Units

The numerous designations within the National Park System sometime confuse visitors. The names are created in the Congressional legislation authorizing the sites or by the president, who proclaims *"national monuments"* under the Antiquities Act of 1906. Many names are descriptive -- lakeshores, seashores, battlefields --but others cannot be neatly categorized because of the diversity of resources within them. In 1970, Congress elaborated on the 1916 National Park Service Organic Act, saying all units of the system have equal legal standing in a national system.

National Monument: The Antiquities Act of 1906 authorized the President to declare by public proclamation landmarks, structures, and other objects of historic or scientific interest situated on lands owned or controlled by the government to be national monuments (Craters of the Moon NM and Preserve, Hagerman Fossil Beds NM, John Day Fossil Beds, Minidoka Internment NM).

National Preserve: National preserves are areas having characteristics associated with national parks, but in which Congress has permitted continued public hunting, trapping, oil/gas exploration and extraction. Many existing national preserves, without sport hunting, would qualify for national park designation (Craters of the Moon NM and Preserve).

National Historic Site: Usually, a national historic site contains a single historical feature that was directly associated with its subject. Derived from the Historic Sites Act of 1935, a number of historic sites were established by secretaries of the Interior, but most have been authorized by acts of Congress (Whitman Mission NHS).

National Historical Park: This designation generally applies to historic parks that extend beyond single properties or buildings (Nez Perce NHP).

National Battlefield: This general title includes national battlefield, national battlefield park, national battlefield site, and national military park. In 1958, an NPS committee recommended national battlefield as the single title for all such park lands (Big Hole NB).

National Recreation Area: Twelve NRAs in the system are centered on large reservoirs and emphasize water-based recreation. Five other NRAs are located near major population centers. Such urban parks combine scarce open spaces with the preservation of significant historic resources and important natural areas in location that can provide outdoor recreation for large numbers of people (Lake Roosevelt NRA).

National Reserve: This unit of the National Park System is managed cooperatively by the National Park Service and the Idaho Department of Parks and Recreation (City of Rocks NR).

Appendix C. UCBN Resource Management and General Management Plan Summaries

Note: This information was assembled from various park documents, including general management plans, resource management plans, and strategic plans. This does not represent the comprehensive goals and objectives for each park but represents subsets that are most relevant to natural resource monitoring.

Big Hole National Battlefield
Source: NEPE/BIHO General Management Plan 1997

Big Hole National Battlefield	• Facilitate protection and offer interpretation of Nez Perce sites in Idaho, Oregon, Washington, Montana, and Wyoming that have exceptional value in commemorating the history of the United States. • Preserve and protect tangible resources that document the history of the Nez Perce peoples and the significant role of the Nez Perce in North American history. • Interpret the culture and history of the Nez Perce peoples and promote documentation to enhance that interpretation.	Purpose

City of Rocks National Reserve
Source: CIRO Resource Management Plan 1994

City of Rocks National Reserve	• To preserve, protect, and interpret the resources and significant values that contribute to City of Rocks' uniqueness and attractiveness. • To manage recreation to ensure preservation and protection of these resource values.	Purpose
	• Identify, inventory, evaluate, protect, and preserve the resources related to the California Trail. • Strive to preserve and restore natural resources. • Balance ecological relationships and processes with uses in the reserve. • Maintain natural conditions as much as possible. • Determine the location of and protect the important habitat used by rare species and species sensitive to human uses. • Protect air quality at the highest level possible under the Clean Air Act by working cooperatively with the state of Idaho to redesignate the area from Class II to Class I. • Conserve natural hydrological processes, including subsurface hydrology and control the acceleration of erosion due to human activities to preserve natural, cultural, and scenic resources. • Protect or restore wetlands and riparian areas by managing their use wherever possible. • Complete a comprehensive inventory of natural resources in the reserve.	Management Objectives

Craters of the Moon National Monument and Preserve
Source: CRMO Strategic Plan 2000-2005 and 1988 Statement for Management

Craters of the Moon National Monument and Preserve	• The purpose of Craters of the Moon National Monument is to preserve and protect the remarkable geological features, wilderness solitude, and natural systems that have shaped, and continue to shape the landscape of the Great Rift region of the Snake River plain.	Purpose
	• To preserve to the greatest extent possible the basaltic volcanism features of the monument through effective interpretation and protection programs. • To perpetuate the natural ecosystems of the monument through active and effective resource management programs. • To preserve visibility and associated vistas and to prevent deterioration of the airshed and all air quality related values. • To promote a continuing program of scientific research and study to gather information that will allow for long-term wildlife management programs. • To work on a cooperative basis with other government agencies, primarily the Bureau of Land Management, in matters of mutual concern such as the effect of stock grazing in the vicinity of the monument. • To establish objective policy and guidelines (backcountry management plan) that will ensure a strong and definite commitment by park management to the preservation of the monument's wilderness.	Management Objectives

Hagerman Fossil Beds National Monument
Source: HAFO General Management Plan 1996

Hagerman Fossil Beds National Monument	• To preserve for the benefit and enjoyment of present and future generations the outstanding paleontological sites known as the Hagerman Valley fossil sites.	Purpose
	• Preserve and protect the paleontological resources of the Hagerman Valley fossil sites, including both specimens and their context. • Encourage and support scientific research and related activities associated with monument resources and the science of paleontology. • Preserve, protect, and interpret the natural and cultural resources associated with the monument. • Cooperatively manage hunting and fishing in the monument to ensure the continuance of this historic use as legislatively required, while protecting monument resources, values, public safety, research, and other authorized activities. • Cooperate with the operation, maintenance, repair, upgrade, and modification of existing electrical and irrigation facilities within the boundaries of the monument as legislatively required while minimizing any adverse impacts of these activities on monument resources, values, research, or visitors.	Management Goals

John Day Fossil Beds National Monument
Source: JODA Resource Management Plan 1999

John Day Fossil Beds National Monument	• Establishment of the monument is intended to preserve, protect, and interpret the extensive tertiary fossils found in the geologic formations of these areas.	Purpose
	• Encourage resource-compatible activities or scientific investigations of the monument, which results in obtaining and sharing knowledge of the paleontological, geological, and ecological scientific study of the region. • In areas designated as "natural zones", maintain or restore indigenous flora, fauna, and natural communities to achieve species diversity and community structure equivalent to pre-European settlement conditions. • Identify, determine the significance of, and protect the monument's natural and cultural resources.	Management Goals

Lake Roosevelt National Recreation Area
Source: LARO Fire Management Plan 2000

Lake Roosevelt National Receation Area	• Provide opportunities for diverse, safe, quality, outdoor recreation experiences for the public. • Preserve, conserve, and protect the integrity of natural, cultural, and scenic resources. • Provide opportunities to enhance public appreciation and understanding about the area's significant resources.	Purpose

Minidoka Internment National Monument
Source: MIIN Draft Management Plan 2004

Minidoka Internment National Monument	• The purpose of the Minidoka Internment National Monument is to provide opportunities for public education and interpretation of the incarceration and internment of Japanese Americans during WWII. The monument protects and manages resources related to the Minidoka Relocation Center.	Purpose
	• Protection and management of natural resources and the site. • Control of exotic plant species. • Fire management. • Hunting and the protection of sage grouse habitat.	Identified Management Issues

Nez Perce National Historic Park
Source: NEPE/BIHO General Management Plan 1997

Nez Perce National Historic Park	• Facilitate protection and offer interpretation of Nez Perce sites in Idaho, Oregon, Washington, Montana, and Wyoming that have exceptional value in commemorating the history of the United States. • Preserve and protect tangible resources that document the history of the Nez Perce peoples and the significant role of the Nez Perce in North American history. • Interpret the culture and history of the Nez Perce peoples and promote documentation to enhance that interpretation.	Purpose

Whitman Mission National Historic Site
Source: WHMI General Management Plan 2000

Whitman Mission National Historic Site	• To preserve and maintain the site of the Mission and school for Indians established by Marcus and Narcissa Whitman between 1836-1847 along the Walla Walla River at Waiilatpu, and to preserve and maintain the memorials to their lives.	Purpose
	• To preserve and protect the historic, cultural, and natural resources of Whitman Mission National Historic Site for present and future generations. • To preserve and enhance the natural resources of the NHS, including riparian and wetland areas, in accord with all applicable laws, NPS policies, and executive orders.	Mission Goals

Appendix D. 2002 Vital Signs Workshop Report

Northern Semi-Arid Network
Vital Signs Monitoring Plan

Program Background and Justification

In accordance with the Congressional mandate to increase scientific research and detect long-term changes and trends in resources in the National Park System, the Inventory and Monitoring Program was created in the early 1990's. The program's intent was to document trends and conditions of valuable resources to assure the ecological integrity of each park's ecosystem, as well as preserving its biodiversity and uniqueness. The national strategy for inventory and monitoring seeks to:

- Detect significant changes in resource abundance, condition, population structure or ecological processes.
- Evaluate the effects of management action on population or community dynamics or ecological processes.

The national strategy consists of a framework having three major components:

- Completion of basic resource inventories upon which monitoring can be based.
- Creation of an experimental Prototype Monitoring Program to evaluate alternative monitoring designs and strategies.
- Implementation of operational monitoring of critical parameters ("vital signs") in all natural resource parks.

An important component of the NPS national framework for monitoring consists of networks of parks that will conduct long-term ecological monitoring for critical parameters or "vital signs." As of October 1, 2000, approximately 270 park units organized in 32 networks will participate in Vital Signs Monitoring.

The Northern Semi-Arid Network is one such network, uniting eight park sites in four western states, on the basis of shared characteristics, which include: low to moderate rainfall, plant communities that typically occur in these climates, similar adjacent land use histories, characterization as "islands" amidst surrounding, often fragmented, landscapes, and generally small size, with lack of buffer zones.

Defined Objectives of the Northern Semi-Arid Network Monitoring Program:

- Determine status and trends of the health of the park ecosystem
- Establish normal limits of variation in key park resources
- Provide early warning signs of resource decline
- Evaluate the effectiveness of resource management practices

In preparation for the Vital Signs Monitoring Plan Workshop, the network has completed a computerized resource database documenting all natural resource studies pertaining to

each site; documented species lists for each park in the network; documented information on existing natural resource data. To avoid a "death by models" situation, a simple, straightforward conceptual model was developed before the workshop, providing a starting point and framework for addressing and evaluating vital signs and monitoring strategies at the network level. The workshop was organized to identify and validate vital signs common to each park site, substantiate the conceptual model's premises, and add further input to monitoring focus, measures and methods. Prior to the workshop, a copy of the **Draft Vital Signs Monitoring Plan for the Northern Semi-Arid Network** was distributed to participants. Resource Managers were also sent a questionnaire, examining the following points as preparation for workshop discussions:

- What are your park's most significant resources for which information about status and trends is needed?
- What park resources have regional or even national significance due to their unique nature or because they serve as indicators of regional trends?
- Are there particular resources that the park has special mandates or commitments to protect either by park legislation, in a general management plan, or in other laws of planning documents? (e.g. Federally listed species at all parks)
- What, in your opinion, are the greatest current or prospective internal threats to significant park resources? (e.g. climbing at CIRO, trail impacts at JODA)
- What are the greatest external threats? (e.g. irrigation at HAFO)
- Are there significant current or future ecosystem restoration projects in the park for which long-term monitoring is needed? (e.g. vegetation restoration projects at WHMI)
- (Especially for Resource Managers) What long-term natural resources monitoring projects have been undertaken in the past or are ongoing now?

Resource Managers responded to the questionnaire in writing and also addressed the critical points in the workshop. Summaries of those presentations are contained in Workshop Proceedings: Park Summaries.

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Workshop Proceedings, April 16-17, 2002

A workshop on the Vital Signs Monitoring Plan for the Northern Semi-Arid Network was conducted at the University of Idaho on April 16-17, with representatives from the eight park sites attending. Appropriate additional resource specialists and scientists also participated. The objectives of the workshop were threefold:

- To identify significant natural resources and their future desired condition
- To identify current threats and stresses that can affect park resources
- Brainstorm and recommend potential vital sign indicators for long-term monitoring that can evaluate the condition and health of the natural resources of network parks.

Based on the network approach, the program will set up new vital signs monitoring opportunities based on commonality, but will also identify more site-specific situations, and facilitate improved database storage. An inventory-monitoring strategy will help synthesize new programs and facilitate more efficient management decisions. The following handouts guided the workshop proceedings:

- Draft Vital Signs Monitoring Plan for the Northern Semi-Arid Network
- Ecosystem Effects Worksheet
- Vital Signs Indicator Worksheet

Park Summaries

Network park site representatives defined their park's ecological concerns in written responses and workshop presentations (a more detailed evaluation of each park site is contained in the **Draft Vital Signs Monitoring Plan for the Northern Semi-Arid Network**). Park site representatives addressed site conditions and concerns in the context of the following:

- *What are the park's most significant resources for which information about status and trends is needed?*
- *What park resources have regional or even national significance due to uniqueness, or because they serve as indicators of regional trends?*
- *What are the greatest current or prospective internal threats to significant park resources?*
- *What are the greatest external threats?*

Big Hole National Battlefield (BIHO) Dan Foster

Cultural landscapes are the most significant resources to be protected at BIHO, with invasion of exotic species and changes to local hydrology as both internal and external threats. Over the years, fire has been kept out of the landscape, creating a change in ecology. Additionally, four nearby irrigation canals have leaked, encouraging non-native

willow growth. Grazing patterns near park borders have impacted native grasses, as well. BIHO identifies restoration of forest ecology by thinning and prescribed burn, and prescribed fire in willow/riparian and sage/grasslands as ecosystem restoration projects for which long-term monitoring is needed.

Nez Perce National Historical Park (NEPE) Dan Foster
With 38 dispersed cultural landscape locations, the park's sites are all listed on the National Register of Historic Places and are thus in need of protection, especially from encroaching development to satisfy visitor demand. Proposed visitor centers such as those at Bear Paw and Heart of the Monster will impact ecosystems. Currently NEPE's Spalding site needs restoration of ponderosa pine/grass areas, while the White Bird village site requires building removal. All locations suffer some amount of impact from exotic species.

City of Rocks National Reserve (CIRO) Wallace Keck
CIRO's significant resources include the California Trail, Indian Grove and riparian communities, with the area boasting Idaho's largest pinyon pine and a large pinyon pine forest. The park's high elevation supports several distinct plant communities (sagebrush, pinyon-juniper, etc.), and granite monoliths provide shelter for raptors, pack rats, cliff swallows and swifts. The area is a rock-climbing mecca, but current threats from rock climbers are being mitigated. Grazing in riparian areas, dust dispersal from gravel roads, and erosion and sedimentation are additional areas of concern within the park, and juniper theft is an external threat that has become a recent problem.

Craters of the Moon National Monument (CRMO) John Apel
With its borders recently expanded to more than 12 times the original size, CRMO's significant resources include numerous volcanic features, kipukas, a Class I airshed, lava tubes, populations of sage grouse, Townsend's big-eared bats and pygmy rabbits, natural quiet and night skies. The spread of invasive weeds, destruction of geologic features by collectors, and illegal off-road vehicle use pose some of the biggest problems to the park itself. External threats include the spread of invasive weeds, regional haze impacts on visibility, development impacts on night sky, and white pine blister rust impacts on limber pine. Restoration of sagebrush steppe habitat downgraded by wildland fire and invasion of cheat grass is a major focus.

Hagerman Fossil Beds National Monument (HAFO) Mike Wissenbach
Fossils and the associated stratigraphy are HAFO's most significant resources, while landslides, altered hydrological regimes (high water tables, fluctuating reservoir levels, perched aquifers, irrigation) and wind/water erosion pose the biggest threats to slope stability and fossil resources. Restoration and monitoring work would likely focus on revegetation of landslide areas to stabilize slopes, and control of exotic species. This section of the Snake River does not currently meet water quality standards; some of the impacts affect submerged lands that are within monument boundaries.

John Day Fossil Beds National Monument (JODA) Ken Hyde

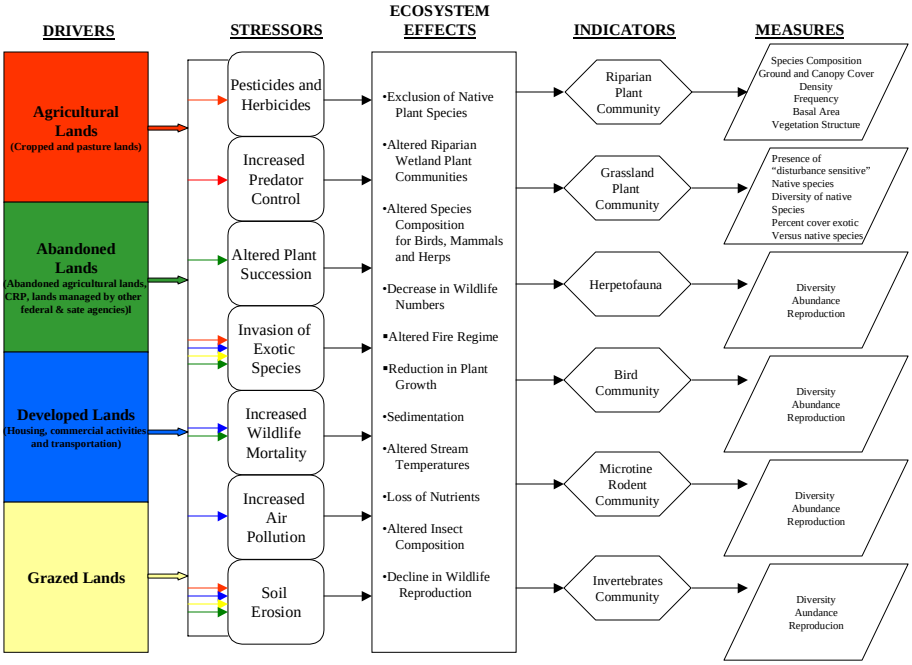
JODA lists three areas of focus: riparian area vegetation changes; changes in plant communities due to noxious weed invasions and reintroduction of fire; population dynamics of amphibians, reptiles and small rodents. The amphibian population as well as steelhead salmon, bald eagle and Columbia spotted frog, are of concern, and noxious weeds such as cheat grass and medusa head are impacting sagebrush, mountain mahogany and rodent populations. The reintroduction of fire may or may not benefit native plant and animal communities, and newly planted old farm fields should be monitored for noxious weeds, future flood events and benefits to native wildlife populations.

Lake Roosevelt National Recreation Area (LARO) Scott Hebner
LARO's focus concentrates on plant communities, water and fish, with raptors and water birds also of special significance. The mixed ownership and water fluctuations fragment resource management, and industrial pollution, residential development and noxious weeds pose major threats to the landscape. Restoration projects which require monitoring programs include polluted sediment impacts and shrub-steppe and forest restoration. Because the lake is manmade, it is not a natural aquatic environment.

Whitman Mission National Historic Site (WHMI) Roger Trick

WHMI has a cultural resource focus, but native vegetation and surface water quality and quantity are the park's major resource interests for new monitoring programs. As with other network sites, exotic species and noxious weeds are a major concern, as is the quality of irrigation water coming into the park. There is some ongoing vegetation restoration work, which will require monitoring, and water quality monitoring also needs to be undertaken.

Workshop Evaluation of Conceptual Model



The initial conceptual model developed for the Northern Semi-Arid Network assessed common situations, noting that all eight park sites feature low to moderate rainfall (arid/semi-arid), isolated riparian areas, plant communities that typically occur in these climates, similar adjacent land use histories, characterization as "islands" amidst surrounding, often fragmented, landscapes, and generally small size, with lack of buffer zones.

The workshop itself was conducted in four segments, using the same steps to evaluate each component (Drivers, Stressors, Ecosystem Effects, Indicators/Vital Signs) of the conceptual model. Each segment followed essentially the same format:

Process

- Breakout group discussion/validation of model component
- Changes and proposals to the model as addressed in small groups
- Questions and problems brought to the main group
- Consensus of the whole group

Decision

- Agreement to add, subtract or alter categories or features of model
- Amend conceptual model to reflect group suggestions
- Go to next segment of workshop, incorporating amended model

Segment One: DRIVERS

In Segment One, DRIVERS were identified as agricultural lands, abandoned lands, developed lands, and grazed lands.

Process

Red Group Discussed *recreational access* as a potential Driver or Stressor, and also considered *flowing water* as a Driver. The group considered *public perception* and *politics* as Drivers, as well, but finally agreed to leave the current set of Drivers in place with broad definitions. The group wanted to identify pathways between Drivers and Stressors, such as streams and channels, and also wanted some emphasis on access and recreation issues at a future point.

Green Group Considered *climate change* as a Driver and agreed to be cognizant of that in future discussions. The group discussed *land conversion, soundscape, overflights, clear night sky, light pollution and air quality* as relative issues, but agreed to propose *increased visitation* as the only added Driver.

Blue Group Stressed that Drivers needed to be significant to the whole network in order to be considered. The group also discussed whether Drivers were internal or external, and considered *climate* as a possible Driver, along with *natural influences*. The group further agreed that there should be an established baseline for Drivers, and that participants should understand the baseline and stay within it.

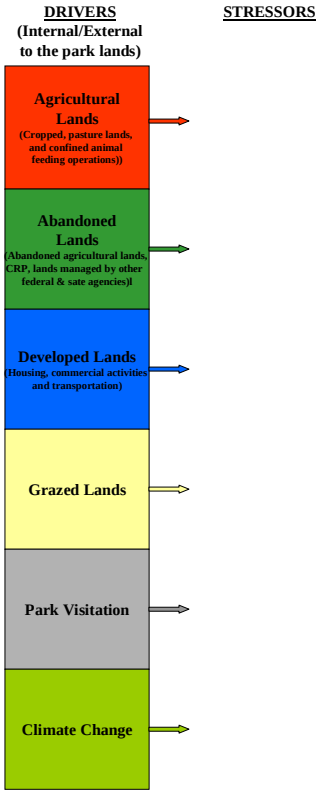
Additional Comments/Questions

- Every park could list *increased visitation*, but with the size park being discussed, is it applicable?
- We should be looking to the future and collecting baseline data now.
- Is *increased visitation* a Driver or more of a pathway or subtext of development?

