chemistry parameters in the North Fork Big Hole River including: dissolved oxygen, pH, specific conductance, temperature, and turbidity. Each parameter was evaluated hourly between the months of June and October using a continuous water quality monitor. In addition, aquatic macroinvertebrates were collected using the EPA's Environmental Monitoring and Assessment Program (EMAP) protocol.

Results indicate that most core parameters are within state regulatory thresholds; however, dissolved oxygen levels are slightly below the suggested threshold.

The lack of historical water chemistry data from the North Fork Big Hole River limits comparisons between data collected in 2009 and the state regulatory thresholds. Low dissolved oxygen levels may indicate that water temperatures are elevated relative to "naturally occurring" conditions. Heavy rain on recently burned upstream areas increased turbidity levels in late July and early August.

Wetlands: Detailed wetland mapping for Big Hole has not been completed under the NWI (Bon 2004, USFWS 2004b in NPS BIHO 2005). According to the NPS (2002a in NPS BIHO 2005), wetland and riparian areas exist in the valley bottomland occupied by the North Fork. In addition, approximately 3.5 acres of incidental wetlands have been created by the seasonal leakage from Canals 1 and 2. This accounts for less than five percent of the total estimated wetlands, both natural and incidental, within Big Hole. As reported by ACOE (Steinle 2005 in NPS BIHO 2005), Canals 1 and 2 and their associated wetlands are not jurisdictional waters of the U.S. (NPS BIHO 2005).

Floodplains: There are no FIRM for Beaverhead County, Montana. Much of the lower meadow area surrounding the North Fork of the Big Hole River, however, is prone to seasonal flooding from high run-off events. This includes much of the lower Nez Perce encampment area on the eastern edge of the meadow.

B. Biological Resources

1. Vegetation

a. City of Rocks Vegetation

The reserve contains low rolling grasslands, interspersed with sagebrush and dense sagebrush scrub in lower elevations, while higher elevations contain stands of pinon pine and Rocky Mountain juniper. The northern end of the reserve contains lush grasslands near springs, and occasional aspen groves. Most vegetation within the reserve, except in steep rocky areas, has been dramatically altered from intense grazing, dryland farming, fire suppression, brush control, seeding, development of roads and trails and camping.

An elevation range of 3,147 feet in a variety of exposures, together with protruding granite rock monoliths, has resulted in the identification of eight major plant communities in the reserve. The dominant plant communities and their areal extent include:

- big sagebrush / grasslands (37 percent),
- pinon / juniper woodland / forest (37 percent),
- mixed scrub (8.7 percent), 4) conifer/aspen woodlands (6.8 percent),
- riparian scrub / herbaceous wetlands (2.6 percent),
- mountain mahogany scrub (2.4 percent),
- high elevation meadows (2 percent), and
- unvegetated areas (3.8 percent) (NPS CIRO 1994).

The reserve's vegetation map, produced in 1992, has not been ground-truthed.

Big sagebrush / grasslands: This community occurs in the Circle Creek basin and upper Emigrant Canyon. With an understory of native perennial grasses, it formerly comprised much of the landscape of the reserve. Today the community is highly degraded, with an understory of native and nonnative forbs and grasses, including native rabbitbrush and tansy mustard and nonnative Russian thistle, peppergrass, cheatgrass, halogeton, and crested wheatgrass.

Pinon / juniper woodland / forest: This community occurs in rockier areas, with steeper slopes. The woodlands are dominated by single-leaf pinon pine and Utah juniper interspersed with mountain big sagebrush, curl-leaf mountain mahogany, Rocky Mountain juniper, chokecherry, bluebunch wheatgrass, and Great Basin wild rye. Within the reserve is the northernmost extent of the single-leaf pinon pine.

Mixed scrub: Higher slopes are covered with mountain big sagebrush, mountain snowberry, serviceberry, and bitterbrush, growing in association with other shrubs, grasses and forbs.

Conifer/aspen woodlands: This community is characterized by groves of aspen, stands of Douglas-fir and lodgepole pine and open meadows, located in the upper stony / grassy slopes in the reserve. Aspen occurs in steep canyons with intermittent or perennial streams. Narrowleaf poplar, thinleaf alder, serviceberry, chokecherry, snowberry and Rocky Mountain juniper comprise the understory.

Riparian scrub / herbaceous wetlands: These areas border intermittent and perennial streams and springs, a transition zone between aquatic and terrestrial communities and have been adversely affected by erosion from overgrazing. Typical species include aspen, willow, chokecherry, rushes, sedges and bluegrasses.

Mountain mahogany scrub: Pure stands of curl-leaf mountain mahogany occur adjacent to or surrounded by pinon / juniper woodlands in less rocky or steep areas. Species found in association, include limber pine, mountain snowberry, Idaho fescue and bluebunch wheatgrass.

High elevation meadows: Mountain meadows contain a variety of native grasses, sedges and forbs, including nonnative invasive plants such as wheatgrass, cheatgrass, halogeton, and others.