Decision

Consensus of Group

- Need to amplify current Drivers to clarify Developed Lands as internal or external to park, Agricultural Lands to include Confined Animal Feeding Operations.
- Drivers proposed included *Park Visitation* and *Climate Change.*



Segment Two: STRESSORS

In Segment Two, Stressors were identified as pesticides and herbicides, increased predator control, altered plant succession, invasion of exotic species, increased wildlife mortality, increased air pollution, and soil erosion.

Process:

Red Group The group first reconsidered *park visitation* as a Stressor, viewing the park as an attraction and therefore a Driver. When visitation was viewed as a Driver, however, such things as *water consumption (both internal and external)* and *water pollution* were rated as Stressors. *Increased predator control* was viewed as too narrow in scope, and *animal control* became the new delineation.

Green Group The group regrouped Drivers and Stressors in the following way:

Drivers	Stressors

- Agricultural Lands > Water Quality, Irrigation
- Abandoned Lands > Water Quality
- Developed Lands > Noise, Light, Air Quality
- Grazed Lands > No Changes in Stressors
- Park Visitation > Roads, Traffic, Noise, Light
- Climate > Air Stream Temperature, Precipitation/Moisture Levels

Other changes:

- Omit Increased Wildlife Mortality
- Grazed Lands changed to Grazed and Range Lands
- Add Crop and Forage Lands to Agricultural Lands.

Blue Group The group submitted the following changes and comments:

- Increased Wildlife Mortality changed to Increased Wildlife and Plant Mortality
- Move Increased Plant Mortality moved to Ecosystem Effects
- Altered Plant Succession changed to Altered Plant Succession/Plant Community Composition
- Fragmentation added to Ecosystem Effects
- Water Quality as Stressor or Ecosystem Effect?
- Water Pollution considered as a Stressor leading to Water Quality as an Ecosystem Effect
- Altered Hydrology and Altered Fire Regime both evaluated as Stressors

Group Consensus

The groups summarized the following:

- Pesticides and Herbicides changed to ***Agricultural Chemical Applications***, which includes herbicides, insecticides and fertilizers.
- Increased Predator Control changed to ***Animal Damage Control***.
- Altered Plant Succession changed to ***Altered Plant Succession/Community Composition.***
- Increased Wildlife Mortality moved to Ecosystem Effects.
- The following Stressors added:
    - Air Pollution
    - Soil Erosion
    - Noise Pollution
    - Light Pollution
    - Water Pollution
    - Altered Hydrology
    - Roads/Traffic
    - Altered Temperature/Precipitation

A vote on the amended Stressors ranked them in the following order of importance: (vote counts shown in parenthesis).

1. Invasion of Exotic Species (21)
2. Altered Plant Succession/Community Composition (14)
3. Altered Fire Regime (13)
4. Altered Hydrology (9)
5. Agricultural Chemical Applications (7)
6. Roads and Traffic (6)

7. Soil Erosion (5)
   Light Pollution (5)
   Water Pollution (5)
8. Altered Temperature/Precipitation
9. Animal Damage Control (2)
10. Noise Pollution (1)
11. Air Pollution (0)

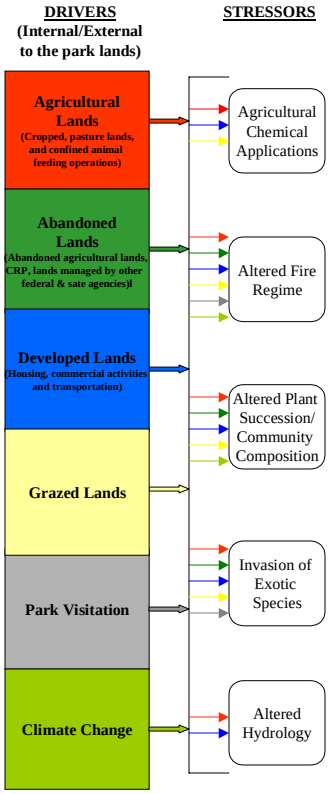
Additional Comments

One workshop participant questioned the findings as useful for short-term, but wondered if the long-term was being left out, as in the case of Climate Change. The facilitator noted that Climate Change had been elevated to Driver, while it was further explained that monitoring would ultimately focus more long-term but that wasn't realistic at this point.

Decision:

The group identified the top 5 as Stressors, and reorganized the remaining categories as either Ecosystem Effects or Indicators. The conceptual model added the amended Stressors:

1. Invasion of Exotic Species
2. Altered Plant Succession/Community Composition
3. Altered Fire Regime
4. Altered Hydrology
5. Agricultural Chemical Applications



Segment Three: ECOSYSTEM EFFECTS

(Handout: Ecosystem Effects Worksheet)

In Segment Three, Ecosystem Effects were identified and numbered as follows:

1. Exclusion of native species
2. Altered riparian/wetland plant communities
3. Altered species composition for bird, mammals, herps
4. Decrease in wildlife numbers
5. Altered fire regime
6. Reduction in plant growth
7. Sedimentation
8. Altered stream temperatures
9. Loss of nutrients
10. Altered insect composition
11. Decline in wildlife reproduction

Process:

Red Group

- Change 3 to *Altered Vertebrate Composition*
- Change 4 to *Change in Wildlife Abundance*
- Change 10 to *Altered Invertebrate Composition*

- Add new category, *Altered Soil Properties (#12)*
- Add new category, *Alteration of Grass/Shrub Lands (#13)*
- Add new category, *Alteration of Forests* (dropped)

Green Group

- Change 1 to *Exclusion of Native Plant Communities/Structures*
- Change 7 to *Soil Erosion and Sedimentation*
- Change 9 to *Change in Nutrient Availability*
- Add new category, *Water Quality*

Blue Group

- Combine 4 and 11 to *Altered Wildlife Abundance/Reproduction*
- Change 9 to *Loss of Soil Nutrients*
- Add new category, *Altered Grass/ Shrub-Steppe Community (Same as #13 for Red Group)*
- Change 10 to *Altered Invertebrate Composition*

Additional Discussion

Altered Hydrology as an issue:

- CRMO – Moot point because all hydrology currently involves park domestic water supply
- JODA – Springs
- LARO – Main theme, especially water fluctuation
- NEPE – Water everywhere, surface runoff
- HAFO – Irrigation, perched aquifers, river shoreline
- BIHO – Leaking irrigation canals
- WHMI – Water quality
- CIRO – Erosion and deepening channels

The full group consensus was that the effects of Altered Hydrology showed up under other categories and could not be addressed in a network wide manner. There was further clarification, noting distinctions between water quality and water amount; also distinctions between precipitation and stream flow as related to Altered Hydrology.

Does "change" refer to number or composition in #1? Return to using term "exclusion" because the other categories cover number and composition.

Is there a network need for weather stations? CRMO, WHMI, JODA have stations, but CIRO does not. Fire funding allows for summer weather monitoring, such as at LARO. NEPE has multiple sites, some near Forest Service and BLM weather stations. BIHO has no station but does have Forest Service facility nearby.

Amended Ecosystem Effects List:

1. Exclusion of native species
2. Altered riparian/wetland plant communities
3. Altered vertebrate species composition
4. Altered wildlife abundance/reproduction
5. Altered fire regime (removed later)
6. Reduction in plant growth
7. Sedimentation and soil erosion
8. Altered stream temperatures
9. Loss of nutrients
10. Altered invertebrate species composition
11. Decline in wildlife reproduction
12. Altered soil properties*
13. Alteration of grass/shrub-steppe communities**

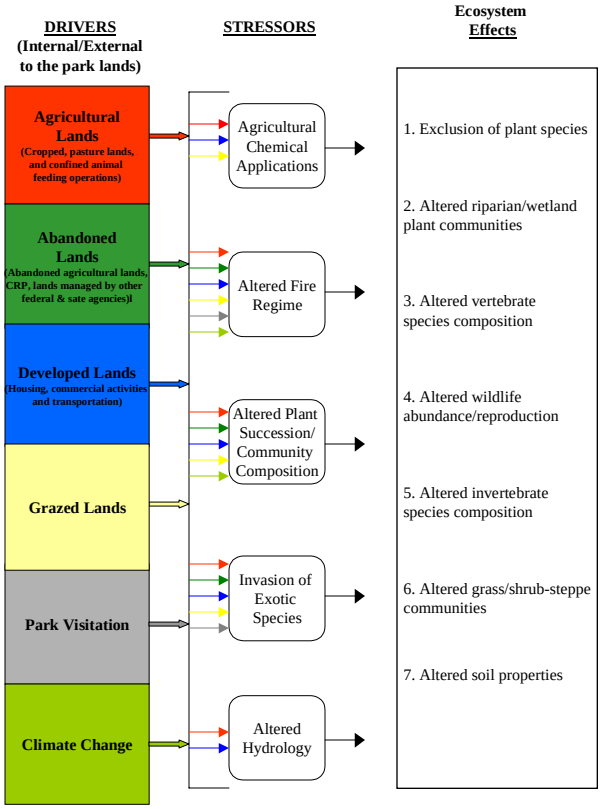
The group linked Ecosystem Effects to Stressors in the following manner (numbers keyed to Amended Ecosystem Effects List above with items #12 and #13 added by group consensus and #5 restored to Stressor):

	Invasion of Exotic Species	Altered Plant Succession/ Community Composition	Altered Fire Regime	Altered Hydrology	Agricultural Chemical Application
Blue Group	1, 2, 3, 4, 5, 10, 12	1, 2, 3, 4, 5 10, 12*	1, 2, 3, 4, 10, 12*	2, 3, 4, 10	1, 2, 3, 4, 10
Red Group	1, 2, 3, 4, 10, 12*, 13**	3, 4, 10, 12*	1, 3, 4, 10, 12*, 13**	2, 3, 4, 10, 12*	1, 2, 3, 4, 10, 12*, 13**
Green Group	1, 2, 3, 4, 5, 6, 10, 11	1, 2, 3, 4, 5, 7, 9, 10, 11	1, 2, 3, 4, 7, 9, 10	2, 3, 6, 7, 8	1, 3, 6, 9, 10

Decision:

The following *Revised Ecosystem Effects List* reflects consensus within the network:

1. Exclusion of native plant species
2. Altered riparian/wetland plant communities
3. Altered vertebrate species composition
4. Altered wildlife abundance/reproduction
5. Altered invertebrate species composition
6. Altered grass/shrub-steppe communities
7. Altered soil properties



Segment Four: INDICATORS/VITAL SIGNS

(Handout: Vital Signs Indicator Worksheet)

In Segment Four, INDICATORS* were identified as:

- Riparian Plant Community
- Grassland Plant Community
- Herpetofauna
- Bird Community
- Microtine Rodent Community
- Invertebrate Community

* Notes group disagreement over Indicators as correct term.

Process:

Red Group The group listed its relevant Indicators as follows:

1. Microbiotic crust
2. Sage/grass dependent birds
3. Sage/grass dependent microtine rodents
4. Bats
5. Aquatic macroinvertebrates
6. Herps
7. Invasive species
8. Neotropic birds

9. Grasshoppers/beetles/butterflies/moths
10. Structural diversity of sage/grasslands
11. Structural diversity of riparian/wetlands
12. Native plant species diversity and abundance
13. Wetland indicator plants
14. Native bunchgrasses

Green Group The group considered the following Indicator strategy:

- Monitor the abundance/frequency of
  - ✓ Perennial grass
  - ✓ Idaho fescue
  - ✓ Dominant tree species

- Monitor riparian and wetland conditions based on
  - ✓ Soil moisture
  - ✓ Abundance of species
- Consult a bird expert for the species indicator appropriate to the area and monitor abundance/reproduction (consider sage grouse, other network-wide species)
- Monitor small mammal numbers (consider mice, bats, etc.)
- Monitor aquatic insects (consider butterflies, bees, wasps)
- Monitor soil crust and observe presence of cheat grass, perennial grasses, sage grouse.

Blue Group The group looked for applicable species for each area of concern and developed the following chart for its Indicators:

Effects Number	Plants	Invertebrates	Herps	Birds	Mammals
1				Brewer's Sparrow, Vesper Sparrow	Long-eared myotis bats
2			Pseudacris (Boreal Chorus, Pacific Tree Frog); True frogs (spotted, leopard) PAO*	Yellow warbler, yellow-headed blackbird	Bats
3			Striped whip snake, sagebrush lizard PAO	Brewer's sparrow, Vesper sparrow, yellow warbler	Bats
4				Brewer's sparrow, Vesper sparrow, yellow warbler	Bats
5				Brewer's sparrow, Vesper sparrow, yellow warbler	Bats
6			Striped whip snake, sagebrush lizard	Brewer's sparrow, Vesper sparrow, yellow warbler	
7					

*PAO: Proportion of Area Occupied

Group Summary

The full group considered the following as Indicators, with applicable Ecosystem Effects numbers listed beside each species or category:

1. Bullfrog 2, 3, 4
2. Spotted frog 2, 3, 4
3. Tree frog 2, 3, 4
4. Striped whip snake 3, 4, 6
5. Sagebrush lizard 3, 4, 6
6. Vesper sparrow 1, 3, 4, 5, 6
7. Brewer's sparrow 1, 3, 4, 5, 6
8. Yellow warbler 1, 2, 3, 4, 5
9. Yellow-headed blackbird 1, 2, 3, 4, 5
10. Bats 1, 2, 3, 4, 5
11. Native grasses 1, 3, 4, 5, 6, 7
12. Dominant upland tree species (juniper) 1, 3, 4
13. Soil moisture 1, 2, 7
14. Native populus abundance 1, 2, 3, 4, 5
15. Sage grouse 1, 3, 4, 6
16. Small mammal diversity 1, 2, 3, 4, 6, 7
17. Aquatic insects 2, 3, 4, 5
18. Lacewings
19. Cheat grass 1, 3, 4, 5, 6, 7
20. Microbiotic crust 1, 6, 7
21. EPT order of insects
22. Soil erosion 7
23. Cover types via remote sensing 1, 2, 6
24. Invasive exotic plant species 1, 2, 3, 4, 5, 6, 7
25. Structural diversity of sage/grasslands 1, 3, 4, 6
26. Structural diversity of riparian/wetlands 1, 2, 3, 4
27. Native plant species diversity/abundance 1, 2, 3, 4, 5, 6, 7
28. Wetland indicator plants 1, 2
29. Native bunchgrasses (group with perennial grasses)

Group Discussion and Comments

The workshop facilitator noted that the group moved from 7 Ecosystem Effects to 29 Indicators. He also noted that #3 (altered vertebrate species composition) and #4 (altered wildlife abundance/reproduction) were always found together in groupings, so the two Effects might be considered as one in reality.

The group talked about the semantics of *composition, abundance* and *reproduction,* seeking clarification and questioning whether *"diversity"* might be the better term. One participant pointed out that there is a difference in monitoring *species composition* and *abundance.*

Discussion came back to the appropriateness of Indicators as the correct term, and clarification was sought between that term and Vital Signs. Some suggested that *Affected Communities* or *Species Assemblages* might be more accurate. Some questioned the placement of the new Indicator list on the conceptual model, and thought it might be better to list Vital Signs Indicators and another category, Specific Indicators.

In trying to solidify choices for Indicators, group members considered the following:

- Riparian/Wetlands Plant Community
- Grassland/Shrub-Steppe Plant Community
- Herpetofauna
- Avifauna
- Small Mammal Community
- Invertebrate Community
- Soils (added)

Decision:
The group chose not to prioritize Indicators at this workshop, noting that many did not have enough background or information on which to make a committed decision. This segment will be further researched through a peer review process, with findings noted on the website.

Final Conceptual Model

In a final step, the Project Leader subjected the proposed Indicators and group comments to a peer review process, developing a model based on the outcome of that additional information. It was decided that a fine line exists between Measures and Methods, and that the line between the two could be easily blurred. Many of the more detailed Indicators proposed by the group could alternately be considered in the Measures column, with means of monitoring categorized as Methods.

The final conceptual model was altered to best reflect workshop findings, coupled with peer review input. Thus, the initial Indicators were condensed and a 7th indicator added. The Indicators are listed as follows:

- Riparian/Wetlands Plant Community
- Grassland/Shrub-Steppe Plant Community
- Herpetofauna
- Avifauna
- Small Mammal Community
- Invertebrate Community
- Soil Properties

It was determined that monitoring questions should be added to the list of "Vital Sign Indicators." With monitoring questions added, the vital signs are better defined and the challenge of priority ranking by scientific reviewers is simplified. Reviewers will now be able to evaluate what monitoring a specific vital sign will accomplish in each network park. Peer review is an important component of the process to identify and rank vital

signs and being able to address a specific monitoring question is necessary. Specific monitoring questions were determined for each of the 7 identified "Vital Signs." Monitoring questions were developed based on discussions with resource managers from network parks and scientists present at the workshop.

Listed below are the 7 vital signs and the list of monitoring questions that are important to address in the network parks.

- Vital Sign: Riparian/Wetlands Plant Community
  Monitoring Question: What are the impacts of restoration efforts on the riparian wetlands plant community?

- Vital Sign: Riparian/Wetlands Plant Community
  Monitoring Question: What are the impacts in the use of prescribed fire on the riparian/wetland plant community?

- Vital Sign: Riparian/Wetlands Plant Community
  Monitoring Question: What is the abundance and impact of invasive species in the riparian wetland community?

- Vital Sign: Grassland/Shrub-Steppe Plant Community
  Monitoring Question: What are the impacts of restoration efforts on the grassland/shrub-steppe plant community?

- Vital Sign: Grassland/Shrub-Steppe Plant Community
  Monitoring Question: What are the impacts in the use of prescribed fire on the grassland/shrub-steppe plant community?

- Vital Sign: Grassland/Shrub-Steppe Plant Community
  Monitoring Question: What is the abundance and impact of invasive species in the grassland/shrub-steppe plant community?

- Vital Sign: Herpetofauna
  Monitoring Question: What is the amphibian species diversity in the wetland/riparian areas?

- Vital Sign: Herpetofauna
  Monitoring Question: What is the reptile species diversity in the grassland/shrub-steppe areas?

- Vital Sign: Avifauna
  Monitoring Question: What is the bird species diversity in the wetland/riparian areas?

- Vital Sign: Avifauna

Monitoring Question: What is the bird species diversity in the grassland/shrub-steppe areas?

- Vital Sign: Small Mammal Community
  Monitoring Question: What is the small mammal diversity in the wetland/riparian areas?

- Vital Sign: Small Mammal Community
  Monitoring Question: What is the small mammal diversity in the grassland/shrub-steppe areas?

- Vital Sign: Invertebrate Community
  Monitoring Question: What is the invertebrate diversity in the wetland/riparian areas?

- Vital Sign: Invertebrate Community
  Monitoring Question: What is the invertebrate diversity in the grassland/shrub-steppe areas?

- Vital Signs: Soil Properties
  Monitoring Question: What are the effects of erosion and/or sedimentation on overall habitat conditions?

Appendix E. Resource managers responses to questionnaire at 2002 Vital Signs Monitoring Workshop

Park Summaries

Network park site representatives defined their park's ecological concerns in written responses and workshop presentations. Park site representatives addressed site conditions and concerns in the context of the following:

- *What are the park's most significant resources for which information about status and trends is needed?*
- *What park resources have regional or even national significance due to uniqueness, or because they serve as indicators of regional trends?*
- *What are the greatest current or prospective internal threats to significant park resources?*
- *What are the greatest external threats?*

Big Hole National Battlefield (BIHO) Dan Foster

Cultural landscapes are the most significant resources to be protected at BIHO, with invasion of exotic species and changes to local hydrology as both internal and external threats. Over the years, fire has been kept out of the landscape, creating a change in ecology. Additionally, four nearby irrigation canals have leaked, encouraging non-native willow growth. Grazing patterns near park borders have impacted native grasses, as well. BIHO identifies restoration of forest ecology by thinning and prescribed burn, and prescribed fire in willow/riparian and sage/grasslands as ecosystem restoration projects for which long-term monitoring is needed.

Nez Perce National Historical Park (NEPE) Dan Foster

With 38 dispersed cultural landscape locations, the park's sites are all listed on the National Register of Historic Places and are thus in need of protection, especially from encroaching development to satisfy visitor demand. Proposed visitor centers such as those at Bear Paw and Heart of the Monster will impact ecosystems. Currently NEPE's Spalding site needs restoration of ponderosa pine/grass areas, while the White Bird village site requires building removal. All locations suffer some amount of impact from exotic species.

City of Rocks National Reserve (CIRO) Wallace Keck

CIRO's significant resources include the California Trail, Indian Grove and riparian communities, with the area boasting Idaho's largest pinyon pine and a large pinyon pine forest. The park's high elevation supports several distinct plant communities (sagebrush, pinyon-juniper, etc.), and granite monoliths provide shelter for raptors, pack rats, cliff swallows and swifts. The area is a rock-climbing mecca, but current threats from rock climbers are being mitigated. Grazing in riparian areas, dust dispersal from gravel roads, and erosion and sedimentation are additional areas of concern within the park, and juniper theft is an external threat that has become a recent problem.

Craters of the Moon National Monument (CRMO) John Apel
With its borders recently expanded to more than 12 times the original size, CRMO's significant resources include numerous volcanic features, kipukas, a Class I airshed, lava tubes, populations of sage grouse, Townsend's big-eared bats and pygmy rabbits, natural quiet and night skies. The spread of invasive weeds, destruction of geologic features by collectors, and illegal off-road vehicle use pose some of the biggest problems to the park itself. External threats include the spread of invasive weeds, regional haze impacts on visibility, development impacts on night sky, and white pine blister rust impacts on limber pine. Restoration of sagebrush steppe habitat downgraded by wildland fire and invasion of cheat grass is a major focus.