Unvegetated areas: Exposed rock formations, often including lichens and mining spoils areas comprise this community type.

Nonnative invasive plants: The NRM-EPMT summary lists 59 acres, but it is likely that a much greater area of the reserve is affected. A recent NPS Project Management Information System (PMIS) statement listed 11,000 acres (Tim Bennett pers. comm. 2007). Among the nonnative invasive plants that have been introduced to or which have invaded the reserve include: cheatgrass, common burdock, Russian olive, kochia, common mullein, and crested wheatgrass. Instead of its native perennial grasses understory, these species and others now comprise the understory in the big sagebrush community.

Canada thistle is the most pervasive noxious weed in the reserve; efforts are being made to control this species. Spotted knapweed is the most invasive noxious weed threatening City of Rocks for which eradication is likely. Other invasive weed threats include houndstongue, black henbane, and Scotch and musk thistles. A single invasive saltcedar tree was removed from City of Rocks and the reserve must continually monitor for the threat of saltcedar and other new invaders such as dyers woad and leafy spurge from surrounding lands. Cheatgrass has increased dramatically and continues to spread throughout the shrub-steppe habitat of the Great Basin in Idaho, disturbing and shortening the normal fire regimes from 60-110 years to about every 3-5 years, diminishing desirable vegetation by creating cheatgrass monocultures such that some animals dependent on the desirable vegetation have been reduced or even eliminated (Kurdila 1995; Vitousek *et al.* 1996, 1997; Whisenant 1990 in NPS CIRO 2006).

b. Craters of the Moon Vegetation

Although the wide expanses of lava at first seem to be nearly devoid of vegetation, monument vegetation is diverse, encompassing a wide variety of species and habitats (Figure 26). Because of the geology, topography and climate, the presence of vegetation is highly dependent on the availability and depth of soil. It varies from the unique kipukas (islands of vegetation surrounded by lava flows), to parks (large kipukas), to rangelands dominated by sagebrush, grasses and forbs that surround the edges of the lava flows to scattered limber pine (*Pinus flexilis*), to small stands of Douglas-fir (*Pseudotsuga menziesii*) and quaking aspen (*Populus tremuloides*) on some north facing slopes in the northern portion of the monument (NPS CRMO 2005:112-113).

Five major vegetation types (including at least 35 different vegetation communities and 785 species of plants) have been identified in the monument:

1) Vegetated lava complex (53 percent)
2) Sagebrush steppe complex (60 percent)
3) Grasslands complex
4) Mountain complex, and
5) Cinder cone complex.

Vegetated Lava Complex: This vegetation type is found in approximately 53 percent of the monument and contains both exposed (unvegetated) lava and vegetated lava. Exposed lava flows are generally devoid of trees, shrubs and forbs, but containing lichens and mosses. Vegetated lava is defined as lava fields that contain greater than five percent cover. Within it, plants occur as islands, pockets or clustered individuals in the lava flow. It primarily consists of early successional or adaptable plants that can grow in the limited windblown soil that occurs in cracks and crevices within the basalt.

Characteristic plants depend on the type of lava and the amount of soil and may include Penstemon (*Penstemon* sp.), gland cinquefoil (*Potentilla glandulosa*), fern-bush (*Chamaebatiaria millefolium*) and rock spirea (*Holodiscus dumosus*). Where soil development or deposition has occurred, trees or shrubs may be found.

Sagebrush Steppe Complex: A portion of the proposed project area is within the sagebrush steppe complex. Sagebrush steppe is found over approximately 60 percent of the monument, on the more developed soils of the rangelands, kipukas, cinder cones, older lava flows and in the foothills of the Pioneer Mountains. Although it was once more common, fire, agriculture and livestock grazing have reduced its extent and modified its composition (NPS CRMO 2005:113). Pre-settlement sagebrush steppe may be found in isolated kipukas that have not been subject to these practices. In fact, due to disturbance in southern Idaho by cultivation, fire and weed invasion, some of the sagebrush steppe communities in the monument are the best remaining examples of this vegetation type in the Snake River Plain (NPS CRMO 2005:115).

Although sagebrush steppe appears to be a monotonous landscape, there is a remarkable diversity of plant and community types. Numerous factors influence the diversity, density, cover, distribution and health of this plant community, including differences in soil depth and development; precipitation (8-16 inches); elevation (4,000-7,500 feet); historical and current land management; the presence of invasive species; and fire frequency. Vegetation structure and composition in turn influence the ability of sagebrush steppe to resist invasive species invasion, as well as to recover from fire and land management practices (NPS CRMO 2005:115-116).

Three species of sagebrush dominate this vegetation type in the monument: mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), basin big sagebrush (*Artemisia tridentata ssp. tridentata*) and Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*). Other co-dominants include low sagebrush (*Artemisia arbuscula*), antelope bitterbrush (*Purshia tridentata*), three-tip sagebrush (*Artemisia tripartita*), rubber rabbitbrush (*Chrysothamnus nauseosus*) and green rabbitbrush (*Chrysothamnus viscidiflorus*). Forbs and grasses vary widely in sagebrush steppe, but often include Sandberg bluegrass

(*Poa secunda*), Idaho fescue (*Festuca idahoensis*), needlegrasses (*Achnatherum* sp.), bluebunch wheatgrass (*Pseudoroegneria spicata*), buckwheats (*Eriogonum* sp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), lupine (*Lupinus* sp.), phlox (*Phlox* sp.), and milk vetches (*Astragalus* sp.).

Grasslands Complex: This vegetation type is dominated by native or introduced perennial grasses. Historically these grasslands were part of the sagebrush steppe complex and formed as a result of disturbance, primarily fire. Shrubs would eventually reinvade these areas if they remained free of fire for several decades. The annual grassland type is also the result of disturbance to the soil surface or from fire. At Craters of the Moon, this type is dominated by cheatgrass, an exotic species that perpetuates shorter fire return intervals and conditions that maintain its dominance.

Mountain Complex: This complex includes five vegetation types: Douglas-fir, Aspen, Riparian, Mountain Shrub, and Wetland. The Douglas-fir type is found on relatively steep, north-facing slopes of older cinder cones and along Little Cottonwood Creek. Aspen is predominantly found in upland sites away from perennial streams. Riparian is characterized by dense woody vegetation, including cottonwood, chokecherry, willow, alder and a dense layer of tall forbs adjacent to perennial streams. Mountain Shrub includes mountain big sagebrush, low sagebrush, and mountain snowberry and occupies slopes and ridges of the Pioneer Mountains. Wetlands occur intermittently, primarily along the northern edges of the monument.

Cinder Cone Complex: This complex includes three different plant communities – cinder gardens, limber pine type and mid- to high elevation sagebrush steppe communities. Cinder gardens (less than one percent of the monument) produce spectacular spring wildflower displays and are dominated by dwarf buckwheat, scorpion weed, Douglas chaenactis, dwarf monkeyflower, and bitterroot.

Nonnative and Invasive Plants

Nonnative Invasive Species: Thirteen state-listed noxious plants are known to occur in the monument. Disturbed areas, including road rights-of-way are particularly susceptible to the invasion of these species. Most noxious weeds are found in these disturbed areas, intensively grazed areas and areas subject to frequent burning. Specifically, over 200 infestations of spotted and diffuse knapweed occur along U.S. Highway 20/26/93. NPS staff, in cooperation with Lost River and Blaine County Cooperative Weed Management Areas, has mapped and continues to treat these areas. Other troublesome nonnative invasive plants include: Russian knapweed, rush skeletonweed, dyers woad, leafy spurge, Canada thistle, Scotch thistle, and field bindweed. Cheatgrass, although not a state-listed noxious weed, is extremely competitive and readily invades and dominates disturbed areas.

The recently (2006) reconstructed portion of U.S. Highway 20/26/93 road shoulder was reseeded by the Idaho Transportation Department with native grasses, including bluebunch wheatgrass, Sandberg bluegrass, Indian ricegrass, and bottlebrush squirreltail. Many nonnative plants, however, are also invading the recently disturbed roadside. Cheatgrass, spotted and diffuse knapweed have been noted.

Leafy spurge, dyers woad, rush skeletonweed and diffuse, spotted and Russian knapweeds are noxious weeds threatening native ecosystems at Craters of the Moon. Rush skeletonweed, dyers woad and leafy spurge threaten benchmark plant communities-resources identified in the parks enabling proclamation. Failure to manage these noxious nonnatives to protect benchmark communities could result in permanent damage to native plant communities. According to a recent Invasive Plant Strategy Report compiled by the Western Forestry Leadership Coalition, rush skeletonweed has spread from 40 acres to four million acres in Idaho in just three short decades. Left unchecked, rush skeletonweed can form dense monocultures on rangelands and displace native plants. Leafy spurge population changes indicate that infestations are doubling every 10 years and in some cases every five years (Anderson *et. al.* 1999 in NPS CRMO 2005). Canada and scotch thistles, cheatgrass and common mullein also threaten the park at this time. All nonnative species require vigilant monitoring and control to protect weed-free sagebrush steppe habitat.

There are 212 taxa at Craters of the Moon that have been identified as exhibiting some level of "weedyness," The "weedyness" of 11 of the 212 remains to be verified. Of plants recognized as noxious in Idaho, there are 19 noxious weeds entered in the NPSpecies database, of which 13 occur in Craters of the Moon (Table 36: *Idaho Noxious Weeds at Craters of the Moon*). Four are encroaching, and two are falsely reported (Popovich 2008 in NPS CRMO 2005).