Hagerman Fossil Beds National Monument (HAFO) Mike Wissenbach
Fossils and the associated stratigraphy are HAFO's most significant resources, while landslides, altered hydrological regimes (high water tables, fluctuating reservoir levels, perched aquifers, irrigation) and wind/water erosion pose the biggest threats to slope stability and fossil resources. Restoration and monitoring work would likely focus on revegetation of landslide areas to stabilize slopes, and control of exotic species. This section of the Snake River does not currently meet water quality standards; some of the impacts affect submerged lands that are within monument boundaries.

John Day Fossil Beds National Monument (JODA) Ken Hyde
JODA lists three areas of focus: riparian area vegetation changes; changes in plant communities due to noxious weed invasions and reintroduction of fire; population dynamics of amphibians, reptiles and small rodents. The amphibian population as well as steelhead salmon, bald eagle and Columbia spotted frog, are of concern, and noxious weeds such as cheat grass and medusa head are impacting sagebrush, mountain mahogany and rodent populations. The reintroduction of fire may or may not benefit native plant and animal communities, and newly planted old farm fields should be monitored for noxious weeds, future flood events and benefits to native wildlife populations.

Lake Roosevelt National Recreation Area (LARO) Scott Hebner
LARO's focus concentrates on plant communities, water and fish, with raptors and water birds also of special significance. The mixed ownership and water fluctuations fragment resource management, and industrial pollution, residential development and noxious weeds pose major threats to the landscape. Restoration projects which require monitoring programs include polluted sediment impacts and shrub-steppe and forest restoration. Because the lake is manmade, it is not a natural aquatic environment.

Whitman Mission National Historic Site (WHMI) Roger Trick
WHMI has a cultural resource focus, but native vegetation and surface water quality and quantity are the park's major resource interests for new monitoring programs. As with other network sites, exotic species and noxious weeds are a major concern, as is the quality of irrigation water coming into the park. There is some ongoing vegetation restoration work, which will require monitoring, and water quality monitoring also needs to be undertaken.

Appendix F. Individual park descriptions

BIG HOLE NATIONAL BATTLEFIELD (BIHO)

Size: 265 hectares (655 acres)

Designation Date: 1910

Park History and Purpose: Big Hole National Battlefield is a memorial to the people who fought and died there on August 9 and 10, 1877. They were combatants in a five month conflict that came to be called the Nez Perce War of 1877. Like other Indian Wars in the late 1800's, the Nez Perce War involved two very different groups with very different outlooks on land rights, civilian authority, government powers, social organization, and the responsibilities of the individuals to society. In 1992, legislation incorporated Big Hole National Battlefield with Nez Perce National Historical Park, making it part of a unique park consisting of 38 different sites located in five states; Oregon, Washington, Idaho, Montana, and Wyoming.

Location: Big Hole National Battlefield is approximately 75 miles southwest of Butte, Montana and about 110 miles southeast of Missoula, Montana in southwestern Montana. The park is located in the western portion of the Big Hole Valley, ten miles west of Wisdom, Montana on state highway 43.

Elevation: The Battlefield is topographically diverse. Mountain slopes occupy 42 percent of the area and range from 1860m (6100 ft.) to 2100m (6900 ft.) in elevation. Bench land occupies about 24 percent of the site and the flood plain formed by the North Fork of the Big Hole River comprises the remaining 34 percent of the Battlefield.

Climate: Summers are generally cool and breezy, with impressive mosquito populations in June and early July. Summer thunderstorms are not uncommon. Winters are frigid with deep snow. 30-year (1971-2000) climate data collected in Wisdom, Montana, show that the site is quite dry, with mean annual precipitation only totaling 30 cm (12 in) (Western Regional Climate Center 2003). January and July 30-year mean maximum and minimum temperatures are 27 and 1.5 degrees F^o and 77 and 37 degrees F^o, respectively (Western Regional Climate Center 2003).

General Description: The site contains sagebrush steppe, lodgepole pine forest, small groves of aspen, and a rich riparian corridor bordering the Big Hole River that contains potential spawning and rearing habitat for the sensitive arctic grayling (*Thyallus arcticus*).

Flora: The mountain slopes of the Battlefield are vegetated principally by conifers. Four major vegetation types were identified by Pierce (1981) for the mountain slopes; forest, forest ravine, sagebrush steppe, and gramanoid steppe. The major habitat type within the forest vegetation type is lodgepole pine/pinegrass (*Pinus contorta /Calamagrostis rubescens)*. Douglas-fir (*Pseudotsuga menzeisii*) and ponderosa pine (*Pinus ponderosa*)

are scattered along the forest edge. Forest ravine comprises less than 3 percent of the area of mountain slopes. Approximately 20 percent of the mountain slope within the Battlefield boundary is comprised of sagebrush steppe with big sagebrush/Idaho fescue (*Artemisia tridentata/Festuca idahoensis)* as the primary habitat type.

The flood plain contains three major vegetation types: willow, graminoid, and aquatic. Fifty percent of the flood plain is dominated by willow species. The graminoid community comprises about 47 percent of the floodplain and is described by Pierce (1981) as a tufted hairgrass/sedge (*Deschampsia caespitosa/Carex)* habitat type. The North Fork branch of the Big Hole River runs through the flood plain in a northeasterly direction and comprises 3 percent of the flood plain forming the aquatic habitat. The floodplain supports a population of camas lily (*Camassia quamash*). This species is an important cultural resource as well as a unique component of the natural vegetation in the Battlefield. Camas is a traditional food crop for the Nez Perce people. It is a facultative wetland species that is at risk in areas where floodplain hydrology is altered by irrigation.

The benchland is divided into two vegetation types. Approximately 60 percent of the landform was grassland of the Idaho fescue/bluebunch wheatgrass (*Festuca idahoensis/Agropyron spicatum*) habitat type. Shrubland makes up another 20 percent of the benchland with big sagebrush/Idaho fescue habitat type dominating. The remaining 20 percent of the bench is occupied by the visitors center, park housing, parking lots, roadways, and sewage lagoons.

Fauna: Two inventories of vertebrates have been conducted at Big Hole NB (Van Sickle 1987, Strobel et al. (2003). 83 species of birds, 31 species of mammals (excluding bats), six species of fish (although other fish have been found more recently), two reptiles, and two amphibians. Bats have not yet been inventoried. Elk hunting in the surrounding area is a source of revenue for adjacent communities in the fall. The Big Hole valley is an internationally renowned fly fishing destination. The arctic greyling is particularly unique and important vertebrate in the Big Hole valley, although it is not yet clear how much use the reach of the North Fork in the Battlefield receives from this species. The Big Hole valley is one of the last strongholds of this species in the lower 48 states.

Mammals: Big Hole Battlefield's willow-dominated riparian area is prime year-round habitat for beaver (*Castor canadensis*) and moose (*Alces alces*). A large elk (*Cervus elaphus*) herd also uses the area and wolf periodically pass through the park. Van Sickle (1987) completed a survey that documented 36 species of mammals that occurred on the battlefield site. Along with this survey Van Sickle (1987) also identified 30 species of mammals that were not found on the Battlefield but are potentially present in the park. The University of Idaho Department of Fish and Wildlife Resources conducted an inventory in 2002 under a cooperative agreement with the National Park Service Upper Columbia Basin Network. A total of 31 mammals, representing 88% of the expected list, were confirmed in the battlefield in 2002 (Strobel et al. 2003). One confirmed species, the gray wolf (*Canis lupus*), is listed by the Montana Natural Heritage Program as a "species of special concern".

Birds: A survey of vertebrates at Big Hole (Van Sickle 1987) listed 90 species of birds. Results of bird surveys conducted in 1999 by Rita Dixon from the University of Idaho documented 83 species of birds at Big Hole (Dixon 2004).

Fish: Six species of fish were found in the North Fork of the Big Hole River during a survey conducted in 1987. The fish found were typical of low gradient reaches of high mountain streams. Mottled sculpins (*Cottus bairdi*) were the most abundant species captured and were found in every habitat. Other abundant species included white suckers (*Catostomus commersoni*), burbot (*Lota lota*), mountain whitefish (*Prosopium williamsoni*) , and brook trout (*Salvelinus fontinales*). A realtively uncommon species present in the North Fork was the longnose dace (*Rhinichthys cataractae*).

Herptofauna: Two species of reptiles and two species of amphibians were found on the Big Hole National Battlefield during 1987 and confirmed again in 2002 (Strobel et al. 2003, Van Sickle 1987). A total of 4 herpetofauna, representing 100% of the expected list, were confirmed in 2002. Wandering gartersnakes (*Thamnophis elegans vagrans*) were the most abundant reptile and were found throughout the Battlefield, with the exception of the coniferous forest. A den was located in the rock abutment under the North Fork bridge during the 1987 survey. Fifteen to twenty snakes were observed sunning at this location. Two red-sided gartersnakes (*Thamnophis sirtalis parietalis*) were captured in 1987, both of which were found on the flood plain. Columbia spotted frogs (*Rana luteiventris*) were abundant on the flood plain during this same survey. The backwater pools associated with the beaver dam provided excellent habitat for spotted frog tadpoles. Two western toads (*Bufo boreas*) were found on the flood plain during 1987. No tadpoles were encountered, however one adult captured in late May 1987 appeared to be laden with eggs. One confirmed species, the western toad, is listed by the Montana Natural Heritage Program as a "species of special concern".

Unique Features and Species of Special Concern: No inventory has been conducted in the park to determine the presence of endangered, threatened, or rare species. Some have been seen on park lands and waters, such as Montana arctic grayling (*Montana sensitive*) in the North Fork of the Big Hole River.

Resource Management Concerns

Exotic Plant Species: The spread of exotic and noxious weeds continues to be the major natural resource issue at Big Hole National Battlefield. In the past, local weed control districts have made requests of the park to control its infestations of yellow starthistle and Scotch thistle, field bindweed, poison hemlock, and other weed species. On-going control efforts are primarily limited to mechanical (and some herbicide) treatments.

Historic Vegetation Restoration: Restoration of the historic landscape of 1877 has been the focus of some interest over the last 20 years or so (Big Hole RMP 1987, Pierce 1982). At Big Hole, the exclusion of the natural fire regime appears to have altered forest succession. Lodgepole pine is expanding down slope into the steppe area adjacent to the

"seige" area. This is a threat to the historic viewshed of the Battlefield and has some potential ecological ramifications as well. In 1987 trees were removed on about 10 acres to restore the "bald" areas on the slopes above the battlefield. Prescribed fire was also used in 1986, 1988, 1993, 1997, 1998, and 1999 in the restoration of the natural system. More recent concern has been raised over the old irrigation canals that run across the monument on the east side of the battlefield below the visitor center. Water rights of downstream private lands will preclude any attempt to have these canals discontinued and removed. Currently, the canals are unlined and leak, allowing for narrow strips of green riparian vegetation to develop horizontally across the east slope of the battlefield. As with the lodgepole pine expansion, this has both viewshed and ecological ramifications. Future solutions may include lining or re-engineering the canals. Finally, concern is also growing over the impacts the access road and dike supporting the trail that leads to the "seige" area may be having on the natural meander course of the North Fork Big Hole River. Other hydrologic and ecological issues may also be related to this. Because of Big Hole's unique historic experience, altered flow and channel morphology not only cause natural resource problems such as bank erosion and degraded water quality through sedimentation. There is also concern that grave sites will also be exposed. An assessment of this issue is planned for 2005.

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CITY OF ROCKS NATIONAL RESERVE (CIRO)

Size: 5,708 hectares (14,107 acres)

Designation Date: 1988

Park History and Purpose: Beginning in 1843, City of Rocks was a landmark for emigrants on the California Trail and Salt Lake Alternate Trail and later on freight routes.

The area's historical and geological values, scenery, and opportunities for recreation led to its designation as City of Rocks National Reserve in 1988. This unit of the National Park System is managed cooperatively by the National Park Service and the Idaho Department of Parks and Recreation.

The site is replete with high scenic granite spires and sculptured rock formations. It is a nationally recognized climbing destination. The reserve contains numerous small riparian zones tucked into the granite canyons and contains a diversity of vegetation cover types that are representative of the high elevation areas of the northern Great Basin.

Location: City of Rocks National Reserve lies southwest of the town of Almo in southeast Idaho.

Elevation: The elevation of the Reserve ranges from 5,650 feet where Circle Creek meets the east boundary of the Reserve to 8,867 feet at Graham Peak, in the northern portion of the park.

Climate: City of Rocks is located in southern Idaho on the northern edge of the Great Basin. Outdoor recreation can be pleasant from April through October. Summers are generally dry. Weather data obtained from a station in Malta, Idaho, 27 miles from the Reserve, show 30-year mean annual precipitation to be 11 inches (Idaho State Climate Service 2003). Most precipitation falls in winter and spring. Summer temperatures range wildly with nighttime lows occasionally approaching freezing and midday highs nearing 100° F. July and August also experience afternoon thundershowers.

Flora: One or the reserve’s most notable qualities is its large degree of biological diversity concentrated in a relatively small area. The great variety of textures, colors, and shapes in the natural landscape contributes considerably to the reserve’s scenic quality. Intense grazing, dryland farming, and other events associated with the settlement of the area have reduced the diversity of the natural landscape by causing successional shifts in plant communities toward a dominance of woody perennial and alien annual herbs in many areas of the reserve.

The range of elevations within the compact area of the Reserve combines with other factors to create varied patterns of vegetation and wildlife habitat. At high elevations the forest patches contain Douglas fir (*Pseudotsuga menzeisii*), subalpine fire (*Abies lasiocarpa*), and limber pine (*Pinus flexilis*). Middle elevation forests consist of quaking

aspen (*Populus tremuloides*), mountain mahogany (*Cercocarpus ledifolia*), and cottonwood (*Populus spp.*). Sagebrush, pinyon pines (*Pinus monophylla*), and juniper (*Juniperus spp.*) dominate lower elevations. The Reserve boasts Idaho's tallest pinyon pines, at more than 55 feet. The nuts of the trees provide important proteins and fats for wildlife. Both Rocky Mountain and Utah juniper are present in the monument (*J. scopularum* and *osteosperma*, respectively). In addition to the trees, spring and summer displays of wildflowers can be spectacular. Over 450 plant species have been recorded at the City of Rocks (John 1995).

Fauna: Part of Idaho's Minidoka Bird Refuge, the City of Rocks is home to eagles, falcons, vultures, hawks, hummingbirds, jays, sparrows, doves, and the state bird, the mountain bluebird. Among the mammals that live within the park are elk, mule deer, mountain lions, coyotes, badgers, bobcats, porcupines, ground squirrels, and bats. Thirty-five species of mammals were confirmed in the Reserve during 2003 (Madison et. al. 2003). The cliff chipmunk (*Tamias dorsalis*), a "peripheral species" in Idaho, was found to be common in the area and the Reserve appears to support a relatively large population of this species. The spotted bat (*Euderma maculatum*) was confirmed in the Reserve in 2003. This species is listed as a species of special concern by the state of Idaho and is poorly known in the state. The hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and pallid bat (*Antrozous pallidus*) were also confirmed in the Reserve for the first time during the 2003 inventory. The deer mouse (*Peromyscus maniculatus*) and the great basin pocket mouse (*Perognathus parvus*) were the two most abundant mammals represented in trapping results. The piñon mouse (*Peromyscus truei*) was reconfirmed in the Reserve for the first time since an unvouchered report was made in 1967. City of Rocks is at the northern limit of the range for this unique species and the voucher specimen for this species collected in 2003 may represent a significant range extension for Idaho. In March of 2003, a ringtail (*Bassariscus astutus*) was found dead in the Castle Rocks area of the Reserve by Idaho Department of Fish and Game personnel. This was the first record of the species in Idaho and also represents a significant northward range extension. The status of this unique and secretive species in the Reserve should be further evaluated in the future.

Two species of lizards were observed during an herpetological inventory conducted in 2001, including the common sagebrush lizard (*Sceloporus graciosus*) and the western skink (*Eumeces skiltonianus*). Four species of snakes were observed including the rubber boa (*Charina bottae*), the striped whipsnake (*Masticophis taeniatus*), the gophersnake (*Pituophis catenifer*), and the western terrestrial gartersnake (*Thamnophis elegans*). The common sagebrush lizard was the most widespread and abundant species with 100 observations throughout the study area accounting for 70% of the total observations. Terrestrial Gartersnakes were the most abundant snake species detected with 33 observations accounting for 23% of the total observations. The boreal chorus frog (*Pseudacris maculata*) was the only amphibian species detected with 1 observation accounting for only 0.6% of the total observations (Shive 2001).

Unique Features and Species of Special Concern: Information is limited for rare or species of special concern and their important habitats within the reserve.

Many rocks in the reserve provide essential habitat to some species that are sensitive to human activity. The rock cliffs provide important nesting habitat for various species of raptors, including the ferruginous hawk (*Buteo regalis*), a candidate threatened or endangered species. The cracks, crevices, and caves may be important roosting habitat for as many as six species of bats, including Townsend's big-eared bat (*Corynorhinus townsendii*), also a candidate species.

Plants that have been identified as species of special concern include Narrow-leaved Indian Paintbrush (*Castilleja angustifolia var. flavescens*), Simpson's Hedgehog Cactus (*Pediocactus simpsonii var. robustior*), and Kruckeberg's swordfern (*Polystichum kruckebergii*).

There are no federally listed threatened or endangered species in the reserve. However, ferruginous hawks and Townsend's big-eared bats, category 2 (candidate) species, do occur in the reserve. Ferruginous hawks and Townsend's big-eared bats and their important critical habitats should be strictly protected. Other mammal species identified by the state as rare or sensitive and possible occurring at CIRO include the cliff chipmunk, Pallid bat, and Pinon mouse.

Resource Management Concerns

Rare and Species of Special Concern Inventory: It was determined in the Comprehensive Management Plan for CIRO that the reserve should inventory all federal and state listed threatened, endangered, rare, declining, sensitive, or candidate species native to and present the reserve along with their critical habitats. These species would be given special consideration in all future planning activities and in management of special uses and activities such as grazing and recreation, including climbing. Species of special concern would be periodically monitored to ascertain the health of each identified population.

Recreation Use: City of Rocks offers scenic walks near the historic California Trail and opportunities for wildlife watching, photography, world-class technical rock climbing, mountain biking, hiking, horseback riding, ice climbing, cross country skiing, snowmobiling, snowshoeing, picnicking, and camping near rock formations. High visitor use is attributed to excellent rock climbing opportunities. Impacts on natural resources at CIRO due to recreational use are a management concern.

Many rocks in the reserve provide essential habitat to some species that are sensitive to human activity. To ensure protection of sensitive cliff-dwelling species their habitat should be inventoried and important habitat monitored seasonally. Efforts would be directed primarily at protecting ferruginous hawks, golden eagles, red-tailed hawks, prairie falcons, and Townsend's big-eared bat.

In recent years an increase in vegetative disturbance in the reserve has been attributed to an increase in recreational activities. The overuse of the land in some areas of the reserve has caused the loss of both vegetative cover and soil.

Exotic Plant Species: Many introduced plant species exist within the reserve. Some are a threat to resources; for example, halogeton is toxic to livestock and wildlife. Invasive plant species should be eradicated or controlled if they threaten to spread or compete with reserve resources and if control is feasible.

Canada thistle (*Cirsium arvense*) was found to be the most widespread noxious weed at City of Rocks (Monello and Wright 1998). Poison hemlock (*Conium maculatum*) was the only other noxious weed found within the park boundary. John (1995) found spotted knapweed (*Centaurea maculosa*) and field bindweed (*Convolvulus arvensis*) within the reserve. In 2003, a total of 790 acres were surveyed within City of Rocks National Reserve (Prather 2003). The acres surveyed represented sites targeted for survey and did not encompass the entire park. Field bindweed was the most widely distributed species. Most species were located on fewer than 5 acres. Of the species with greater than 1 acre total infested, salt cedar is by far the biggest concern.

Grazing: Grazing over the years has caused an increase in the density of woody plants and their expansion into new areas of the reserve. Increasing woody plant cover, especially sagebrush, has served to confine livestock grazing to less and less productive area over time, resulting in non-native plant species that are more resistant to livestock grazing.

Various techniques could be used involving fire and vegetation management to restore the range to more natural vegetative communities. For example, some basin areas now covered with monotypic stands of sagebrush and nonnative grasses could be managed toward a natural community of native perennial grasses and widely dispersed sagebrush. Protecting the natural vegetative communities would increase forage for both livestock and wildlife, provide better soil protection from erosion, and support a greater diversity of wildlife.

Wetland Inventory: It was determined in the Comprehensive Management Plan for CIRO that a wetland inventory, monitoring, and protection program should be developed (CIRO CMP 1994). This program should include a detailed onsite evaluation of all wetlands on the reserve. The study will determine the location, condition, threats to, and ecological function of all wetlands. The data will be used to monitor and mitigate impacts, including those caused by grazing.

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UCBN park document(s) used in this park description:
City of Rocks Comprehensive Management Plan, 1994.

CRATERS OF THE MOON NATIONAL MONUMENT AND PRESERVE (CRMO)

Size: 190,081 hectares (469,711 acres)

Designation Date: 1924

Park History and Purpose: The Craters of the Moon National Monument was established on May 2, 1924 (Presidential Proclamation 1694), for the purpose of protecting the unusual landscape of the Craters of the Moon lava field. This "lunar" landscape was thought to resemble that of the Moon and was described in the Proclamation as "weird and scenic landscape peculiar to itself." The unusual scientific value of the expanded monument is the great diversity of exquisitely preserved volcanic features within a relatively small area. The expanded monument includes almost all the features of basaltic volcanism, including the craters, cones, lava flows, caves, and fissures of the 65-mile-long Great Rift, a geological feature that is comparable to great rift zones of Iceland and Hawaii. It comprises the most diverse and geologically recent part of the lava terrain that covers the southern Snake River Plain, a broad lava plain made up of innumerable basalt lava flows that erupted during the past 5 million years.