In addition, there are 62 taxa entered in the NPSpecies database that are or may have been seeded or planted within Craters of the Moon (see Popovich 2008 in NPS CRMO 2005). Five are unconfirmed, two are falsely reported, and one is believed historic. About 28 are native to Craters of the Moon and occur naturally, and about 34 are or may be nonnative to Craters of the Moon, some of which are not native to North America. Most seeding is performed by the BLM on BLM-administered land. In all cases, taxa seeded or planted in Craters of the Moon historically had nearly all source material used that came from off-site, which cannot and should not be considered local genotypes. Seeding or planting efforts by the NPS attempt to use plant materials native to the Snake River Plain, and desire to use material collected on site to preserve local genotypic material. Recognition and attempted use of local or regional native plant material substantially increased in the BLM in the 1990's, and continues to be stressed today (Popovich 2008 in NPS CRMO 2005).

Table 36: Idaho Noxious Weed Status at Craters of the Moon

Family	*Scientific Name*	Idaho Listing	Park Status
Asteraceae	*Acroptilon repens*	Control	Present in Park
Asteraceae	*Ambrosia tomentosa*	Control	False Report
Brassicaceae	*Berteroa incana*	Contain	Encroaching
Brassicaceae	*Cardaria draba*	Contain	Encroaching
Asteraceae	*Carduus nutans*	Control	Present in Park
Asteraceae	*Centaurea diffusa*	Contain	Present in Park
Asteraceae	*Centaurea stoebe*	Contain	Present in Park
Asteraceae	*Centaurea solstitialis*	Contain	Encroaching
Asteraceae	*Chondrilla juncea*	Contain	Present in Park
Asteraceae	*Cirsium arvense*	Contain	Present in Park
Convolvulaceae	*Convolvulus arvensis*	Contain	Present in Park
Boraginaceae	*Cynoglossum officinale*	Contain	Present in Park
Euphorbiaceae	*Euphorbia esula*	Contain	Present in Park
Solanaceae	*Hyoscyamus niger*	Control	Present in Park
Brassicaceae	*Isatis tinctoria*	Control	Present in Park
Scrophulariaceae	*Linaria genistifolia ssp. dalmatica*	Contain	Present in Park
Asteraceae	*Onopordum acanthium*	Contain	Present in Park
Lamiaceae	*Salvia aethiopis*	Control	Encroaching
Asteraceae	*Sonchus arvensis*	Control	False Report