Since 1924, the monument has been expanded and boundary adjustments made through four presidential proclamations issued pursuant to the Antiquities Act (34 Stat. 225, 16 U.S.C. 431). Presidential Proclamation1843 of July 23, 1928, expanded the monument to include certain springs for water supply and additional features of scientific interest. Presidential Proclamation 1916 of July 9, 1930, Presidential Proclamation 2499 of 18, 1941, and Presidential Proclamation 3506 of November 19, 1962, made further adjustments to the boundaries. In 1996, a minor boundary adjustment was made by section 205 of the Omnibus Parks and Public Lands Management Act of 1996 (Public Law 104-333, 110 Stat. 4093, 4106).

A Proclamation dated November 9, 2000 enlarged the boundary to assure protection of the entire Great Rift volcanic zone and associated lava features, all objects of scientific interest. The Federal land and interests in land reserved consist of approximately 661,287 acres. The Craters of the Moon, Open Crack, Kings Bowl, and Wapi crack sets and the associated Craters of the Moon, Kings Bowl, and Wapi lava fields constitute this volcanic rift zone system. Craters of Moon is the largest basaltic volcanic field of dominantly Holocene age (less than 10,000 years old) in the conterminous United States. Each of the past eruptive episodes lasted up to several hundred years in duration and was separated from other eruptive episodes by quiet periods of several hundred years to about 3,000 years. The first eruptive episode began about 15,000 years ago and the latest ended about 2,100 years ago.

Craters of the Moon holds the most diverse and youngest part of the lava terrain that covers the southern Snake River Plain of Idaho, a broad plain made up of innumerable basalt lava flows during the past 5 million years. The most recent eruptions at the Craters of the Moon took place about 2,100 years ago and were likely witnessed by the Shoshone

people, whose legend speaks of a serpent on a mountain who, angered by lightening, coiled around and squeezed the mountain until the rocks crumbled and melted, fire shot from cracks, and liquid rock flowed from the fissures as the mountain exploded. The volcanic field now lies dormant, in the latest of a series of quiet periods that separate the eight eruptive episodes during which the 60 lava flows and 25 cinder cones of this composite volcanic field were formed. Some of the lava flows traveled distances of as much as 43 miles from their vents, and some flows diverged around areas of higher ground and rejoined downstream to form isolated islands of older terrain surrounded by new lava. These areas are called "kipukas."

The kipukas provide a window on vegetative communities of the past that have been erased from most of the Snake River Plain. In many instances, the expanse of rugged lava surrounding the small pocket of soils has protected the kipukas from people, animals, and even exotic plants. As a result, these kipukas represent some of the last nearly pristine and undisturbed vegetation in the Snake River Plain, including 700-year-old juniper trees and relict stands of sagebrush that are essential habitat for sensitive sage grouse populations. These tracts of relict vegetation are remarkable benchmarks that aid in the scientific study of changes to vegetative communities from recent human activity as well as the role of natural fire in the sagebrush steppe ecosystem.

The Kings Bowl lava field and the Wapi lava field are included in the enlarged monument. The Kings Bowl field erupted during a single fissure eruption on the southern part of the Great Rift about 2,250 years ago. This eruption probably lasted only a few hours to a few days. The field preserves explosion pits, lava lakes, squeeze-ups, basalt mounds, and an ash blanket. The Wapi field probably formed from a fissure eruption simultaneously with the eruption of the Kings Bowl field. With more prolonged activity over a period of months to a few years, the Wapi field formed a low shield volcano. The Bear Trap lava tube, located between the Craters of the Moon and the Wapi lava fields, is a cave system more than 15 miles long. The lava tube is remarkable for its length and for the number of well preserved lava-cave features, such as lava stalactites and curbs, the latter marking high stands of the flowing lava forever frozen on the lava tube walls. The lava tubes and pit craters of the monument are known for their unusual preservation of winter ice and snow into the hot summer months, due to shielding from the sun and the insulating properties of the basalt.

Location: The Craters of the Moon National Monument and Preserve is located in central Idaho, approximately 160 miles east of Boise

Elevation: Elevations in the monument range from 1,625 meters to 2,355 meters. The tallest cinder cone, Big Cinder Butte, rises more than 200 meters above the surrounding plain.

Climate: The climate is semi-arid, with hot and dry summers and cold and wet winters. Winter snows comprise most of the annual precipitation in the monument. Snow pack usually lasts most of the winter. The 30-year mean annual precipitation is 15 inches in the

north (CRMO weather station data) and less than 10 inches in the south (Minidoka Dam, weather station data). The average July maximum temperature is 84 degrees fahrenheit and average January minimum temperature is 10 degrees degrees fahrenheit (CRMO weather station data). Surface temperatures on the lava flows can reach 170 degrees fahrenheit during summer heat and winter temperatures frequently remain below freezing for long periods.

General Description: Although a desolate looking place, the park thrives with wildlife. More than 350 species of plants and 43 mammals can be found in the park and more than 160 different species of birds have been seen here.

Flora: Twenty-six vegetation types, containing over 300 native species, have been identified within Craters of the Moon. These vegetation types can be combined into eight major categories:

Cinder garden/lava flows: 70.10% - Areas of low total plant cover. Common species include dwarf buckwheat (*Eriogonum. ovalifolium var. depressum*), dwarf monkeyflower (*Mimulus nanus*), bitterroot (*Lewisia rediviva*), tansybush (*Chamaebatiaria millefolium),* mockorange (*Philadelphus lewisii*), desert parsley (*Lomatium*), sandberg bluegrass (*Poa sandbergii*), rubber rabbitbrush (*Chrysothamnus nauseosus*), mountain big sagebrush, needle grass (*Stipa spp.*), and indian rice grass (*Oryzopsis hymenoides*).

Sagebrush associations: 19.90% - five species of sagebrush occur in the monument: mountain big sagebrush, big sagebrush, low sagebrush (*Artemisia arbuscula*), early low sagebrush (*Artemisia arbuscula*), and three-tip sagebrush (*Artemisia tripartitia*). Common plants in association with sagebrush include bluebunch wheatgrass, sandberg bluegrass, needle grass, cheat grass, and Idaho fescue.

Limber Pine associations: 7.10% - antelope bitterbrush (*Purshia tridentata*) is the main shrub in these areas.

Bitterbrush associations: 2.60% - other common species in these areas include rubber rabbitbrush, wax current (*Ribes cereum*), great basin wildrye (*Elymus cinereus*), arrowleaf balsamroot (*Balsamorhizza sagitatta*), and buckwheats.

Riparian:.13% -This type is located along streams in the North End. Tree species include quaking aspen, black cottonwood, mountain alder (*Alnus incana*), and bog birch (*Betula glandulosa*). There is a thick tall forb component including cow parsnip (*Heracleum lanatum*), bigsting nettle (*Urtica dioica*), and small-leaf angelica (*Angelica pinnata*).

Douglas-fir/Mountain Snowberry: .10% - found on steep, north-facing slopes and along Little Cottonwood Creek.

Grasses: .08% - the predominate grasses are bluebunch wheatgrass, Idaho fescue, sandberg bluegrass, and Great Basin wildrye.

Upland Quaking Aspen:.07% -Most common on upland sites in the North End. Understory is composed of mountain snowberry (*Symphoricarpos albus*), willow, forbes, and grasses.

The 1962 proclamation added Carey Kipuka to the Monument because of the scientific value of the sagebrush-grassland association.

In 1989, Carey Kipuka and portions of the North End of the Monument were nominated for inclusion in the National Natural Landmark System as representative of the Columbia Plateau Natural Region, Low Sagebrush Theme, Low Sagebrush/Idaho Fescue Subtheme. The National Natural Landmark Evaluation report states that these areas are "outstanding examples" and are "nationally significant".

Carey Kipuka was designated a Research Natural Area in 1993.

Fauna: Wildlife resources are abundant and varied. Approximately 50 species of mammals and 159 species of birds have been recorded at Craters of the Moon. A study conducted in the 1960s recorded over 2,000 species of invertebrates. A systematic inventory of reptiles and amphibians has been conducted and a report is in progress. The available information indicates that eight reptile species and two species of amphibians have been observed (CRMO RMP 1992).

Exotic species present in the monument include european starling (*Sturnella vulgaris*), chukar (*Alectoris chukar*), gray partridge (*Perdix perdis*), rock dove (*Columba livia*) and european house sparrow (*Passer domesticus*).

Several species were extirpated prior to the establishment of the monument: grizzly bear (*Ursus arctos*), wolf, and bison (*Bison bison*). The bighorn sheep (*Ovis canadensis*) is also thought to be extirpated, however a ewe was recorded in the Devils Orchard area in 1990. Porcupines were common in the monument in the 1920s and 1930s, however no live individuals have been documented since 1980 and only four were observed in the twenty years prior to 1980.

Mammals: Significant vertebrate predators in the monument are coyote (*Canis latrans*), red fox (*Vulpes vulpes*), mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), black bear (*Ursus americanus*), badger (*Taxidea taxus*), and long-tailed weasel (*Mustela frenata*).

Mule deer (*Odocoileus hemionus*), elk, and pronghorn (*Antilocapra americana*) are important large herbivores at Craters of the Moon. The Craters mule deer herd has an unusual dual summer range within the park.

Three subspecies of mammals endemic to the Snake River Plain were first described at Craters of the Moon. They are a pika (*Ochotona princeps goldmani*), a yellow-pine

chipmunk (*Eutamias amoenus craterieus*), and a Great Basin pocket mouse (*Perognathus parvus idahoensis*).

A 2003 mammal inventory was conducted at CRMO and between the period 1990-2003, 45 species of mammals have been documented in or adjacent to the monument. One of those, the river otter (*Lutra canadensis*), was documented for the first time during the 2003 inventory. The moose, first documented in 1999, was observed in the monument at a greater rate in 2003 by monument and inventory staff. The deer mouse and the Ord's kangaroo rat (*Dipodomys ordii*) were the two most abundant species captured during inventory efforts in 2003 (Madison et. al. 2003).

Birds: Hoffman (1988) sampled birds using a station index technique and reported 64 species. A checklist provided to park visitors indicates 156 species of birds potentially could be encountered.

Herptofauna: Two species of amphibians and eight species of reptiles were found on the monument (Hoffman 1988). Additional inventory work has been completed on amphibians and reptiles at CRMO by Idaho State University and a final report is in progress.

Unique Features and Species of Special Concern

Plants: *Phacelia inconspicua*, a rare plant in Idaho, was documented in the North End of the monument during a rare plant survey. It has also been documented on BLM lands adjacent to the monument. This plant is a federal candidate species under the Endangered Species Act.

Wildlife: No federally listed threatened or endangered species occur at Craters of the Moon. Bald eagles are occasionally recorded flying across the monument, but do not reside here. Two former federal candidate species are found within the monument: blind cave leiodid beetle (*Glacicavicola bathyscoides*), and Townsend's big-eared bat. It is possible that the spotted bat, also an Idaho species of concern, occurs at Craters. Several other Idaho species of special concern have been observed: ferruginous hawk, merlin, and bobcat.

Resource Management Concerns

Preserving remnant stands of high quality sagebrush steppe habitat undisturbed by grazing has become increasingly important as habitat has been lost due to increased fire frequency and cheatgrass conversion. This has led to petitions being filed with the US Fish and Wildlife Service to list sage grouse as an endangered species. With the expansion of the monument, NPS concerns over management of sagebrush steppe habitat have increased significantly. NPS resource management staff indicates that they "don't know just what's out there". Invasive weeds, including leafy spurge and knapweeds, just became a much bigger issue with significant infestations on lands added to the monument.

Another resource management concern on the horizon is the potential introduction of white pine blister rust within the monument's limber pine stands. White pine blister rust is found in the Yellowstone region and the central Idaho mountains less than 60 miles from the monument. In the northern Rockies white pine blister rust has resulted in mortalities rates as high as 90% in limber and white bark pine.

Information is needed on the monument's water resources, especially the perennial ice in caves and deep crevices. It appears that many waterholes in the lava have dried up since they were reported in the 1920s.

The Federal Cave Resources Act of 1987 requires that cave resources be studied and significant caves be identified.

The U.S. Geological Survey predicts that volcanic activity will occur in the monument in the future. That agency has recommended installation of a seismic monitoring system to warn of impending eruptions.

Protection of geological resources is important because geology is the primary theme of Craters of the Moon. The fragile geological resources may appear to be sturdy, but they are affected by visitors; increased erosion of the spatter cones causes irreversible damage. Heavy use by visitors is contributing to erosion of the Inferno Cone trail. Illegal collection of specimens is another major problem.

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UCBN park document(s) used in this park description:
Craters of the Moon Resource Management Plan, 1992.

HAGERMAN FOSSIL BEDS NATIONAL MONUMENT (HAFO)

Size: 1760 hectares (4351 acres)

Designation Date: 1988

Park History and Purpose: On November 18, 1988, Hagerman Fossil Beds National Monument was "established by Congress to: 1) preserve for the benefit and enjoyment of present and future generations the outstanding paleontological sites known as the Hagerman Valley fossil sites, 2) to provide a center for continuing paleontological research, and 3) to provide for the display and interpretation of the scientific specimens uncovered at such sites.

Hagerman Fossil Beds NM contains the largest concentration of Hagerman Horse fossils in North America. The Monument is internationally significant because it protects the world's richest know fossil deposits from a time period called the late Pliocene epoch, 3.5 million years ago. These plants and animals represent the last glimpse of time that existed before the Ice Age, and the earliest appearances of modern flora and fauna. It is also one of three National Park Service (NPS) units that includes ruts from the wagons traveling the Oregon Trail. The park also preserves pre-history and historical settlement resources.

Location: Hagerman Fossil Beds National Monument is located in south central Idaho on the western escarpment of Hagerman Valley. Hagerman Valley lies within the central Snake River Plain region of the eastern portion of the Columbia Plateau physiographic province. The Snake River flows west, then north, through this valley and scribes the eastern boundary of the Monument, a shoreline distance of approximately 7 miles. The entire length of the Snake River through the Monument is part of the Lower Salmon Falls Reservoir, the dam for which is located a short distance downstream from the monument. Another dam, the Upper Salmon Falls, is about 12 miles upstream from the Monument.

West of the Snake River, where the Monument is located, bluffs rise approximately 600 feet above the river. Much of this steep terrain is of badlands-type topography characterized by ridges, canyons, landslide scarps, and some flats. The bluffs are composed primarily of poorly consolidated, 3 to 4 million year old flood plain and stream deposits, volcanic ash and thin basalt flows that extend further northwest. Hagerman Valley formed about 15,000 years ago where the Bonneville Flood eroded between these sedimentary deposits and the basalt bedrock to the east. Vegetative cover is sparse, except around seeps and their intermittent streams, and is characterized by sagebrush steppe vegetation. Half a dozen landslides have occurred within the area of the Monument since the late 1970s, causing removal of vegetation, destruction of stratigraphy and paleontological sites, and steepening of some portions of the bluffs.

The western boundary of the Monument generally follows the crest of the bluffs. The plateau beyond the western boundary has been used as farmland since the 1970s, primarily for growing sugar beets, potatoes, winter wheat, and corn. The Monument consists of 4,350 acres, including 420 acres of currently State-owned land, and is 7 miles

long and 2 miles wide at its widest reach. Average width is approximately 1 mile. The Monument can be accessed by boat across the Reservoir, or by land 5 miles southwest of the town of Hagerman. The Bell Rapids project road provides public vehicular access through the southern end of the Monument. Graveled farm roads access the northern end of the Monument.

A basalt cliff forms the eastern rim of the Hagerman Valley. The eastern rim averages 400 ft in elevation above the Snake River (2,800 ft above sea level) and is characterized by resistant basalt cliffs. A gently sloping bench two to four miles wide, stretches from the base of the cliff to the river. A site on the east side of the Snake River immediately north of the Bell Rapids boat dock with commanding a view of the bluffs has been purchased for the planned construction of a Research Center and Museum.

Climate: The climate in the region is semi-arid, with cool and dry winters and hot and dry summers. Rainfall patterns are variable in the region but most falls in the early spring and late fall. 30-year mean annual precipitation available from a weather station 9 miles north of Hagerman in the town of Bliss is 9.5 inches. Snowfall represents a small proportion of the winter precipitation but snow pack is ephemeral and rarely lasts more than a few days. 30-year January and July mean temperatures from Hagerman are 35 and 67 degrees Fahrenheit, respectively. 30-year mean January and July minimum and maximum temperatures are 19 and 53 degrees Fahrenheit and 40 and 94 degrees Fahrenheit, respectively. It is important to note that winter and summer temperature extremes frequently drop below freezing in the winter and above 100 degrees in the summer.

General Description: Very little quantitative documentation of Monument resources, other than paleontological resources, has been carried out. Six major landslides have occurred within the area of the Monument since the early 1970s, causing loss of scientifically significant strata, removal of vegetation, and forming dangerous vertical cliffs on the bluffs.

Wildlife and vegetation in the monument tend to be typical of the intermountain region and its high desert scrub and sagebrush communities. The Snake River provides habitat for migrating waterfowl, riparian vegetation, and fish species.

Vegetation in the Monument has been mapped for GIS vegetation types, but has never been ground surveyed. The Monument is surrounded by agricultural lands, as well as small towns, residences, and other developed areas. Grazing prior to establishment of the Monument in 1988 also undoubtedly contributed to alteration of soils, loss of native grasses, and establishment of non-native plant species.

Flora: The Monument consists predominantly of the sagebrush steppe communities common to much of south central Idaho. The steep slope of the bluffs west of the river provide an environment that contributes to the diversity of plant species. A riparian zone and local areas of marshland occur along the Reservoir. Wetlands exist along both Billingsley and Riley creeks.

Flora on the upland plateau was once a vast complex of Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) association. Most of this vegetation has been replaced by agricultural crops. Some of the Monument's west boundary areas were cleared and now support gray rabbitbrush, and introduced grasses and weeds.

Vegetation on the slopes is sparse in many areas due to aspect and slope. Greasewood (*Sarcobatus vermiculatus*) and rabbitbrush occur on more alkaline soils. Scattered four-wing saltbush (*Atriplex canescens*) occurs on more calcareous soils. Grasses are dominated by the non-native cheatgrass. Russian thistle (*Salsoa kali*) predominates on disturbed sites.

Riparian vegetation includes black cottonwood (*Populus trichocarpa*), bullrush (*Scirpus spp*.), and cattails (*Typha spp*.). Willows are most common in the vicinity of the dam and the falls to the north and south of the Monument. There are locally dense stands of the invasive Russian olive (*Eleagnus angustifolia*) along the shore, and purple loosestrife (*Lythrum salicaria*) and saltcedar (*Tamarix spp*.) is invading. Other aquatic vegetation includes as coontail (*Ceratophyllum demersum*), duckweed (*Lemna spp*.), watercress (*Rorippa nasturtium-aquaticum*), and pondweed (*Potamogeton spp*.). Algal mats are common in warm weather.

The Monument is also important to microbiotic plants, usually forming a soil crust or found on aging brush or rocks. A USGS-BRD botanist indicated that the exclusion of grazing makes portions of the Monument significant as a botanical preserve.

Fauna: The 2003 Hagerman Fossil Beds National Monument vertebrate inventory developed species lists and additional information on birds, non-volant mammals, and herpetofauna (Oelrich et.al. 2003). One hundred fifty-three bird species and twenty-six mammal species were confirmed. One of these species, the white-tailed antelope ground squirrel (*Ammospermophilus leucurus*) was not expected to occur in the monument. The pronghorn was confirmed in one location just outside of the monument. Of the 18 expected species of herpetofauna, 14 species were confirmed. A total of 4 amphibians and 10 reptiles were documented on the monument. The sagebrush lizard was found in one discrete location in the monument in 2003.

Mammals: Agricultural and residential development, as well as recreational activity, have altered the wildlife community of the Monument. The most visible species, when its population is high, is the black-trail jackrabbit. Other species include Paiute and Belding's ground squirrels (*Spermophilus spp*.), western harvest mouse (*Reithrodontomys megalotis*), wood rats (*Neotoma cinerea*), yellow-bellied marmots (*Marmota flavivventris*), and kangaroo rats (*Dipodomys spp.*). Predators include coyotes, badgers, striped skunks (*Mephitis mephitis*), weasels and mink (*Mustela spp*.), and an occasional bobcat. Small mammals are plentiful in the sparse desert vegetation as well as in the riparian habitats

Birds: One of the most abundant bird species is the non-native pheasant (*Phasianus colchicus*). Adjoining agricultural lands provide nesting and brooding cover, while the river breaks are used for escape and winter cover. Modest populations of exotic gray partridge and chukar partridge occur in the area, with their populations depending on annual nesting success. California quail (*Callipepla californica*) are also common.

Waterfowl species are dominated by seasonal migrations. The state fish hatchery and game preserve in the Riley Creek marsh area serve as a resting area for migratory birds. Along with other species of dabbling and diving ducks, as many as 10,000 ducks may be present at a given time.

Golden eagles (*Aquila chrysaetos*) are seen during the winter season. The Idaho Power Company has completed some limited bird surveys in the Monument in preparation for their request of relicensing for the hydropower operations.

In 1991, the Nongame and Endangered Wildlife Program of the Idaho Department of Fish and Game (IDF&G) published a booklet "Idaho Bird Distribution: Mapping by Latilong," which contains wintering and breeding range information for bird species.

Fish: Fish reside in the small impoundments and the Snake River. The aquatic ecosystem is inextricably linked, through the riparian zone, with the terrestrial ecosystem. Species of fish in this stretch of the Snake River include rainbow trout (*Salmo gairdneri*), small-mouth bass (*Micropterus dolomieui*), chub (*Couesius plumbeus*), suckers (*Catostomus spp*.), and non-native carp (*Cyprinus carpio*). Sturgeon (*Acipenser transmontanus*), although once plentiful, are now rare.