From Popovich 2008

Figure 26: Craters of the Moon Vegetation Map

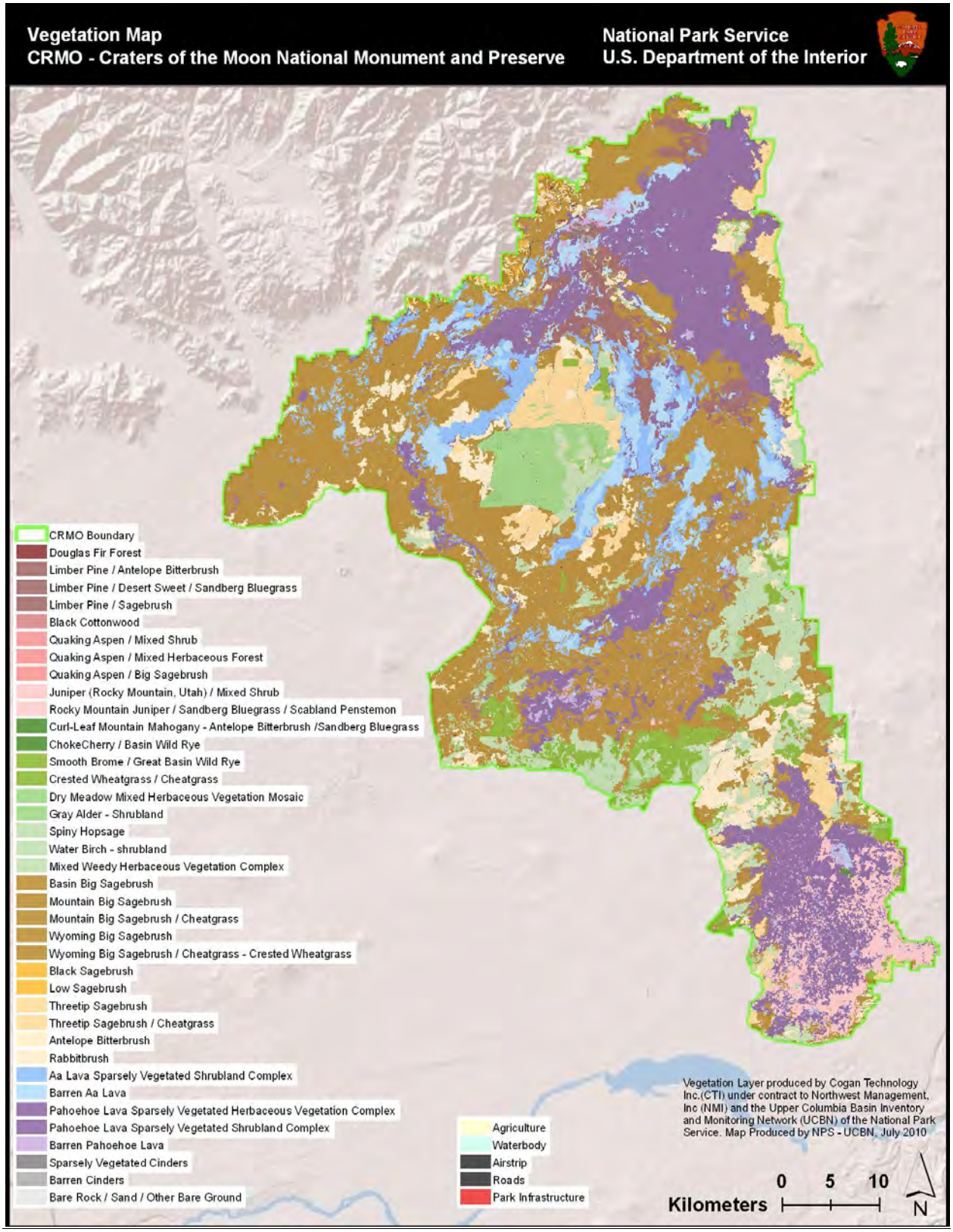
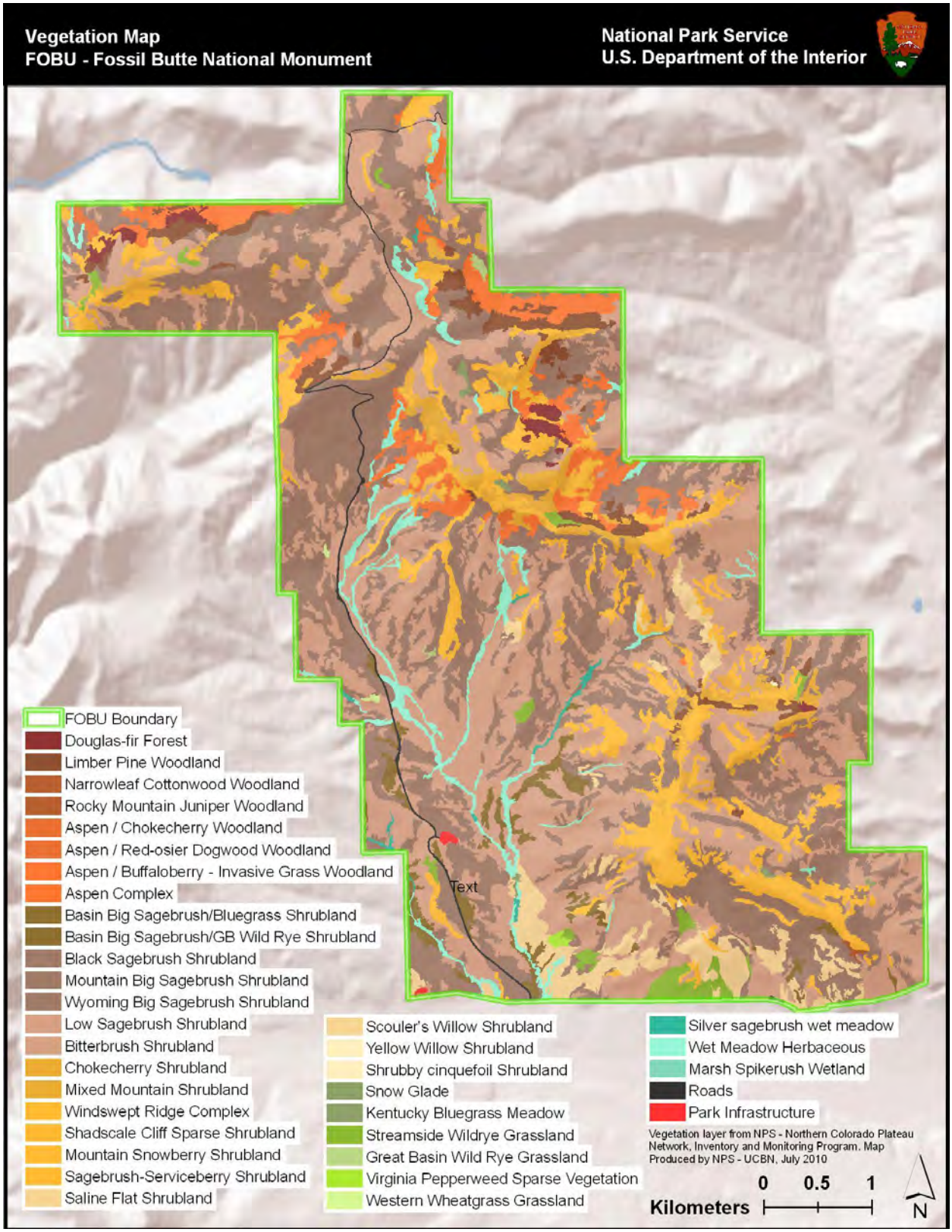


Figure 27: Fossil Butte Vegetation Map



c. Fossil Butte Vegetation

Approximately 530 taxa, 68 families, and 257 genera of plants are documented by specimen records in Fossil Butte. FOBU vegetation was originally mapped in 1984 by Dorn (in NPS FOBU 2005) who described 14 types. In 2010 FOBU vegetation was remapped using modern methods which resulted in 71 vegetation associations (Friesen *et al.* 2010 in NPS FOBU 2005). During this project 71 plant associations were recognized.