Several stocks of Snake River salmon have been listed as threatened or endangered species. One landslide that occurred in 1993, upstream from the Monument, completely blocked the flow of the Snake River for a period of time. There is similar potential for landslides in the monument to impact habitats through which runs of threatened salmon pass.

Herptofauna: Fourteen reptile and amphibian species were found during the 2003 inventory and four species of reptiles that were expected to occur were not found (Oelrich et al. 2003). Undocumented species include the long-toed salamander (*Ambystoma macrodactylum*), northern leopard frog (*Rana pipiens*), longnose leopard lizard (*Gambelis wislizenii),* and the western skink.

The pacific tree frog (*Hyla regilla*) was confirmed in this study based only on the calls that were heard at dusk. This species occurred in the cottonwood and Russian olive groves along the river.

The sagebrush lizard was found in one location in the monument. This species was found on the north end. University of Idaho biologists also encountered this species during a birding outing in the monument during 2001.

The long-toed salamander likely occurs in the monument and may be encountered in the future by looking under logs in moist woodlands in the monument and around the paleontology buildings and riparian area on the east side of the river.

The northern leopard frog has been documented near the Hagerman Valley in the past and is expected to occur here. However, this species is experiencing dramatic declines in distribution in the Pacific Northwest due to disease and competition from exotic species such as the bullfrog (*Rana catesbiana*). The longnose leopard lizard is expected to occur in the monument but invasion of cheatgrass and other annual grasses may be reducing the habitat quality of the monument for this species. This species depends on open tracts of loose soils in shrub steppe for foraging and the species has been lost from many areas where invasive vegetation has increased.

Unique Features and Species of Special Concern

Plants: The Idaho Conservation Data Center lists the following plant species of concern in the Monument and their sites need protection:

Giant helleborine	*Epipactis gigantea*
Packard's cowpie buckwheat	*Eriogonum shockley var. packardiae*
Owyhee mourning milkvetch	*Astragalus atratus var. owyheensis*

Mourning milkvetch (*Astragalus atratus var. inseptus (*C1*)), may be present and needs verification. Torrey's blazing star (*Mentzelia terreyi var. acerosa*) is no longer State listed but may require protection considerations.

Wildlife: Four federally listed threatened or endangered animals may occur in the monument: the bald eagle (*Haliaeetus leucocephalus*) and three species of freshwater snails, the desert valvata (*Valvata utahensis*), the Snake River Physa (*Physa natricaria*), and the Bliss Rapids snail (*Taylorconcha serpenticola*). Surveys for endangered and threatened animals have not been conducted in the monument.

Paleontological Resources: The Hagerman fossil beds are located in fluvial and floodplain deposits along the eastern margin of the Glenns Ferry Formation. More than 500 fossil sites have been documented over a six-square mile area at different horizons within these sediments. Many fossil exposures have occurred in areas of ablation, where the wind has eroded the protective sedimentary cover. But the most well known discovery has been the Smithsonian Institution Horse Quarry, the largest single deposit of an extinct species of zebra-like horse ever found. Also preserved within the sediments is one of the most prolific and diverse deposits of Pliocene animals. Over 100 species of vertebrates, including 18 fish, 4 amphibians, 9 reptiles, 27 birds and 50 mammals have currently been identified, as well as freshwater snails and clams, and plant pollen.

Present in the Monument are carbonaceous paper shales with high amounts of plant debris that represent pond deposits. As of yet there have been no studies on these shales with regard to the macrobotanical material. Study of plants from these deposits should

yield important information on the vegetation associated with pond environments. These shales also have the potential to produce insects.

Although not perfectly preserved, a log was discovered buried in the strata. Isotope studies on this wood should yield important data with regard to water associated with the living tree and related environmental and climatic information.

Resource Management Concerns

Aquatic Resources: Along the shoreline of the Monument, the flow of water through the reservoir may affect water quality, water temperature, and substrate; fish and other aquatic species; waterfowl and other water-associated bird species; native and non-native riparian plants, amphibians, and other species; and, in turn, upland species.

Restoration of Historic Vegetation: One of the resource management objectives stated in the Resource Management Plan is to re-establish native plant communities and associated ecological processes, such as disturbance regimes and soil processes. The strategy developed to meet this objective is to document existing and historical vegetation and to develop vegetation goals and a management plan to accomplish them.

Wildlife: One of the resource management objectives stated in the Resource Management Plan is to perpetuate natural diversity, abundance, and behavior of native wildlife species. A strategy to meet this objective includes an inventory of existing and extirpated species, coordination with other agencies, companies, and other interested parties in acquiring information and meeting mutual goals, and identification of species of special concern and their patterns and locations of habitat use.

Recreation Use: People currently visit the Monument for a variety of activities, primarily to see fossils, which unfortunately requires a guided tour by a Park Ranger. Limited number of staff does not provide much opportunity. As an alternative, staff has developed a self-guided driving tour, a historic trail tour, and a guide for the trail system. Trail uses include hiking, mountain biking, and horseback riding, all of which incorporate enjoyment of the open space. Other on-site uses include fishing and hunting. Adjacent uses in the reservoir include boating, jet-skiing, and other lake uses. In the future, as NPS facilities are developed and the Monument becomes more widely known, the number of people who are drawn to the Monument will increase. This diverse array of visitor activities may have a variety of impacts. No monitoring of visitor impacts is currently carried out.

Land Use Impacts: Pesticides and fertilizers are used in the agriculture that occurs in the region. These chemicals have the potential to affect water quality in wetlands and surface and subsurface waters.

Exotic Plant Species: One of the resource management objectives stated in the Resource Management Plan is to control the spread of non-native species and, where feasible, remove them from areas where they are already established. A strategy to meet this objective is to inventory and map vegetation species. This inventory would be followed

by the application of IPM techniques to control and manage non-native species and a close coordination with counties and other agencies in management of non-native species.

Non-native plant species known to be present include Russian olive, Russian thistle, quackgrass (*Agropyron repens*), cheatgrass, blue mustard (*Chorispora tenella*), tansymustard (*Descurainia sophia*), tumble-mustard (*Sisymbrium altissimum*) and medusahead *(Taeniatherum caput-medusae*). These and other non-native species likely to be present impair the monument's native plant communities and ecosystem processes.

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UCBN park document(s) used in this park description:
Hagerman Fossil Beds Resource Management Plan,

JOHN DAY FOSSIL BEDS NATIONAL MONUMENT (JODA)

Size: 5688 hectares (14,056 acres)

Designation Date: 1974

Park History and Purpose: Within the heavily eroded volcanic deposits of the scenic John Day River basin is a well-preserved fossil record of plants and animals. This remarkably complete record, spanning more than 40 of the 65 million years of the Cenozoic Era (the "Age of Mammals and Flowering Plants") is world-renown. Authorized October 26, 1974, and established in 1975, this 14,000 acre park is divided into three widely separated units; the Sheep Rock Unit, Painted Hills Unit, and Clarno Unit. The monument's main headquarters is at the visitor center in the Sheep Rock Unit. There is also a park office located in John Day, Oregon.

The park's purpose is to identify, interpret, and protect the geologic, paleontological, natural, and cultural resources along the central and upper John Day River and to provide facilities that will promote and assist visitor recreational enjoyment and understanding of the same.

Location: John Day Fossil Beds National Monument consists of 14,056 acres in three noncontiguous units. Sheep Rock is the largest unit, located a few miles northwest of Dayville in Grant County. The next biggest unit is Painted Hills, lying 10 miles northwest of Mitchell in adjacent Wheeler County. Also in Wheeler County is the smallest unit, Clarno, roughly 20 miles southwest of Fossil. An administrative headquarters is located at the park's main visitor contact point, that being the Cant Ranch in the Sheep Rock Unit.

Climate: The extensive rain shadow cast by the Cascade Mountains and Ochoco mountains to the west dominates the climate of the monument. Winters are cool and dry and summers are hot and dry. Rainfall patterns are variable in the region but most falls in the early spring and late fall (Oregon Climate Service 2003). Thirty-year averages available from a weather station near the town of Dayville, 8 miles up the John Day River from the Sheep Rock Unit, show that total annual precipitation is approximately 11 inches (Oregon Climate Service 2003). Records from Mitchell, near the Painted Hills Unit, are similar, and the Clarno Unit may receive even less precipitation because of its low elevation (Oregon Climate Service 2003). Data from the rain gauge at the monument headquarters indicate that rainfall there has been below average in recent years. The total precipitation in the Sheep Rock Unit for 2001 and 2002 was 10 and 6.5 inches, respectively (Ken Hyde, JODA, personal communication). In 2003, precipitation was higher, with a total of 11.5 inches recorded at Sheep Rock (Ken Hyde, JODA, personal communication). Snowfall represents a significant proportion of the winter precipitation but snowpack is ephemeral and rarely lasts more than a few days. Thirty-year January and July mean temperatures from Dayville are 36 and 71 degrees Fahrenheit, respectively (Oregon Climate Service 2003). Thirty-year mean January and July maximum and minimum temperatures are 45 and 90 degrees and 27 and 52 degrees, respectively

(Oregon Climate Service 2003). It is important to note that winter and summer temperature extremes frequently drop below zero in the winter and above 100 degrees in the summer.

Elevation: Elevation in the monument ranges from approximately 1380 feet in the Clarno Unit, to a high point of approximately 4114 feet in the eastern boundary of the Sheep Rock Unit. The majority of the monument, including much of the Painted Hills, lies within 2000 to 2500 feet.

General Description: Sheep Rock, towering 1,100 feet over the John Day River, gives its name to this unit. Wild big horn sheep and later a thriving domestic sheep ranch both occupied this landscape in the recent past. Meanwhile, the colorful layers of Sheep Rock represent a more distant time, approximately 28 to 25 million years ago. Then, the region was covered by deciduous forests, inhabited by three-toed horses, rhinos, oreodonts, saber-toothed cat-like animals, and lemur-like primates.

The Sheep Rock Unit is home to the James Cant ranch house (built 1918), now the monument's visitor center. The visitor center features a fossil museum and is the administrative headquarters for the monument. A series of trails, outdoor exhibits, and overlooks are also available here.

The Painted Hills Unit is 3,132 acres of scenic beauty unique in the Pacific Northwest. Located 10 miles west of Mitchell, and 75 miles east of Bend, it is visited year around. Over 32,000 people visited the unit last year, with almost 10,000 of them hiking one or more of the unit's interpretive trails. Outdoor exhibits and a picnic area are also available for visitors here.

The yellows, gold, blacks, and reds of the Painted Hills are best seen in the late afternoon. Even after several visits, one may not see the same tone or hue as the claystones differ with ever-changing light and moisture levels. The colors of the hills are sublime. We like to think they even give the passing pronghorn or mountain lion pause to reflect.
Most years, the peak days of wildflower season in late April to early May is spectacular.

The Clarno Unit is 1,969 acres in size and is located 18 miles west of the town of Fossil. It has hiking trails, exhibits, and a picnic area, and received over 12,000 visitors last year. The modern vegetation here is typical of Central Oregon's near-desert environment with a variety of grasses, sagebrush and juniper.

The cliffs of the Palisades are the most prominent landform in the Clarno Unit. The Palisades were formed by a series of volcanic mudflows in a much different environment 44 million years ago. These mudflows, called lahars, preserved a great diversity of fossils. At that time, the Clarno volcanoes dominated a landscape covered by near-tropical forest, with approximately 100 inches of rain per year. Tiny four-toed horses, huge rhino-like brontotheres, crocodilians, and meat-eating creodonts roamed the ancient jungles.

Flora: The primary vegetation type in the monument is sagebrush steppe, consisting of sagebrush or shadscale and a variety of bunchgrasses. Moist alkaline flats support alkali-tolerant greasewood. Along the John Day River and tributaries that flow through the monument, vegetation consists of willows, cottonwoods, and a variety sedges and forbs. Juniper woodlands are also an important vegetation type in the monument. Historically, juniper was restricted to rimrock and canyon bottoms protected from wildfire. Heavy grazing and fire suppression have allowed juniper to expand into deeper soiled steppe habitat.

Fauna: Because of its wilderness character, this region supports a great variety of wildlife species. In winter, seasonal changes force many birds and mammals to move from the mountains into the sagebrush semidesert, where they find suitable habitat alongside the area's permanent residents.

Mammals: Large mammals present in the monument include coyote, mule deer, mountain lion, and bobcat. Smaller species include deer mouse, northern pocket gopher (*Thomomys talpoides*), Ord's kangaroo rat, Great Basin pocket mouse, western harvest mouse, montane vole (*Microtus montanus*), and bushy-tailed wood rat.

Forty-six species of mammals were confirmed in the monument during 2002 and 2003 and one of these, the bighorn sheep (*Ovis canadensis*), was not expected to occur there. All 14 species of bats expected to occur in the monument were documented. The discovery of the spotted bat in all 3 units of the monument was particularly exciting since the species is virtually unknown in Oregon and is rare throughout its range (Rodhouse et al. 2004).

Birds: The numerous raptors here include red-tailed hawk (*Buteo jamaicensis*), golden eagle, prairie falcon (*Falco mexicanus*), American kestrel (*Falco sparverius*), great horned owl (*Bubo virginanus*), barn owl (*Tyto alba*), long-eared owl (*Asio otus*), and screech owl (*Otus kennicottii*). One-hundred forty-two species of expected birds have been confirmed in or adjacent to the monument. Thirteen additional species that were not expected were also recorded in the monument. The 2002-2003 inventory yielded the first record of the peregrine falcon (*Falco peregrinus*) for the monument (Rodhouse et al. 2004).

Herptofauna: A total of 5 species of amphibians and 12 species of reptiles were documented in the monument in 2002 and 2003. Only two expected species of herpetofauna, the pigmy short-horned lizard (*Phrynosoma douglasi*) and the rubber boa (*Charina bottae*), remain to be confirmed. A unique and isolated population of western whiptail (*Cnemidophorus tigris*) lizards was found in the Foree portion of the Sheep Rock Unit (Rodhouse et al. 2004).

Unique Features and Species of Special Concern

Plants: Eight of the plant species found are considered rare or threatened (Youtie and Winward 1977). These plants included John Day milkvetch (*Astragalus diaphanus*), pauper milkvetch (*Astragalus misellus var. misellus*), yellow hairy paintbrush (*Castilleja*

xanthotricha), John Day chaenactis (*Chaenactis nevii*), Henderson's lomatium (*Lomatium hendersonii*), barrel cactus (*Pediocactus simpsonii var. robustior*), crested tongue penstemon (*Penstemon eriantherus var. argillosus*) and belled cinquefoil (*Potentilla glandulosa var. cinquefoil*). A rare plant survey is in progress during FY 04.

Animals: Over 30 species of vertebrates listed as state or federal species of concern have been documented in the monument during recent inventories. However, only the bald eagle, bull trout, and steelhead are listed as threatened under the federal endangered species act.

Resource Management Concerns

Wildlife: The National Park Service presently lacks information to adequately assess the conditions of wildlife populations within the monument. Casual visual observations and information sharing with other agencies such as the Oregon Department of Fish and Wildlife suggests that the populations are stable and with no immediate threats. Recent efforts to improve riparian conditions within the monument are believed to be beneficial to wildlife dependent upon or utilizing those habitat types.

The deer population survey conducted in 1979 (Griffith 1980) concluded that there is a year-long resident population supplemented by a migratory wintering population present in the monument from November through April. Deer do not appear to make exclusive use of the monument as a refuge during hunting season, as extensive vegetation exists on adjacent lands. The temptation to harvest easily accessible deer results in a couple of poaching incidents in the monument each year. Control efforts for certain predators, such as coyotes and cougars, on adjacent lands are moderate to intense and any of these animals using the monument are vulnerable.

A raptor study was completed in 1977 which concluded that the present raptor population is not numerous due most likely to the lack of suitable habitat, particularly in the tree-less riparian areas (Janes 1977). Based upon examination of photographs taken in the 1800's and early 1920's, it doesn't appear that these sections of the river were always devoid of trees. The report makes recommendations for raptor habitat improvement within the monument, including tree plantings in riparian areas.

In 2003, a telemetry study located maternity roosts of pallid bats and western small-footed myotis in and adjacent to the monument. This study determined that pallid bats are highly colonial in the monument and concentrated in the largest cliff complexes. Visitation may be impacting these colonies, as regularly traveled paths are located along the base and rim of some of these cliffs.

Fisheries: The National Park Service presently lacks information to adequately assess the condition of fish populations within the monument. Casual visual observations and information sharing with other agencies such as the Oregon Department of Fish and Wildlife, suggests that the populations are stable and with no immediate threats. Recent efforts to improve riparian conditions within the monument are believed to be beneficial to fish populations. Similar efforts by the Bureau of Land Management and private land

owners along Bridge Creek and its major tributaries are similarly beneficial. Continuation of past agricultural practices such as year-around livestock grazing within riparian areas and clearing of all vegetation from the stream channels along the John Day River and Rock Creek above the monument likely threatens the condition of fish populations by raising temperatures and siltation in waters within the monument. An ongoing study by the University of Oregon, in cooperation with the U.S. Fish and Wildlife Service and ODF&W will provide a better understanding of the relationship between streamside vegetation and fish populations.

The Oregon Department of Fish and Wildlife does not regularly sample fish populations in any waters within the monument. The National Park Service needs to cooperate more closely with that department to determine the baseline condition of fish populations in river waters within the monument. Also, work underway by the University of Oregon on lower Rock Creek and the John Day River near its confluence with Rock Creek will provide some baseline information on fish populations. Ultimately extrapolation and qualified interpretation of existing data should provide a better assessment of the distribution and condition of aquatic populations in the monument.

Vegetation: Most of the monument lands have been subject for the past 100 years to livestock grazing and related agricultural uses. Subsequently, many of the native plants, including grasses, have been severely reduced in their distribution. Population diversity has been reduced as well. Exotic species such as cheat grass have replaced the native grasses and forbs.

Other introduced exotic species, such as knapweed, white top, and medusahead are present and spreading. Dalmation toadflax and yellow star thistle, particularly noxious plants, can also be found in the monument. The effect is an unnatural and unappealing scene. In the case of noxious plants, there are real and perceived threats to surrounding agricultural lands from the spread of these introduced plants. Past and current use of herbicides to control noxious plants within and adjacent to the monument theatens the well-being of other natural resources and processes.

Suppression of fires in and around the monument for the past 100 years has resulted in the proliferation of woody plants such as juniper and big sage, as well as annual grasses, contributing to a serious increase in fuel loads and further exacerbating the condition of native grasses and forbs.

Healthy remnants of native plant communities still exist within the monument. Removal of livestock grazing on most of the monument has removed the potential for overgrazing of these communities. However, the absence of wildfire has resulted in overgrowth of competing over-story vegetation and weakening the vigor of many native plants.

Within the historic zone of the monument, the agricultural fields are in poor condition. The irrigation water distribution system is the principal problem. Three hay fields totaling 57 acres have been offered for lease for hay production and livestock grazing but interest in leasing has been minimal. Also within the historic district is the remnant of a

"Homestead orchard." The remaining fruit trees in the orchard are old and weakening from age, disease, insects and lack of adequate care.

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John Day Fossil Beds Resource Management Plan,

LAKE ROOSEVELT NATIONAL RECREATION AREA (LARO)

Size: 40,625 hectares (100,390 acres)

Designation Date: 1946

Park History and Purpose: In 1946 the Secretary of the Interior, by his approval of an agreement between the Bureau of Reclamation, the Bureau of Indian Affairs, and the National Park Service (NPS), designated the NPS as the manager for the Coulee Dam National Recreation Area. The area included Franklin D. Roosevelt Lake, the Reservoir formed behind Grand Coulee Dam, and the "freeboard" lands that where purchased at and above 1310' elevation. Through over 50 years of changes, including a name change to Lake Roosevelt National Recreation Area in 1997, the NPS now manages approximately 47,438 acres of the 81,389 acres of total water surface, associated shoreline, and 12,936 acres of the 19,196 acres of total freeboard land. Also in 1990 two adjacent Indian Tribes were included in the Lake Roosevelt Cooperative Management Agreement with the other three agencies involved in the 1946 agreement. The Colville Confederated Tribe and the Spokane Tribe of Indians manage the remaining water surface and freeboard land.

The purpose and significance of LARO, as articulated in the park's general management plan is as follows:

PURPOSE

- Provide opportunities for diverse, safe, quality, outdoor recreation experiences for the public.
- Preserve, conserve, and protect the integrity of natural, cultural, and scenic resources.
- Provide opportunities to enhance public appreciation and understanding about the area's significant resources.

SIGNIFICANCE

- It offers a wide variety of recreation opportunities in a diverse natural setting on a 154-mile-long lake bordered by 312 miles of publicly owned shoreline.
- It contains a large section of the upper Columbia River and a record of continuous human occupation dating back more than 9,000 years.
- It is contained within three distinct geologic provinces – the Okanogan Highlands, the Columbia Plateau, and the Kootenay Arc – all of which have been sculpted by Ice Age glaciation and catastrophic floods.

Location: Lake Roosevelt National Recreation Area (LARO) stretches 130 miles along the length of Lake Roosevelt located in north central Washington. The recreation area includes the lower reaches of many rivers and streams, including the Spokane and Kettle Rivers.

Elevation: 1310 feet

Climate: The southwestern portion of the recreation area is in the Columbia Plateau, which experiences a semi-arid climate and consists primarily of sagebrush steppe vegetation interspersed with agricultural lands. Thirty-year mean annual precipitation available from a weather station in the town of Coulee Dam is 11 inches (Western Regional Climate Center 2003). Thirty-year January and July mean temperatures from Coulee Dam are 26 and 72 degrees Fahrenheit, respectively (Western Regional Climate Center 2003). Thirty-year mean January and July maximum and minimum temperatures are 32 and 22 degrees and 86 and 58 degrees, respectively (Western Regional Climate Center 2003). The northeastern portion of the recreation area is in the Okanogan Highlands, which experiences a cooler and wetter climate and consists primarily of pine forest. Thirty-year mean annual precipitation available from a weather station in the town of Northport is 20 inches (Western Regional Climate Center 2003). Thirty-year January and July mean temperatures from Northport are 25 and 69 degrees Fahrenheit, respectively (Western Regional Climate Center 2003). Thirty-year mean January and July maximum and minimum temperatures are 32 and 21 and 86 and 51 degrees, respectively (Western Regional Climate Center 2003).

Flora: The vegetation at LARO fits primarily into three broad categories. These are steppe grasslands, shrub-steppe grasslands and transition forest (ponderosa pine). Other categories include riparian/wetland, mixed-conifer, lithosol areas, rocky outcrops, and actively eroded slopes. The southern third of the lake is bordered by often moderate to steep slopes with a northerly aspect. The toe of these slopes have sedimentary terraces with fairly steep down slope sides. These areas are vegetated with bunchgrasses, forbs, and shrubs. The common shrubs are big sagebrush, rabbitbrush, and antelope bitterbrush. Some soil types support Douglas fir and ponderosa pine in shaded aspects and microsites. The common grasses throughout the whole area, particularly the dry sites include bluebunch wheatgrass, Idaho fescue, sand dropseed (*Sporobolus cryptandrus*) and needle and thread grass (*Stipa comata*). The Northern two thirds is either mountain slopes or larger terraces. Both the mountain slopes and the large terraces have sedimentary terraces at their toe with fairly steep sides. The middle third is predominantly ponderosa pine forests with associated grasses, forbs and shrubs. Common shrubs include antelope bitterbrush, snowberry, serviceberry (*Amelanchier alnifolia*), ocean spray (*Holodiscus discolor*), and wild rose (*Rosa* sp.). The upper third is similar to the middle section but has a little more moisture and in some places supports a mixed-conifer zone with Douglas fir and ponderosa pine. Other trees that occur include Western Larch (*Larix occidentalis*), lodgepole pine, Western paper birch (*Betula papyrifera*), and grand fir (*Abies grandis*). The shrub species are similar to the middle third with the addition of buffalo berry (*Shepherdia canadensis*), and snowbrush ceanothus (*Ceanothus velutinus*). Pinegrass becomes more common in the northern third. The riparian zones, which are most well developed in the northern portion, are dominated by willows, alder, black cottonwood, water birch (*Betula occidentalis*), and the occasional western red cedar (*Thuja plicata*).

Fauna: Animals present at LARO are typical for the semi-arid temperate conditions and the resulting vegetation. Some species, such as deer, can be considered to be quite abundant. Little information is available regarding rare species present at LARO.

Given the linear nature of the national recreation area, terrestrial habitat for larger wildlife is somewhat limited. Although LARO is too narrow to provide all aspects of a large mammal's range and habitat, it does provide important habitat to some charismatic species. The two major examples would be white-tailed deer (*Odocoileus virginanus*) and mule deer and bald eagles (*Haliaetus leucocephalus*). The Washington Department of Fish and Wildlife's Priority Habitats and Species program has listed areas along the Columbia River in LARO as important winter range for deer. For bald eagles, a threatened species, large ponderosa pine trees, and snags, provide critical nesting and roosting habitat. Moose and black bear (*Ursus americanus*) are also occasionally seen in the park.

Hunting is permitted within LARO during established seasons. The Washington Department of Fish and Wildlife establishes the hunting seasons and related regulations. National Park Service and tribal rangers, state game agents, and county sheriffs enforce the hunting regulations.

Mammals: Common large mammal species using the area include whitetail and mule deer, coyote, bobcat, badger, and black bears. Less common large mammals present include elk, moose, and mountain lions. These larger species tend to move through the area in response to daily and seasonal migrations.

Medium-sized mammals found in the area include river otter, muskrat *(Ondatra zibethicus*), mink, raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*). In addition, bats, beaver, porcupine (*Erethizon dorsatum*), mountaincottontail (*Sylvilagus nuttallii*), red squirrel (*Tamiasciurus hudsonicus),* Columbian ground squirrels (*Spermophilus columbianus*), chipmunks (*Tamias spp*.), and yellowbellied marmot.

Forty-one species of mammals were confirmed in or adjacent to the recreation area during an inventory conducted in 2003. A highlight of the 2003 inventory was the discovery of three species of shrews (family Soricidae). This group of cryptic mammals is frequently overlooked and is generally poorly known in the Pacific Northwest. The frequent sightings of the black bear and moose in recent years are also important (McCaffrey et al. 2003).

Birds: The abundance of water and small adjacent areas of riparian and wetland habitats attract an abundance of avian species. Lake Roosevelt is within the Pacific Flyway and serves as a resting area during migration. Resident and migratory birds common to the area include large populations of waterfowl, shorebirds, gallinaceous birds, pigeons, woodpeckers, hummingbirds, raptors, and passerines.

One hundred eighty-two species of birds were confirmed in or adjacent to the recreation area in 2003, including 2 species not expected to occur there (McCaffrey et al. 2003). Several species of raptors nest, roost or forage in the area. Among these are the osprey (*Pandion haliaetus*), golden eagle, bald eagle, red-tailed hawk, Northern harrier (*Circus cyaneus*), rough legged hawk (*Buteo lagopus*), American kestrel, prairie falcon, and peregrine falcon. Peregrine falcons have been reintroduced in LARO in an effort to

restore a breeding population to the area. At present, no aeries are known to have been established within the Recreation Area, but individuals have been spotted utilizing the Recreation Area, and nests are documented south of the recreation area in Banks Lake. Owls include great-horned owl, Northern saw-whet owl (*Aegolius acadicus*), Western screech owl, short-eared owls (*Asio flammeus*), and barn owls.

Dozens of species of passerines use the area for foraging and nesting. The most common of these include swallows, finches, jays, chickadees (*Parus spp.*), ravens (*Corvus corax*), American crow (*Corvus brachyrhynchos*), black-billed magpies (*Pica pica*), Western meadowlarks (*Sturnella neglecta*), American robins (*Turdus migratorius*), sparrows, blackbirds, mourning doves (*Zenaida macroura*), pigeon and juncos (*Junco hyemalis*).

Common waterbirds include surface feeding ducks (mallards, pintails, teal, and golden eyes), diving ducks (redheads, coots, and buffleheads), western grebe (*Aechmophorus occidentalis*), coot (*Fulica americana*), lesser scaup (*Aythya affinis*), common merganser (*Mergus merganser*), common loon (*Gavia immer*), and Canada geese (*Branta canadensis*). Wading and shorebirds in the area include sandpipers, northern killdeer (*Charadrius vociferous*), great blue heron (*Ardea herodias*), as well as gulls (*Larus spp.*), common snipe (*Gallinago gallinago*), and yellowlegs (*Tringa spp.*).

Common gallinaceous birds include a combination of native and introduced species. Native species include ruffed grouse (*Bonasa umbellus*), and blue grouse (*Dendragapus obscurus*). Introduced species include the ring-necked pheasant, chukar, gray partridge, California quail, and wild turkey (*Meleagris pallavo*). The elimination of natural sagebrush and bunchgrass communities on adjacent lands has severely reduced populations of shrub-steppe dependent species. Elimination of fencerows by agriculture has reduced habitat utilized by native and introduced species.

Herptofauna: Sixteen species of herpetofauna were confirmed in or adjacent to the recreation area during an inventory conducted in 2003. Known reptiles and amphibians include the sagebrush lizard, short-horned lizard, western rattlesnake (*Crotalus viridis*), gopher snake, western garter snake, western toad, great basin spade-foot toad (*Spea intermontana*), pacific tree frog, and western painted turtle (*Chrysemys picta*). The rediscovery of the western toad in the southern portion of the recreation area was exciting, as this species is believed to be declining in many parts of its range (Corkran and Thoms 1996). The spotted frog was absent during spring searches in 2003, and may be extirpated in the Lake Roosevelt region due to increasing numbers of introduced gamefish and the bullfrog (Corkran and Thoms 1996, Ray Dashiell personal commuication).

Fish: Lake Roosevelt and its tributaries in the National Recreation Area support a varied fish community that today is considerably different from the native fish community of the early 1900's. The changes over time were caused by the introduction of nonnative species, habitat alterations such as water pollution, damming of rivers and reservoir drawdowns. Surveys in the 1990's have identified up to 30 species of fish in LARO. Seven of these species were found in low numbers, with many represented by only one individual in one survey out of eight. Biologists believe that these individuals may

occasionally wash down from reservoirs and lakes upstream or are introduced by unauthorized human introductions. Of the 30 species detected 10 are not native to the Columbia River. The most abundant species include large-scale sucker (*Catostomus macrocheilus*), smallmouth bass (*Micropterus dolomieui*), burbot, walleye (*Stizostedion vitreum*), kokanee salmon (*Oncorhynchus nerka*), and rainbow trout. One other important species, because of its sensitive nature in the reservoir, is the white sturgeon (*Acipenser transmontanus*).

Unique Features and Species of Special Concern

Plants: Surveys were initiated in 2003 for two State listed sensitive plant species. *Antennaria parvifolia*, Nuttall's pussy-toes and the *Oxytropis campestris var. columbiana*, Columbia crazyweed. Listed as sensitive and threatened by the Washington State Department of Natural Resources Natural Heritage Program, these species were known to exist at LARO. The only known patch of Columbia crazyweed was relocated and mapped. The Nuttal's pussy-toes survey covered 1487 acres divided into 155 survey zones. Of the zones surveyed 59 were found to contain populations of this species. This plant was found to be more abundant than first known.

Animals: Known sensitive species identified by the U.S. Fish and Wildlife Service or potentially present in LARO include four animals. One is known to occur in LARO, one species status is not known, and two are not known to occur in LARO. The known species is the bald eagle, listed as threatened in Washington by the U.S. Fish and Wildlife Service. The bull trout (*Salvelinus confluentus)*, a threatened species, is not known to exist in the reservoir, according to Spokane Indian Tribal Fisheries Biologists. Dr. Al Sholtz, Eastern Washington University, with extensive fishery experience on Lake Roosevelt, believes that lake conditions, such as temperature, are not suitable for bull trout. The last two, grizzly bear and gray wolf, have never been confirmed in LARO. Their presence, although unlikely, would be transitory in nature due to human activity and disturbance along the Recreation Area.

Resource Management Concerns

Land Use Impacts: Water is the major resource that makes up LARO. Lake Roosevelt is designated by the State of Washington as a class AA water body. This is the highest level in the state requiring the highest-level water quality standards. The water quality in Lake Roosevelt is somewhat impaired by both point and non-point pollutants. Studies have revealed that generally the water quality in solution is good but much of the sediment being carried in can tend to be toxic, containing heavy metals and organic pollutants.

The Columbia River above Lake Roosevelt has had close to 95 years of point pollution from a lead/zinc smelter (now one of the largest of its kind) located in Canada. Many tons of effluent and slag have flowed downstream into Lake Roosevelt. In the 1960's a pulp mill opened up upstream and began to discharge various congeners of dioxins and furans. This material has also appeared in the environment of Lake Roosevelt. The Spokane River has been an area of concern as well. The largest population centers in eastern Washington and the Panhandle of Idaho are upstream of Lake Roosevelt in the Spokane

watershed. Upstream of these population centers is the Silver Valley Mining District that has operated for over 100 years.

The impacts of these sources of pollution are not as well defined. Current pollutants identified in the Spokane River portion of Lake Roosevelt have not been tied to any one known pollution source.

Exotic Plant Species: Some important "noxious weeds" include diffuse knapweed (*Centaurea maculosa*), spotted knapweed (*C. diffusa*), yellow star-thistle (*C. solstitialis*), leafy spurge (*Euphorbia esula*), Dalmatian toadflax (*Linaria dalmatica*), Canadian thistle (*Cersium arvense*), tumblemustard (*Sisymbrium altissimum*), and cheat grass (*Bromus tectorum*). LARO staff conducts noxious weed control activities in cooperation with county weed control programs, adjacent landowners, and other affected parties on Lake Roosevelt. However, the invasion of noxious vegetation continues to be a serious problem because control efforts have been limited by insufficient funding. In addition the narrow linear nature of LARO and the numerous roads running the length of LARO provides numerous corridors of dispersal into and out of the area.

An inventory conducted in 2003 by the University of Idaho documented a total of 181 acres infested with weeds of the 1,233 acres surveyed. Several species were limited in distribution with a total of less than 2 acres infested and would be inexpensive to eliminate. Species with less than two acres include: bighead knapweed, Canada thistle, Italian thistle, houndstongue, Kochia and sulphur cinquefoil. Special attention should be paid to bighead knapweed, Italian thistle, houndstongue and sulphur cinquefoil. Other species had fewer than 30 acres and included spotted knapweed, diffuse knapweed, leafy spurge and rush skeletonweed. Dalmation toadflax was the most common species with 131 acres infested and probably a candidate for biological control.

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Western Regional Climate Center. 2003. Washington Climate Summaries. Desert Research Institute, Reno, Nevada. http://www.wrcc.dri.edu/summary/climsmwa.html (accessed 12/15/2003).

UCBN park document(s) used in this park description:
Lake Roosevelt National Recreation Area Resource Management Plan, 1997.

MINIDOKA INTERNMENT NATIONAL MONUMENT (MIIN)
(Added to the Network in 2003 – little information available – General Management Plan due for completion in Winter 2004)

Size: 30 hectares (73 acres)

Designation Date: 2001

Park History and Purpose: The purpose of the Minidoka Internment National Monument is to provide opportunities for public education and interpretation of the internment and incarceration of Nikkei (Japanese American citizens and legal resident aliens of Japanese ancestry) during World War II. The monument protects and manages resources related to the Minidoka Relocation Center.

Location: Located 17 miles Northeast of Twin Falls, Idaho and 21 miles East of Jerome, Idaho.

General Description: Features of significance are the cultural landscape and historical structures (currently listed under Maximo as assets are the grounds, entrance station and walls, potato cellar built by internees, and some foundations). Area has limited natural resources (approximately half the acreage is sage habitat with associated species). The area is surrounded by irrigation fields and developed farm area. No species of concern are known, although habitat might support burrowing owls, sage grouse (adjacent BLM area has leks) and bald eagles (using the canal). Vegetation and noxious weeds are the primary current resource management concern.

NEZ PERCE NATIONAL HISTORICAL PARK (NEPE)

Size: 858 hectares (2,122 acres)

Designation Date: 1965

Park History and Purpose: Nez Perce National Historical Park was established as a unit of the national park system on May 15, 1965, by Public Law 89-19. The law specifies the park was created to "facilitate protection and provide interpretation of sites in the Nez Perce Country of Idaho that have exceptional value in commemorating the history of the Nation." Specifically mentioned are sites relating to early Nez Perce culture, the Lewis and Clark expedition through the area, the fur trade, missionaries, gold mining, logging, the Nez Perce War of 1877, and "such other sites as will depict the role of the Nez Perce country in the westward expansion of the Nation." Sites include historic buildings, battlefields, missions, landscapes, cemeteries, trails, archeological sites, and geologic formations important to the Nez Perce people. A total of 24 sites were established in 1965.

Public Law 102-576 of October 30, 1992, allowed sites to be designated in Oregon, Washington, Montana, and Wyoming. It specified that 14 additional sites in Idaho, Oregon, Washington, and Montana should be included in the park.

Today, the 38 sites of the Nez Perce National Historical Park, scattered across the states of Idaho, Oregon, Washington and Montana, have been designated to commemorate the legends and history of the Nee-Me-Poo (or Nez Perce) and their interaction with explorers, fur traders, missionaries, soldiers, settlers, gold miners, and farmers who moved through or into the area.

On the basis of provisions in the enabling legislation, the purpose of Nez Perce National Historical Park is to:

- Facilitate protection and offer interpretation of Nez Perce sites in Idaho, Oregon, Washington, Montana, and Wyoming that have exceptional value in commemorating the history of the United States.
- Preserve and protect tangible resources that document the history of the Nez Perce peoples and the significant role of the Nez Perce in North American history.
- Interpret the culture and history of the Nez Perce peoples and promote documentation to enhance that interpretation.

Location: Park Headquarters and Visitor Center are located in Spalding, Idaho, 11 miles east of Lewiston. An additional Visitor Center is located at Big Hole National Battlefield, 10 miles west of Wisdom, Montana. Interpretive shelters at Heart of the Monster (Kamiah) and White Bird Battlefield tell the story of events at each location. The shelter at White Bird presents a panoramic view of the battlefield. From this point you can get an idea of how the battle occurred and how skillfully the Nez Perce used the terrain to defeat the U.S. Army. A self-guided (primitive) hiking trail is accessible via old U.S. 95 north of White Bird. At Kamiah the exhibits explain the Heart of the Monster -- the Place of

Beginning where the Nez Perce people sprang from the drops of blood squeezed from the monster's heart. An audio station recounts the legend. Self-guiding trails are present at the Big Hole and Bear Paw Battlefield sites, as well as a self-guided walking tour of the Spalding site.

Elevation: Varies widely between sites.

General Description: The areas encompassing the 38 sites that comprise Nez Perce National Historical Park display the great diversity of the American West -- topography, rainfall, vegetation, and scenery, ranging from the semi-arid regions of Washington, to the lush high mountain meadows of Idaho and Oregon, to the prairies of Montana. The natural resources of Nez Perce NHP are diverse and complex. Scattered throughout four states, the park sites are mostly small pockets of land owned and surrounded by a patchwork of private, local, state, tribal, and other federal ownership.

Because Nez Perce National Historical Park is so widespread geographically, the parkwide environment is difficult to describe. Nez Perce National Historical Park falls into three basic ecoregions: the *shortgrass prairies* of the Palouse Grasslands and Missouri Basin, the *sagebrush steppe* of the Columbia and Snake River Plateaus, and the *conifer/alpine meadows* of the Blue Mountains, the Salmon River Mountains, the basins and ranges of south-western Montana, and the northern Rocky Mountains of Idaho and Montana.

Fauna/Flora: Three major habitats characterize the diversity of NEPE sites, Shortgrass prairie, sagebrush steppe and conifer/alpine meadow.

Shortgrass prairies
Shortgrass prairies are characterized by flat or rolling expanses of low to moderate relief. The elevations of shortgrass prairies in the park range from less than 1,000 feet to about 3,500 feet These prairies are dissected by rivers and streams forming canyons and valleys. Because these regions are relatively dry, they are dominated by shortgrass species such as wheatgrass, fescue, and bluegrass in the Palouse area and buffalo, grama, wheatgrass, and needle- grass in the Missouri Basin. Wildflower species bloom in spring and summer. The Nez Perce used many of these such as the camas lily as a source of food, medicine, and fiber.

The Palouse supports an abundance of wildlife. Bald eagles are frequent visitors to the reaches of the Columbia, Snake, and Clearwater Rivers. Osprey, red-tailed hawk, and other raptors are common, as are a wide variety of migratory and resident birdlife. Cottontail rabbits, ground squirrels, coyotes, bobcats, and skunks also abound in these grasslands.

The Missouri Basin was once the home of large herds of bison. Pronghorn antelope are now the most common large mammal, but deer may be found along stream channels where brush cover is available. Whitetail jackrabbits, desert cottontail, ground squirrels, coyotes, and badgers are common. Hawks are abundant, along with smaller birds such as

the lark bunting, the horned lark, and the meadowlark. Rattlesnakes are also fairly common.

The Missouri Basin sites of shortgrass prairie are the Bear Paw Battlefield and Canyon Creek.

The following sites are in the Palouse Grasslands of the shortgrass prairie ecoregion: Ant and Yellowjacket, Asa Smith Mission, Camas Prairie, Canoe Camp, Clearwater Battlefield, Confluence Overlook, Cottonwood Skirmishes, Coyote's Fishnet, Craig Donation Land Claim, Fort Lapwai, Hasotino Village Site, Heart of the Monster, Lapwai Mission, Lenore, Lewis and Clark Long Camp, Looking Glass Camp, McBeth Mission, Musselshell Meadow, Pierce Courthouse, Saint Joseph's Mission, Spalding, Tolo Lake, Weippe Prairie, Weis Rockshelter, White Bird Battlefield

Sagebrush steppe

Sagebrush steppe is characterized by the plains and tablelands of the Columbia and Snake River Plateaus. These mid-elevation (3,000 feet) plateaus include most of the Northwest's lava fields and are surrounded by lava flows that have been folded or faulted into ridges. The climate on these plateaus is again semiarid and cool. The average annual precipitation is about 16 inches, with precipitation distributed fairly evenly from fall to spring. The predominant vegetation is a variation of sagebrush, shadscale, and short grasses. Stream channels may support a lush understory of willow and other riparian obligates but will rapidly graduate to more arid, alkali-tolerant species such as greasewood, particularly farther from the mountains.

Many wildlife species use these areas as seasonal habitat, particularly during winter. Larger mammals found in these areas are coyote, pronghorn antelope, mountain lion, and bobcat. Smaller species include ground squirrels, deer mouse, and porcupine. Severe winters may force elk and mule deer from higher elevations to these plateaus. The geography of this area supports habitat that is important for many species of migratory waterfowl.
Park sites of the sagebrush steppe are Camas Meadows, Dug Bar, Buffalo Eddy, Nez Perce Cemetery, and Nez Perce Campsites.