1) Mixed Timber
2) Aspen
3) Cottonwood
4) Willow
5) Alkali Sagebrush (low sage)
6) Basin Big Sagebrush
7) Mountain Big Sagebrush
8) Mountain Shrub
9) Grass / Forb
10) Aquatic (rooted in water)
11) Barren
12) Saline
13) Wet Meadow
14) Disturbed

The distribution of these vegetation types is controlled primarily by the depth, clay, and moisture content of the soil, but some types, like the Barren type, which occurs on ridgetops, are also controlled by the force of the wind (www.nps.gov/fobu).

Aspen groves and mixed conifer forest dominated by limber pine and/or Douglas fir occupy steep, northfacing slopes and sites where the soil depth, texture, and moisture levels favor the growth of these species (NPS FOBU 2005:20).

Mixed Timber: Mixed Timber type occurs primarily on steep north-facing and east-facing slopes where soils are shallow, and often calcareous. Limber pine (*Pinus flexilis*), Douglas fir (*Pseudotsuga menziesii*), and aspen dominate the Mixed Timber type. Mountain Shrub type occurs on sites similar to those that support the Mixed Timber. It appears to be a successional precursor to the Mixed Timber type because it sometimes dominates burned areas that once supported stands of the Aspen and Mixed Timber types. Also, conifer seedlings are seen in many areas currently supporting Mountain Shrub communities. Mountain mahogany (*Cercocarpus montanus*), Utah serviceberry (*Amelanchier utahensis*), and mountain snowberry (*Symphoricarps oreophilus*) are the dominant shrubs in the Mountain Shrub type.

The largest of the 15 stands of mixed timber, composed primarily of conifers, but including minor amounts of aspen, is approximately 80 acres in extent. This stand is located on the northern side of Ruby Point. Twelve isolated stands of mixed timber, each smaller than 20 acres, are irregularly dispersed throughout the remainder of the monument (NPS FOBU 2005:20).

Aspen: The Aspen type occurs on mesic sites in these scenarios: along the base of Cundick Ridge and in valleys below springs and seeps, below ridges where the prevailing west wind causes snow accumulation during winters with average (or more) snowfall and wind, and on north-facing slopes which remain in shadow throughout much of the day. The Aspen type is dominated by aspen trees (*Populus tremuloides*).

Aspen and mixed conifer forests occur mostly on north and east-facing slopes and mesic sites along the southwest-facing slopes of Cundick Ridge. Forty-three stands of aspen are present on the monument. Only three stands of aspen exceed 25 acres in area. The largest stand is approximately 80 acres; 27 stands are smaller than 10 acres each (NPS FOBU 2005:20).

Cottonwood and Willow: The Cottonwood and Willow vegetation types occupy, at most, a few acres where seepage or artesian springs keep the soil rather wet.

Sagebrush Communities: Three sagebrush communities dominate the monument's landscape. The Basin Big Sagebrush type (2,573 acres) occurs below approximately 7200 feet of elevation on sites with deep, loamy, fertile soils. It is dominated by basin big sage (*Artemesia tridentata* ssp. *tridentata*), bluegrasses (*Pseudoroegneria* sp.) and wheatgrasses (*Elymus* sp.).

The Mountain Big Sagebrush type (1,338 acres), dominated by mountain big sagebrush (*Artemesia tridentata* ssp. *vaseyana*) occupies sites above 7,200 feet having characteristics similar to sites supporting the Basin Big Sagebrush type. Various wheatgrasses, bluegrasses, and forbs are present in the understory.

The Alkali Sagebrush type (2,031 acres), dominated by low sagebrush (*Artemesia arbuscula*) occurs on deep, clay soils at all elevations. This type occurs on soils with higher salinity and alkalinity than the other sagebrush types.

Mountain Shrub: Stands of mountain shrub, dominated by Serviceberry, generally occur on the lee sides of ridges where meltwater from drifting snow elevates the soil moisture content. The largest stand of mountain shrub is approximately 50 acres in extent. However, the majority of the stands of mountain shrub on the monument are smaller than 25 acres (NPS FOBU 2005:20).