Conifer/Alpine Meadows

The Idaho Batholith, which forms the Bitterroot Range over which the Lolo Trail crosses, and the Wallowa and Blue Mountains in eastern Oregon, are marked with distinctive elevation zones of vegetation. In the Idaho Batholith and the Blue Mountains, Douglas-fir is the climax dominant conifer below the subalpine zone. The Bitterroot Range is dominated by a subalpine belt of mountain hemlock. Below this, western redcedar and western hemlock dominate, but Douglas-fir, western white pine, western larch, and western ponderosa pine can be found in association. Lodgepole pine and grasses are dominant in the basin-and-range areas. Ponderosa pine is scattered below these areas and dominates west of the Continental Divide. The lower mountain slopes of all these areas may graduate from conifer to sagebrush and grass steppe lands.

Some of the larger mammals in these areas are elk, deer, moose, black bear, mountain lion, bobcat, beaver, and porcupine. Blue and ruffed grouse are common game birds.

Severe winters in the higher elevations are usual in these areas. Winter temperatures frequently drop below 32°F, and summer highs may reach only 70°F. Temperature and snowfall vary greatly with elevation. Precipitation varies from 20 to 40 inches per year and comes predominantly in snowfall during the winter months.

Park sites that are in the conifer/alpine meadows ecoregion are Lolo Trail and Pass, Lostine Campsite, Old Chief Joseph Gravesite, Joseph Canyon Viewpoint, and Big Hole National Battlefield.

Animals that have been observed to consistently occupy Nez Perce NHP sites in Idaho include white-tailed deer, great horned owls, redtail hawks, coyotes, game birds, and various rodents such as beaver, mice, voles, and gophers. Skunks, raccoons, porcupines, and birds common to the northern Idaho ecosystem are also found within the park boundaries. Migratory mammals such as deer, elk, and moose, as well as a large variety of birds and raptors, including bald and golden eagles, have been commonly seen at the Idaho sites.

Mammals: Thirty-four species of non-volant mammals were documented at 5 NEPE sites in 2002 (Strobel et al. 2003). The mammals with the highest occurrence across all five sampling sites were the coyote, the deer mouse, the mule deer, the white-tailed deer, and the northern pocket gopher.

Birds: In 1999, in conjunction with the Servicewide Inventory and Monitoring Initiative, an intensive inventory for avian species was initiated at all park managed sites and on the Lolo Trail. This inventory of avian wildlife detected 69 bird species at Buffalo Eddy, 69 bird species at Spalding, 64 bird species at Heart of the Monster, 66 bird species at Lolo Trail and Lolo Pass / Musselshell Meadow, 84 bird species at White Bird Battlefield, 59 bird species at Old Chief Joseph Gravesite, and 53 bird species at Bear Paw Battlefield (Dixon 2004).

Migratory waterfowl, including large numbers of Canada geese, frequently use the park sites along the Clearwater River in Idaho. The geese nest on river islands immediately adjacent to at least two of the park sites. The Spalding site is adjacent to the Lewiston Wildlife Refuge, managed by the Idaho Department of Fish and Game.

Herptofauna: A total of 11 species of amphibians and reptiles were confirmed in 2002 (Strobel et al. 2003). The western toad was the most widely distributed amphibian with the highest estimated abundance across all sites sampled. The bullfrog had the second highest abundance, occurring at two locations. The racer was the most widely distributed reptile with the highest abundance across all sites sampled. The western terrestrial garter snake had the second highest abundance within all sites sampled.

Fish: The park needs to obtain results of systematic inventories of fish from the Nez Perce tribe.

Aquatic Features: The Clearwater River, adjacent to several park sites, is a major

recreational resource and contains federally listed salmon and steelhead. Fishermen from the United States, Canada, and other places in the world, enjoy this year-round trophy fishery. The river also provides opportunities for boating, other river-associated recreation, and limited hunting. The park sites along the river provide walk-in access for some of these types of recreation.

Unique Features and Species of Special Concern

No inventory has been conducted in the park to determine the presence of endangered, threatened, or rare species. Some have been seen on park lands and waters, such as bald eagles on the Clearwater River and Montana arctic grayling in the North Fork of the Big Hole River.

Federally listed threatened or endangered species that could occur in the park are gray wolf, peregrine falcon, bald eagle, Snake River sockeye salmon, chinook salmon, and MacFarlane's four o'clock. Additional species that are state-listed threatened or endangered species or federal candidate species that could occur in the park are California wolverine, swift fox, great gray owl, boreal owl, mountain plover, westslope cutthroat trout, bull trout, fluvial arctic grayling, pygmy gentian, white-margined knotweed, Lemhi beardtongue, stalk-leaved monkeyflower, and candystick.

Resource Management Concerns

Most of Nez Perce National Historical Park's natural resource issues have involved vegetation management. Early efforts focused on maintaining a "park-like quality" and prohibiting land uses that would detract from each site's historical appearance. Gradually the park administration adopted a variety of management tools and assumed the more ambitious goal of restoring the vegetation to its historic appearance. These tools included noxious weed control, prescribed burning, reseeding of native grasses, and selective use of grazing and farming.

Restoration of Historic Vegetation: Native vegetation for the riparian areas of the Spalding, East Kamiah, and Canoe Camp sites may have once included dogwood, ponderosa pine, hawthorn, sedges, tufted hairgrass, cottonwood, snowberry, willows, chokecherry, elderberry, serviceberry, and grasses such as canary grass and bunchgrasses. The intermountain grassland, best represented by White Bird Battlefield, were perhaps dominated by Idaho fescue, bluebunch wheatgrass, and rabbitbrush. Perennial forbs included roundleaf alumroot, arrowleaf balsamroot, and Wyeth eriogonum. The landscape at many of the sites is now impacted, if not dominated, by exotics such as cheatgrass, various thistles, yellow starthistle, poison hemlock, moth mullein, field bindweed, and teasel.

The natural resources of the park have been greatly impacted by a long history of human use. Native grass and floral communities have been damaged or displaced by the effects of grazing, agriculture, and mechanical disturbances. At Big Hole, the exclusion of the natural fire regime appears to have altered forest succession. The absence of perennial

forbs in the prairie is another consequence of disturbance: Though native trees and shrubs still exist, exotic annual grasses have replaced many of the native perennials and often outcompete seedlings of native species.

Little if any of the original native plant communities remain at Spalding. A long history of disturbance--including intensive grazing, agricultural use, road building and maintenance, off-road vehicle disturbances, and landscaping around historic homesites--has left large areas susceptible to invasions by annual grasses and other exotic or noxious weeds.

Exotic Plant Species: The spread of exotic and noxious weeds continues to be the major natural resource issue at all park sites. In the past, local weed control districts have made requests of the park to control its infestations of yellow starthistle and Scotch thistle, field bindweed, poison hemlock, and other weed species. Species such as yellow starthistle, scotch thistle, field bindweed, poison hemlock, and others are rapidly outcompeting existing vegetation. On-going control efforts are primarily limited to mechanical (and some herbicide) treatments at Spalding, East Kamiah, and Big Hole.

Grazing: Grazing on park sites was curtailed in 1997. Although the impacts of current and past grazing practices on the park sites are not thoroughly understood, it probably has contributed to the overall decline of natural vegetative productivity and provided an opportunity for the encroachment of annual grasses and other exotics.

Water Quality: High water quality and quantity are major resources of many park sites. The Clearwater and Snake Rivers and their tributaries (which are adjacent to several park sites) are critical habitat for several species of anadromous fish.

Air Quality: The park is designated as a Class II site for air quality. Most of the park sites are in rural areas with few sources of air quality degradation. However, lumber and paper mill activity near the Spalding and Heart of the Monster sites have negatively affected the quality of air and visual resources nearby.

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UCBN park document(s) used in this park description:
Nez Perce National Historical Park Resource Management Plan,

WHITMAN MISSION NATIONAL HISTORIC SITE (WHMI)

Size: 40 hectares (98 acres)

Designation: 1936

Park History and Purpose: Whitman Mission National Historic Site was established in 1936 to preserve the site of a mission founded in 1836 by Marcus and Narcissa Whitman among the Cayuse people of the Inland Pacific Northwest. The site was the first American settlement in the Pacific Northwest and became an important way station along the Oregon Trail.

Location: Whitman Mission National Historic Site is located at the southern extreme of the Palouse Prairie region of southeastern Washington in Walla Walla, WA. The township and range reference is Township 7 North, Range 35 East, Section 32, of the USGS (United States Geologic Survey) Topographic Quadrangle Map, College Place 1966.

From I-84, travel north on Oregon Route 11 from Pendleton, Oregon to Walla Walla, Washington, then on U.S. Route 12 go west 7 miles.

Elevation: General elevation within Whitman Mission National Historic Site is level and ranges from 615 feet above sea level to 724 feet at the top of Memorial Hill (which rises over 100 feet above the surrounding countryside).

Climate: Whitman Mission National Historic Site is surrounded by a dry, moderate climate. Annual precipitation in the vicinity of the NHS averages 19.48 with approximately 17.8 inches of snow during the winter months. The daily temperature variation can be as much as 40 degrees during the summer. Mean monthly maximum temperature ranges from 40.1 to 97.3 degrees Fahrenheit, while mean minimum temperature ranges from 26.6 to 57.4 degrees Fahrenheit. Frequent, strong winds can occur anytime, as well as Chinook winds. Prevailing winds year around come from the southwest.

Resource Management: Resource management at this site is dedicated to preserving the archeological, historical and landscape values associated with the Whitmans during their work from 1836 to 1847. These include native vegetation and landscape features the Whitmans would have seen and used during their lives at the mission.

The first objective listed in the general management plan for WHMI is to protect and preserve the cultural and natural resources of Whitman Mission. Strategies to achieve this objective include: 1) Inventory cultural and natural resources, 2) Manage, update, and maintain the park's resource information database (includes GIS), 3) Manage and protect park collections and archives, 4) Manage and protect park structural landscape component, including monuments, graves, and landscape features, 5) Implement and

sustain a cultural and natural resource-monitoring program, and 6) Use IPM/fire to protect park resources.
The second objective listed in the general management plan for the park is to restore and preserve the park's natural resources, including riparian and wetland areas, and the cultural landscape. Strategies listed to achieve this objective include: 1) Identify options for Doan Creek and irrigation ditch management and implement the selected option, 2) Manage vegetation, and 3) Collaborate with other federal and state agencies in the protection of hydrologic and aquatic resources.

Flora: The staff at Whitman Mission National Historic Site has compiled a vascular plant checklist and a collection of voucher specimens. There are 190 specimens in the herbarium. At this time, there are no known federally listed threatened or endangered plant species within the NHS.

Whitman Mission is located on the southern extreme of the Palouse Prairie Region. Originally, perennial grasses, principally bluebunch wheatgrass which flourished in swords over the rolling plains, dominated this prairie. Intermixed with it were smaller patches of sandberg bluegrass and Idaho fescue. The region is classified as the *Agropyron-Poa* habitat type. Large native herbivores were generally absent from the Palouse, and because of this, the grasses evolved with a low resistance to grazing. Subsequent grazing by domestic livestock and extensive cultivation for wheat are the main reasons why native perennial grasslands are now rare on the Palouse.

The original inhabitants of the area around Whitman Mission were the Cayuse Indians. The Cayuse practiced very little crop agriculture, depending instead on a partially nomadic existence that emphasized food gathering, horse raising, and salmon fisheries. Fire was used periodically by the Cayuse to burn particular areas to increase the production of wild forage and accessibility of plant foods, to facilitate hunting and travel by burning away underbrush, and to encircle game. The regularity with which the areas on or near, the historic site were burned historically cannot be determined, but frequent cultural burning of any particular area was probably rare.

It is probable that at the time the mission was established, a mixture of three plant communities occupied the site. At the time the mission was established in 1836, the Walla Walla River flowed through the site during times of high water. On the floodplains along the Walla Walla River and nearby Mill Creek, a narrow plant community consisting of dense tangled thickets of willows, cottonwoods, red-osier dogwood (*Cornus* stolonifera), blackberries (*Rubus spp*.), elderberries (*Sambucus spp*.), and other species common to riparian areas probably occurred. An association of perennial grasses, shrubs, and native forbs occupied the hillside area where soil depths and drainage were greater. Perennial grasses common to the Palouse dominated the rest of Whitman Mission.

Intermixed throughout the site was giant wild ryegrass, a species preferring a year-round supply of soil moisture and occurring primarily on clay bottomlands and seepage areas. It now occurs as scattered large bunches of grass, but historically, it may have been more

extensive. It was this species that gave the Indian name to the location, *Waiilatpu*, meaning, place of the people of the rye grass.

It is likely that the Cayuse used the resources at the site at least periodically for centuries before the mission was established. Archeological evidence of modification to the natural conditions has not been documented. However, soon after the mission was established, an irrigation system was developed, crops were planted, and areas were opened to grazing by draft stock and cattle. A considerable number of stock animals moved through the mission from the Oregon Trail, and there was ample opportunity for the introduction of exotic plants. The changes that occurred to the plants and landscape during the time the mission was active -- the introduction of domestic livestock, exotic plants and agriculture, and the removal of riparian vegetation for fire and building wood, were a portent of things to come for the entire Palouse Prairie.

Fauna: The bald eagle is the only federally listed threatened or endangered wildlife species that has been observed within the NHS boundaries. There are no proposed or candidate species identified within the area of the NHS.

Mammals: Wildlife at Whitman Mission National Historic Site is represented primarily by a variety of small rodents. Twenty-seven mammal species were confirmed during a 2003 inventory (Rodhouse et al. 2003). The most common mammals are cottontail rabbits (*Sylvilagus spp.)* voles (*Microtus spp.)* deer mice, western harvest mice and northern pocket gophers. Also present are beaver, whitetail deer, mule deer, muskrats, raccoons, weasels, skunks, badgers, porcupines, and feral house cats (*Felis catus*).

Birds: A variety of common birds, ducks, and geese have been seen within Whitman Mission National Historic Site. One hundred seventeen birds were expected to occur in or adjacent to the mission and 202 species were confirmed, including all 117 expected species (Rodhouse et al. 2003)

Bird species commonly observed include mourning dove (*Sandier macroura*), woodpeckers (*Picoides spp* and *Mealnerpes spp.*), barn owls, swallows (*Hirundo spp*.), wrens, (*Troglodytes aedon*), Wilson's warblers (*Wilsonia pusilla*), yellow-rumped *warblers (Dendroica coronate auduboni*), sparrows (*Spizella spp*., *Melospiza spp*., and *Zonotrichia spp*.), robins (*Turdus migratorius*), juncos (*Junco spp*.) starlings, crows (*Corvus spp*.), hawks (*Accipeter spp*. and *Buteo spp*.), pheasants, mallards (*Anas platyrhynchos)* and Canada geese. Other species seen are California quail, bobwhite quail (*Colinus virginianus*) and wild turkey.

Bald eagles, a federally listed species, occasionally pass through the NHS. There are no known nesting sites within or in close proximity to the NHS.

Amphibians and Reptiles: A total of 3 amphibians and 5 reptiles were documented on the mission during 2002 (Rodhouse et al. 2003). Bullfrogs are abundant around the Millpond, Mill Creek, and along the irrigation channel. Common garter snakes and gopher snakes have been observed at various locations throughout Whitman Mission National Historic

Site. Painted turtles are found here as well. The 2002-2003 inventory confirmed the great basin spadefoot toad, a unique species of amphibian.

Fish: The following species of fish are found in Mill Creek: steelhead (*Oncorhynchus mykiss*), carp, and sunfish (*Eupomotis gibbosus*) No other information is available concerning fish in the waters running through the NHS. However, occasionally fish (carp) do enter the irrigation channel.

Water Resources: Surface water resources at the National Historic Site include Mill Creek, Doan Creek, the Millpond, and the irrigation ditch. Mill Creek originates in the Blue Mountains, approximately 30 miles east of Whitman Mission and flows through the northwestern corner of the NHS. Doan Creek originates three miles east of the NHS and passes through a private airport, a former dairy, and agricultural land before entering the NHS at the northeastern boundary. Here, Doan Creek splits into two channels through the NHS; one continuing west along the northern boundary until joining with Mill Creek (this is the channel referred to as Doan Creek); and the other channel turning south, then west and connecting back to Mill Creek just west of Sweagle Road near the intersection with Whitman Mission Road (the NHS's entrance road). Doan and Mill Creeks come together at the northwestern boundary of the NHS. Further west, Mill Creek joins the Walla Walla River.

The historic Millpond covers about two and one-half acres and is held by earthen dikes. The Millpond was restored in 1961, and is located on the eastern end of the mission grounds. The irrigation channel from Doan Creek supplies the Millpond.

Marcus Whitman is credited with establishing the first irrigation ditch in this area. In one form or another at least one irrigation ditch has crossed the mission grounds since Whitman's time. Currently, Whitman Mission National Historic Site is responsible for maintaining 5,967 feet of irrigation ditch in accordance with Washington State law. The current irrigation ditch on the NHS land supports water that supplies two farms west of the NHS.

In addition to the existing surface water resources, evidence exists of former stream channels for both Doan Creek and the Walla Walla River. A former Doan Creek channel is an important wetland habitat in the northeastern quarter of the NHS. The former channel of the Walla Walla River (the oxbow of the Walla Walla River) is important to the interpretation of the history of Whitman Mission National Historic Site.

Resource Management Concerns

Exotic Plants: Whitman Mission contains non-native plants that occur in all areas of the park. By 1985, major emphasis for maintenance within the NHS was being placed on revegetation and the control of exotic plant species. Vegetation management has converted 60% of the NHS from exotic grasses and weeds to grasses that grew in the area during Whitman's era, or to grasses that have the same appearance as the native grasses. These native-appearing grasses will gradually be replaced with native species by NHS staff.

In 1994, a vegetation plan was developed and implemented for the area surrounding the visitor center. In 1995, vegetative alternatives were developed for treating exotics on the banks of the irrigation channel. Some implementation has been initiated.

In 1997, an inventory of exotic pest plant species identified the following six species of concern: field bindweed, jointed goatgrass (*Aegilops cylindrica*), poison hemlock, yellow starthistle (*Centaurea solstitalis*), Canada thistle, and Scotch thistle. Control strategies for these species have been developed, and incorporate more extensive use of integrated pest management techniques.

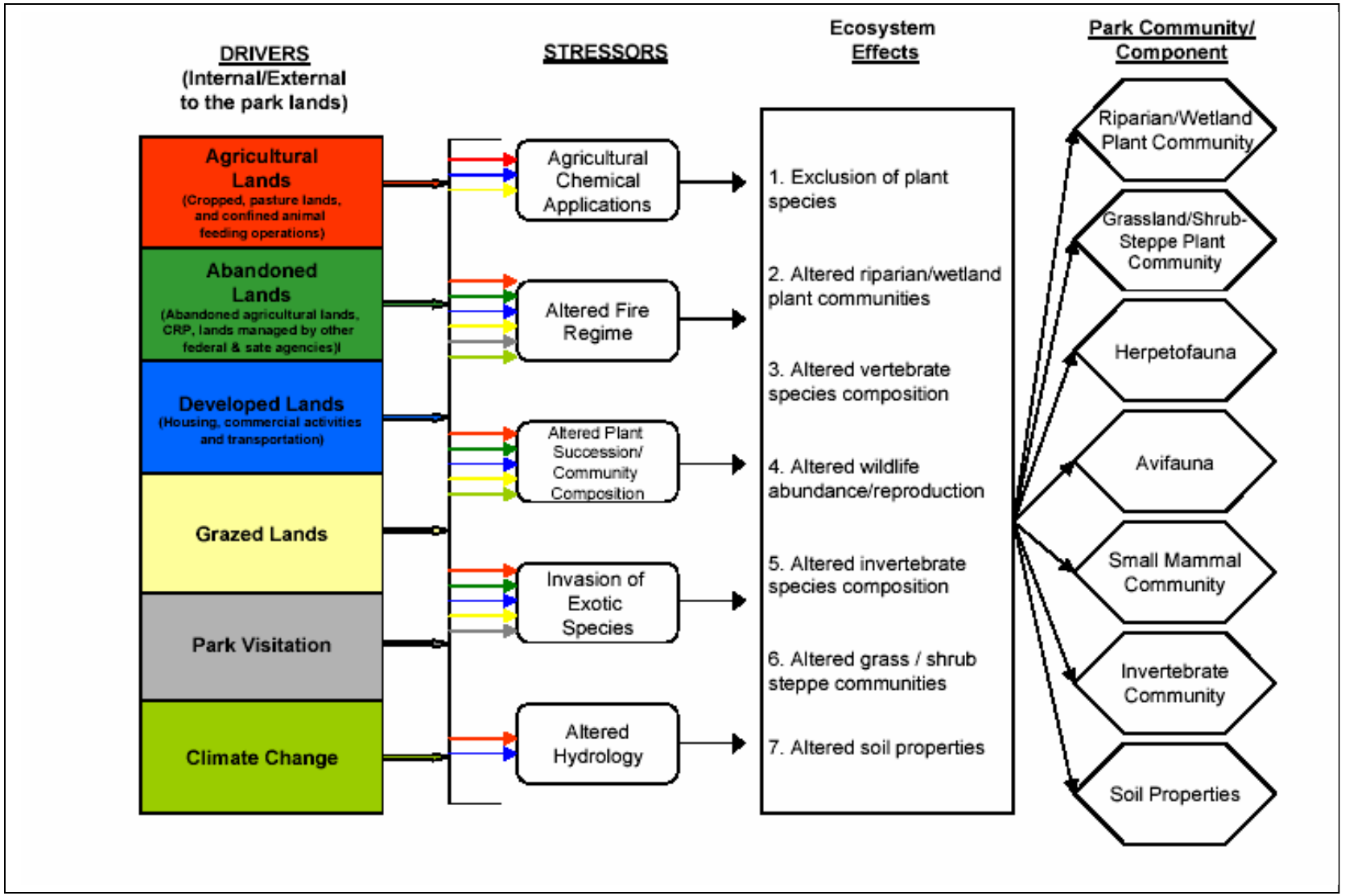
Wetlands: Approximately ten acres of the NHS is wetland, but is not formally classified as such in any NPS, U.S. Army Corps of Engineers, National Wetlands Inventory, or Natural Resource Conservation Service document. While there are no springs within the NHS, there are distinct former stream channels of Doan Creek and the Walla Walla River, which hold water in the winter and spring. There is a wetland enhancement project planned by NHS staff to unchannel Doan Creek along the northern boundary to allow more water to meander, creating more wetland habitat. The U.S. Army Corps of Engineers has purchased land that borders the south boundary of the NHS and the north bank of the Walla Walla River. The State Department of Fish and Wildlife is administering land along this southern boundary as a riparian habitat. Management of this land in its natural state is compatible with the historic setting of the NHS.

Literature Cited

Rodhouse, T., A. St. John and L. Garrett. 2003. 2002-2003 Vertebrate Inventory Whitman Mission National Historic Site. University of Idaho, Moscow, ID 62 pp.

UCBN park document(s) used in this park description:
Whitman Mission National Historic Park Resource Management Plan,

Appendix G. Conceptual Model Developed for Vital Signs Monitoring Workshop April 2002.



Appendix H. 2004 Vital Signs Monitoring Workshop Report

Upper Columbia Basin Network
(Previously known as Northern Semi-Arid Network)
Workshop Proceedings

March 9 – 11, 2004
Moscow, Idaho

A Vital Signs Scoping Workshop was conducted at the University of Idaho on March 9 – 11, with representatives from Big Hole National Battlefield (BIHO), Nez Perce National Historical Park (NEPE), City of Rocks National Reserve (CIRO), Craters of the Moon National Monument and Preserve (CRMO), Hagerman Fossil Beds National Monument (HAFO), John Day Fossil Beds National Monument (JODA), Lake Roosevelt National Recreation Area (LARO) and Whitman Mission National Historic Site (WHMI) attending. A new site, the Minidoka Internment National Monument (MIIN) was added since the last vital signs workshop in April 2002. Also, the network has been renamed the Upper Columbia Basin Network.

Network I&M Coordinator Lisa Garrett welcomed participants and introduced the network's newest employee, Leona Svancara, Network Data Manager. Tom Rodhouse, Network Ecologist, provided necessary background for participating workgroups.

Workshop handouts were provided to all participants in a 3-ring binder. The handouts provided information on the Network parks and natural resource concerns identified by members of the Science Advisory Committee. The handouts include the following: Agenda, Purpose of the Meeting and Expected Outcomes, Servicewide Monitoring Goals and Objectives, GPRA Goals specific to UCBN Parks, Potential Partners, Species of Concern, Park Visitation Statistics/Acreage/Designation Date, Prioritized Stressors Affecting Park Natural Resources, Noxious Weed List, Workgroups, Example Vital Sign Categories, Glossary of Terms, and a List of Workshop Participants.

Purpose of the Meeting: Continue the development of an integrated and comprehensive long-term monitoring plan for the network that provides essential information needed to preserve and enhance each park's most important natural resources.

Expected Outcomes:

- Create a network of stakeholders united to preserve the most important resources in the network.
- Review technical information developed by the Science Advisory Committee leading to the development of a long-term monitoring plan for the network's most important resources.
- Develop a list of vital signs and associated monitoring questions that will help track a subset of the total suite of natural resources that park managers are directed to preserve. In situations where natural areas have been so altered that

ecological integrity has been lost, monitoring information can help managers develop restoration plans or ecologically sound management objectives.

Other benefits include:

- Identify major drivers and threats (stressors) to important natural resources within the network.
- Identify protocols that could be used to monitor vital signs.
- Identify partnerships and collaboration potential for maximizing monitoring funds.

Ecological Framework

Network Ecologist Tom Rodhouse spoke of an ecological framework needed to set the stage for the workgroups and the pragmatic/ecological context. He encouraged group participants to "think outside the box," and across jurisdictions and disciplines, to build the most effective network strategy.

Rodhouse summarized service-wide monitoring goals and objectives as:

- Determine status and trends in selected indicators of the condition of park ecosystems to allow park managers to make better-informed decisions and work more effectively with other agencies and individuals for the benefit of park resources (leverage partnerships for maximum efficiency)
- Note early warning of abnormal conditions to develop effective monitoring and cost savings
- Develop basic research and useable data to better understand the dynamic nature and conditions of park ecosystems, and supply baseline reference points
- Meet legislated protection mandates
- Develop a means of measuring progress toward performance goals

Criteria should be measured in terms of ecological, legislative, management and partnership significance.

Rodhouse cited the definition of an *Ecosystem* as: a spatially explicit unit of the Earth that includes all of the organisms, along with all the components of the abiotic environment within its boundaries.

He further recounted that *drivers* are natural in origin, while *stressors* are generally human-caused, and *disturbances* can be either human-caused or natural. He spoke of the *range of natural variability* and the *critical concept of scale* as contexts for evaluation. In discussing scale, *spatial* includes a range from global to microsite, while *temporal* could encompass, as an example, a geologic range from plate tectonics to daily temperature fluctuation. On an *organizational scale*, both spatial and temporal are considered. Scale has a dependence on status and trend, the dynamic nature of the park ecosystem, and reference points for comparison with other environments.

In summarizing, Rodhouse reiterated that the network objective should be a programmatic integration of the ecological, spatial and temporal. He further stated a National Park Service challenge: "An effective monitoring system will yield information that is greater than the sum of individual parts."

Garrett stressed the need for the monitoring program to be comprehensive and integrated, yet also specific enough for individual park monitoring requirements. Because of money constraints, she again encouraged participants to form partnerships and develop scientific collaboration that can lead to further educational programs, more precise data and better training.

Garrett spoke of the need to efficiently wrap up this component of the vital signs monitoring plan, with Phase One due June 1, 2004. She stressed that no monitoring will be allowed until the plan has been through the peer review process.

Specialist Presenters

Pete Biggam, Soils

As the only Soil Scientist for the NPS, Biggam addressed the group on the need to raise awareness of the NPS soils programs and the relationship of soils to vital signs monitoring. He stressed that the function of soil directly relates to water and air, plant life, human habitation and other components, and that we need to understand and preserve soil resources. He noted that we should:

- Educate people to the role of soil
- Collect good relative data
- Separate natural and unnatural erosion.

With many of the nation's soils already mapped, Biggam said today's soil surveys will be more dynamic and can tell resource managers much about other resources. For example, a soil type classification can furnish further information on plant life and climate, and can even show relationships between critical habitat and endangered species. Biological soil crusts, once disturbed, can be the gateway for noxious weed problems, he said, also noting that some dynamic soil properties are susceptible to change due to climate. Biggam spoke generally of soil resistance and resilience, and stressed that in some instances, good soil health is impossible to restore. Biggam's overview also included partnership possibilities, protocols and surveys already in existence to help the network monitor its soil resources, and strategies to make the public more aware of soil and its importance.

Elizabeth Waddell, Air/Climate/Land Use

Waddell said that 40 NPS ozone and meteorological monitoring sites exist, but within the network, only Craters of the Moon has a national monitoring site. She suggested, however, that if a park wants to monitor for ozone, it can monitor ozone sensitive plants, observing for foliar injury, reduced growth and increased vulnerability to other stressors. She said all network parks have low risk of ozone pollution except City of Rocks.

Acid deposition is monitored nationally through 37 NPS sites through the National Atmospheric Deposition Program, while there are eight sites nationwide for mercury pollution. She said acid deposition doesn't need to be monitored hourly, but acid deposition risk should include the following criteria: ability of lakes and soils to neutralize it; potential for subtle change in aquatic and terrestrial ecosystems, including species composition; potential for damage to cultural or natural resources; magnitude of potential changes in emission sources (she cited agricultural burning as one example of a source). She stressed the negative effects of acid deposition on plants and soils. She also mentioned related visibility issues. Lichens were noted as an indicator for mercury pollution.

Waddell said that whatever is bad in the atmosphere can often make invasive species worse. She also said air quality is both a stressor and a vital sign. She suggested that measurement and monitoring can tie in with water quality, invasive species and soil moisture issues. Her presentation listed current air quality issues within the UCBN:

- Ammonia emissions from agriculture are forecast to increase significantly:
  - Acid deposition
  - Visibility
  - Fertilization
  - Water quality (nitrates in ground water and streams)
- New coal fired plants proposed for northern Nevada will likely increase:
  - Acid deposition
  - Visibility
  - Ozone
- LARO: metals in water/sediment
- CRMO, CIRO: radionuclides
- CIRO: ozone, nitrogen deposition

Bruce Heise, Geology

Heise identified the following Geologic Features and Processes for the UCBN:

- Glacial features and processes
- Caves and karst features and processes
- Geothermal features and processes
- Stream (fluvial) features and processes
- Lake (lacustrine) features and processes
- Hillslope features and processes
- Volcanic features and processes
- Windblown (Aeolian) features and processes
- Seismic (faults, earthquakes, tsunamis) features and processes
- Unique geologic features (paleontologic resources, geologic age points, geochemical data, etc)
- Disturbed lands/mineral development (mining, grazing, logging)
- Geologic outreach — interpretation and education

Gerry Wright, Wildlife

In a sense, Dr. Wright provided a reality check for the group, noting that people love to talk about monitoring, but not many want to do it. He said that monitoring doesn't come easy and the longest documented vertebrate monitoring program lasted 40 years. He said many programs are dependent on an interested employee staying in place and taking charge. He suggested that if we select things we already know about, we'll be ahead of the game. Wright reiterated the reasons for monitoring, such as early warning, baseline conditions information and legal mandates. Distinguishing between inventory and monitoring, he added that monitoring works best when it's less complex and inexpensive.

Wright identified possible criteria for choosing species to monitor:

- Some species are important in a control function because they are large, dominant and numerous
- Species that are rare and endangered are usually endemic to a certain area
- Is there fluctuation or a state of flux?
- Is the species alien or exotic?
- Is it charismatic?
- Is there a focal species?

Wright observed that there are few commonalities in the network and that each site is a small distinct unit. Bert Frost noted that inventory isn't necessarily what we should monitor, but that we should in fact think outside the box. We should look at what can tell the story and recognize that each park has different needs. At the network level, we can help each other.

Pete Penoyer, Water Quality

NPS Hydrologist Pete Penoyer spoke on the oversight of the Water Resources Division and its directions in I&M, vital signs and funding mechanisms. He said vital signs monitoring requires knowing the condition and managing it, with the directive "to protect and improve." Water quality issues can fall under tenets of the Clean Water Act or be stressor/threat based.

He noted that the following core parameters make the most sense:

- Temperature
- Specific conductance
- The pH level
- Dissolved oxygen
- Qualitative flow

The WRD role in data management is to: organize and compile data, plan and assess, design and implement. Penoyer said nominating a water body as an Outstanding Natural Resource Water (ONRW) can identify water quality and also identify water quality problems.

He outlined the keys to success as:

- Have a strong NPS water quality leader
- Use existing water monitoring protocols
- Partner with others
- Target contracts for practical applied monitoring expertise
- Learn from those who have gone before

Pitfalls:

- Developing protocol on your own
- Synoptic work distraction
- Too many workshops
- Co-opting by other researchers

Steve Bunting, Rangeland/Vegetation

UI Rangeland Ecology Professor Steve Bunting presented an overview of previous efforts to inventory and monitor, with most being at a national level. Although he said there have been efforts from such groups as the EPA, Heinz and the Roundtable Network, there is still a lack of data, especially relating to the network parks. Many of the grassland and shrubland studies have concentrated on soil stability, natural cycles and the presence of a recovery mechanism.

He said that Joyce Heitschmidt listed 16 indicators, among them:

- Land area
- Common types
- Fragmentation
- Threatened and endangered species
- Present vegetation cover
- Productivity
- Ground water
- Changes in fire regimes

Bunting said a qualitative assessment should observe the following attributes:

- Soil stability
- Site stability
- Hydrologic function
- Biotic integrity

Indicators should apply to attributes.

"Working Toward Solutions"
Some Work Group Observations

"There's no simple way to do this…" Ed Krumpe, Workshop Facilitator.

After hearing presentations on each area specialty, the main group divided into work groups to address:

- What's the monitoring question you want answered?
- What are the vital signs?

The objective was to avoid talking about methodology and sampling approaches. The protocol will come later. Monitoring questions should be specific, and not too general so as to help identify protocol and monitoring later.

Workshop participants were further charged to work along both network lines and also be more site specific as they developed vital signs and questions. Workshop facilitator Ed Krumpe provided an example of outcome for the soils/geology work group:

Vital Sign: *Biological Soil Crust*
Monitoring Question: *Is the nitrogen and stabilizing capacity of biological soil crusts changing over time?*

Penny Latham noted that vital signs should be justified and that this approach is being seen at the national level. Mike Wissenbach alluded to the example focusing on soil crust and said soil crusts add to the landscape and add another level of questions.

Work groups were assigned as follows (group leader identified under heading):

Vegetation	**Wildlife**	**Soils/Geology**	**Water/Riparian**	**Air/Climate/Land Use**
Bunting (L)	**Wright (L)**	**Heise (L)**	**Penoyer (L)**	**Waddell (L)**
Wolken	Garton	**Biggam (L)**	Braatne	Apel
Gasser	Rodhouse	Davis	Fisher	Lyon
Hilty	Sauder	Coyner	Hyde	Svancara
Latham	Carter	O'Meara	Leonard	VanderVoet
Kopper	Frost	Hughes	Weaver	Trick
Baun		Wissenbach	Garrett	Elwell
		Gruchy	Pearson	Monsanto
(L) – Group Leader				

Student facilitators were Shannon Amberg, Lynn Westerfield, James Gandy, Geremy Frary, Steve Best, Becky Wiles.

Work Group Dynamics

Day One of the workshop focused on goals, recap and special presentations. With goals clearly defined, Day Two divided the group into work groups. Each work group approached objectives differently, so this section describes some of the dynamics of each group in order to show how questions and vital signs were developed.

Soils and Geology

This group began with a general discussion of how both soils and geology relate to other spheres such as water, cultural resources, etc. From there, the NPS soil scientist encouraged group members to look at soils formats from other groups. Others mentioned the more holistic approach developing in resources, which moves away from the limited focus on vegetation and wildlife. The group reiterated the need to choose vital signs and monitoring questions within the contexts of ecological, management and partnerships aspects.

After an hour of discussion, the group had hammered out geological issues as follows:

Glacial	Caves	Hillslope
Seismic	Geothermal	Disturbed lands
Stream	Volcanic	Geological features

The soils list focused on:

Erosion	Soil biota	Soil aggregate stability
Soil compaction	Soil biological crust	Soil hydrophobicity
Soil disturbance/impacts		

At this point, one of the group's two soil scientists noted that soils are more related to plant life than to geologic aspects. The soils people also questioned how certain geologic functions can be monitored, and agreed that soil types find commonality among the parks, while geologic aspects should be evaluated park by park.

Eventually, the network coordinator allowed the soils members to leave the work group and formulate their own vital signs and questions, while the remainder of geology members worked toward separate goals. The division of the two specialties especially benefited the soils group. Because both members had wide field experience and had worked with national soil surveys, they were able to formulate strong questions with accompanying vital signs based on experience.

Later in the group-wide discussion, one of the soils members explained that breaking away from geology enabled them to rank stressors and work with already identified areas of interest. The vegetation link proved a source of good monitoring questions, particularly as soils properties related to invasive species. Soils people also noted links to fire and agricultural practices.

Air/Climate/Land Use

The group leader facilitated her members in immediately identifying several questions, most based on her expertise. Relying on her earlier presentation from Day One, she and group members were quickly able to pinpoint follow-up monitoring questions and developed the following list in the first hour:

- How are the atmospheric emissions from agricultural land use affecting ecosystems? Specifically:
  - Visibility

    - Fertilization
    - Pesticides
    - Acidification
    - Nitrates to surface
    - Ground water
- What air quality data is needed for our affirmative responsibility under the Clean Air Act and our partnership with the regulatory agencies?
- How is air quality affecting historic and natural viewsheds?
- How is air pollution and light pollution affecting night sky?
- How are parks being affected by ozone now and in the future?

After tackling air quality aspects, both the leader and members admitted that they stalled in developing questions on climate because of the group's lack of background in climate issues. In addressing land use, they relied on a matrix to identify areas of concern and cause and effect. The matrix follows:

Land Use Effects	What's Affected?
Ranchette development	Scenic viewshed
Landscape fragmentation	Cultural landscape
Changes in industry	Air quality
Changes in transportation	Soundscape
Livestock	Visitors
Recreational preferences	Range health
Encroachment	Water availability

An emerging question: How is public and private land use on adjacent land affecting the parks?

Furthermore, how are changes in recreational uses and activities affecting park resources (for example, how is rock climbing affecting City of Rocks?).

It is noteworthy that this group developed no site-specific monitoring questions, but did gather valid commonalities to formulate several questions. The matrix seemed to jell thinking and might help in developing further network-wide and site-specific vital signs and monitoring questions.

Water Resources/Riparian

Discussions revolved around park managers wanting to be involved in monitoring, as the work group approached its goals. The group facilitator noted that financial resources in each of the network parks to manage water resources is limited and many issues depend on park policy.

An hour into the session, the group was focused on sorting out water issues such as seasonal water patterns, water fluxes and differences from historic conditions. Because of varied management policies, some felt such items couldn't be monitored as vital signs.

One group member suggested differentiating between anthropogenic and natural, and felt core parameters can tell basic information about streams, etc. Such things as channel flow and sediment distribution might help develop profiles and dimensions to be maintained.

An abundance of water regulation and law was brought up, with these key considerations:

- Water rights and adjudication
- Cultural landscape
- Regulation and legislative limitation mandates
- Cooperators/neighbors
- Staff limitations

The group agreed to brainstorm, develop 10 questions, and then fine-tune further. One member of the group felt baselines were needed to note changes and others agreed that changes in staff, new programs and staff and agency turnover often made it a "reinvent the wheel" scenario. The NPS hydrologist said this program was to remedy that situation and provide coordinated documentation.

Another member brought up riparian management field experience based on compatible users and agencies. He felt that might provide a model from which to work on possible partnership aspects.

Wildlife

Members of the group began discussions around species population status, distribution of threatened and endangered species, and species of concern. Bats were also discussed. The group decided it was best to zero in on resident species and species of concern for each park, due to the variability of wildlife at each site.

Discussions centered on:

- Key species
- Habitat types
- Groups of species that are vulnerable

There was also discussion on distribution, which in some cases is already known, as contrasted with abundance. This distinction should be reflected in monitoring questions, as well.

The group began its questions with:

- What is the population status of species of concern within each park?
- The species of concern within a park is part of a group habitat

Vegetation

The vegetation group wrestled with a variety of issues, but a strong discussion emerged early in the session on sagebrush because of its presence at most sites. Members noted the links between soils and plant life, and also discussed sagebrush communities, boundaries and other aspects.

Concerning monitoring, some felt there should be baselines and that such information might already exist in other surveys. The hope was to keep inventories simple with perhaps aerial photography every five years because it is relatively inexpensive and can be contracted out. Further, fire regime conditions and classifications can be used as an analysis tool for landscape level monitoring. This brought on more in-depth discussion about what is meant by landscape and watershed, because some felt it was perceived differently at each park.

One question began to take shape on what vegetation should look like and how dysfunctionality might be assessed. The hope was to bring monitoring down to a manageable level, with partnerships again desirable to help defray costs.

Working well into the session, the group had trouble finding commonality because vegetation covers a broad spectrum at the network sites. The general focuses that emerged were:

- Nutrient cycles
- Invasive species
- Plant communities in flux
- Altered hydrological regimes
- Fire regimes
- Plant diversity

Links were again discussed between soil, hydrology, fire and climate. Getting more specific, the group thought it would be worthwhile to distinguish between human-imposed hydrological conditions and natural ones.

Final Session

After the various work groups brainstormed through the morning session, they reconvened in the afternoon, breaking into new groups that reflected other areas of interest. This was to maximize expertise and also draw people into new thinking patterns. "Think outside the box" in other words. After the second session ended, the whole group met to evaluate questions developed in the various work groups. Questions were put up on a screen and subjected to group scrutiny, with some questions obviously repeated by different groups.

Geology identified no vital signs, but developed a dozen questions. The group worked park by park because geologic attributes were clearly distinct. In one comment, a member outside the geology group noted that most questions seemed to involve monitoring in the context of a cultural resource rather than according to geological processes. Questions were rephrased by the general group, and duplicate questions were eliminated. Once again, group members noted the difficulty in monitoring geological processes, but wondered about issues such as gullification and erosion.

The soils group illustrated the idea of developing questions with a network-wide focus, and showed the integration of soils with other elements such as plant life and species of

concern. Members of the soils group noted that they looked at the ranking of stressors and made links, which the group at large agreed could make protocols and monitoring easier, more efficient and less costly.

The water quality group acknowledged how much their questions were related to legal mandates and use. They felt questions should involve how waters are being maintained and how they're changing.

The air quality group's matrix was viewed as a positive help in developing further monitoring questions. Again, the group pointed to legal mandates as a heavy influence in building appropriate monitoring questions.

The vegetation group acknowledged the difficulty in devising questions that went from general to specific, but felt a legitimate focus could be on invasive species and natives, and frequency of invasions. The group at large suggested that a more specific question might be: Are isolated kipukas being invaded by non-native plant species?

Common threads found in the general wrap-up included:

- Difficulty in thinking beyond a specialty or area of expertise
- Moving from general to specific
- Working within legal mandates and the tangle of uses and laws
- Maximizing potential by linking elements such as soils and vegetation
- Park operations and vital signs aren't always in harmony

The late afternoon session was devoted to compiling a list of vital signs and monitoring questions with input from the workgroups. A spreadsheet was projected at the front of the room and group leaders assisted in writing up the monitoring questions that were formulated in their group. The final list contained over 100 questions. This list will be further refined and placed on a website for additional input. As the workshop concluded, all agreed there is more work to do, but a beginning group of vital signs and questions was developed as a starting point.