Grass /Forb: This type is dominated by Sandberg bluegrass (*Pseudoroegneria sandbergii*), but Indian ricegrass *(Achnatherum hymenoides)* and wheatgrasses are also present. Common forbs include stemless goldenweed *(Stenotus acaulis var. acaulis)*, Hood's phlox (*Phlox hoodii*), and starveling milkvetch (*Astragalus jejenus*). This type thrives on drier sites with shallow soil, such as rocky ridges. The Grass/Forb type also exists where fire has burned shrubby vegetation types. Rock outcrops and barren windswept ridges were mapped as the Barren type. Some areas are nearly devoid of vegetation; others support widely-spaced cushion plants, grasses, and forbs such as tufted twinpod (*Physaria condensata*) (www.nps.gov/fobu).

At least 60 different species of grasses occur on the monument. Not all species of grasses occur in grass-dominated vegetation (grasslands), and the species composition of the monument's grasslands varies from place-to-place. Generally, the monument's grasslands are relatively sparse. They generally occur on shallow soils along ridgetops, and areas where sediments are being actively deposited (alluvial fans). The monument's grasslands are composed primarily of native wheatgrasses (*Elymus* sp.), bluegrasses (*Poa* sp.), needlegrasses (*Achnatherum* sp., *Nassella viridula*), Junegrass (*Koelaria macrantha*), and Western grass (*Leucopoa kingii*). Grasslands within the monument boundary are predicted to have higher fuel content than grasslands beyond the monument boundary because domestic livestock have been excluded from the monument since 1989. However, the monument's grasslands are still predicted to burn unpredictably because the vegetation is not dense even though it is not heavily grazed (NPS FOBU 2005:20).

Aquatic: This area includes wetland herbaceous vegetation dominated by sedges such as *Carex utriculata* or *C. nebrascensis*, *Eleocharis palustris*, *Hordeum brachyantherum*, grasses such as *Elymus* sp. *Poa* sp. or rushes like *Juncus balticus*. It occurs around the margins of permanently or semi permanently flooded livestock or beaver ponds. It also includes herbaceous vegetation growing in active channels, saturated drainages or swales or associated with seeps and springs, such as Juncus communities in dense stands on Chicken and Smallpox creeks and their tributaries.

Barren: This area, mostly on windswept ridges is generally devoid of vegetation. Steep outcrops of the fossiliferous Green River Formation, which contain little vegetation, are part of the Barren vegetation type.

Saline: The Saline type is dominated by black greasewood (*Sarcobatus vermiculatus*) and Gardner's saltbush (*Atriplex gardneri*). Saline vegetation is usually sparse, and there are usually patches of barren ground where the soil is encrusted with white deposits of salt (www.nps.gov/fobu).

Wet Meadow: The Wet Meadow type is dominated by Baltic rush (*Juncus balticus*) and sedge species (*Carex sp.*). Many other forb and grass species are present in the Wet Meadow community. Silver sagebrush (*Artemisia cana*) dominates drier sites, and willow species (*Salix sp.*) sometimes occur in more mesic sites.

Nonnative Species: The draft Vegetation Management Plan (Kyte 2001) states that five species on the Wyoming noxious weed list are relatively abundant in the monument. These include Canada thistle, musk thistle, henbane, spotted knapweed, and houndstongue. Most park management documents include direction to reduce the occurrence and dominance of nonnative species. Kyte (2001) recommends a management scheme that includes survey (inventory), monitoring, and restoration of areas dominated by nonnative species. Restoration methods or techniques identified by Kyte (2001) include hand-pulling, biological agents, mowing and other mechanical treatments, and chemical treatments.

Disturbed: Vegetation occupying land disturbed by construction, roads, over-use by cattle, etc.

The following vegetation map created by the Inventory and Monitoring Program for Fossil Butte is based on a more detailed vegetation classification system.

d. Golden Spike Vegetation

Golden Spike is located in Sagebrush Steppe. In the park vegetation is primarily comprised of rabbitbrush (*Chrysothamnus nauseous* and *C. viscidiflorus*), sagebrush (*Artemisia sp.*), with broom snake weed (*Gutierrezia sarothrae*), but also includes Utah juniper (*Juniperus osteogperma*). Perennial and annual grasses are also found, including Indian ricegrass (*Oryzopsis hymenoides*) and wheatgrass (*Agropyron sp.*). Approximately 69 percent of the plants inventoried within the Golden Spike boundary are native (NPS GOSP 2000).

Nonnative Vegetation: A number of nonnative annual and perennial species are also dominant, including Canada thistle, musk thistle, Scotch thistle, dyers woad, field bindweed, crested wheatgrass, Japanese brome, cheatgrass, yellow sweetclover and flixweed, and Russian thistle (Invasive Exotic Plant Monitoring at Golden Spike NHS: 2008 Pilot Field Season).

The following description is taken from the Golden Spike CLR (NPS GOSP 2000):

Historic Vegetation: A few written descriptions and photographs describe the vegetation at the time of the construction and early use of the transcontinental railroad. Isaac Morris, a commissioner who visited the area in May of 1869 described the summit as "covered with artemisia" or sagebrush. Surveyors' maps of the area give few clues to the distribution of native plants across the landscape other than notations such as "shrubby sage and grease wood" and "fine pasture lands." Historical photographs of the area show mixed stands of shrubby plants (presumably sagebrush and rabbitbrush or broom snakeweed) and grasses.

Construction activities did impact the native vegetation both within and adjacent to the right-of-way corridor as indicated by historical photographs. Photos of the area in the vicinity of Promontory Summit taken soon after completion of the transcontinental line, shows a strip of land almost denuded of vegetation — likely due to trampling by people, wagons and draft animals. Beyond the denuded strips, a low-growing variety of sagebrush is visible, possibly the variety referred to by local ranchers as "horse" sage. However, even in these areas, the grasses that one would expect to see in a mixed sagebrush steppe environment are not apparent in the photographs.

Beyond the railroad right-of-way, one of the consequences to settlement of the area was the introduction of large herds of cattle. By the 1880s overstocking had depleted the native grasses and an extremely hard winter in 1888 resulted in the loss of several thousand head. Although the number of cattle on the range subsequently decreased, the area continued to be used for grazing through the entirety of the historical period. A consequence of grazing has been a shift in the distribution of native plants. Overall, there appears to be a proportional increase in the density of native shrubs, and a decrease in the density of native grasses.

Ornamental Vegetation: Introduced landscaping appears limited to the Promontory Summit area. During the settlement period, permanent residents of Promontory Station introduced a number of hearty native and nonnative plants to the area. Box elder trees (*Acer negundo*) were planted to provide

shade. Two of these remain from the historic period. In addition, a nonnative shrub known by the common name of "matrimony vine" (*Lycium barbarum*) was planted around various buildings and structures at the station. Some of matrimony vine is still present. A golden currant bush marks the general vicinity of the Golden Hotel later operated as the Houghton Store.

The NPS has added foundation plantings around the visitor center to soften the edges of the new building, and the asphalt surface of the parking area is divided by planted islands. Mostly native species, such as sagebrush and juniper were used in the landscaping adjacent to the visitor center and in the planting islands. Exceptions include the strip of grass lawn near the front, rear and east end of the visitor center, and the lawn and gardens surrounding the ranger's residence.

Agricultural Vegetation: By the turn of the century the lands along the railroad were being cultivated for dryland farming. The introduction of this method of farming marks the first deliberate large-scale introduction of nonnative plant species into the railroad right-of-way and on adjacent lands. Although the railroad owned all of the lands within the right-of-way, there is no indication that it was fenced. Thus, it was not unusual for adjacent landowners to cultivate right up to the base of the grade. In the historic period, principal crops grown in fields adjacent to the right-of-way primarily included wheat and oats, with some barley. Upon establishment of the park this practice was discontinued and some boundary areas were marked with fencing.

e. Grant-Kohrs Ranch Vegetation

The ranch is comprised of a variety of different plant communities (Figure 28). These include the irrigated hay fields, dry ranges, riparian woodlands, wetlands, and domestic landscapes. Variations in plant communities relate to the availability of water (whether natural or irrigated), as well as variations in soil type and cultural influences. Although areas of native grasses still remain, exotic grass species dominate the meadows and upland areas of the Grant-Kohrs. Major hay species found on the ranch consist of smooth brome (*Bromus inermis*), common timothy (*Phleum partense*), redtop bentgrass (*Agrostis alba*), and white clover (*Trifolium repens*). These species are found in fields where irrigation ditches provide the water necessary to sustain their agricultural production. The predominant pasture species consist of Kentucky bluegrass (*Poa pratensis*), redtop bentgrass, smooth brome, crested wheatgrass (*Agropyron cristatum*), and white clover. These grasses are generally found on the upland areas of the ranch that are not irrigated with surface ditches. The front fields, hand irrigated with water lines connected to the effluent ponds, also contain these species. Although all of these predominant meadow and pasture grasses are exotic species, a few natives, such as bluebunch wheatgrass, western wheatgrass (*Agropyron smithii*), and needle-and thread grass (*Stipa comata*) can still be found in these areas. This is particularly true within the Upland Pasture area west of the Clark Fork River. One small area (27 acres) inside the park boundary remains as the only relatively intact piece of native prairie. This area had been fenced, and thus ungrazed for many years. A portion of it was historically used as a barrow pit for the adjacent railroad bed. This parcel contains the native grasses and forbs found in the inter-mountain region. In contrast to the shrubby vegetation found along the riparian corridor, the cattail-laden wetland, and rolling fields of pasture grasses, the landscapes of the home ranch and the Warren house provide an abundance of domestic plants found nowhere else on the property. These include tree species such as the pine, spruce, ash, birch, and maple, as well as several other native and nonnative shrubs and perennials. As mentioned earlier, young black cottonwoods dominate the front yard of the home ranch. Juniper, boxelder, ash, willow, and spruce also surround the home. Like the Warren complex, the home ranch has several native and nonnative shrubs and perennials in the garden, including lilacs and barberries. (NPS GRKO 2004b)

A total of 341 taxa have been identified on the Ranch -- 12 to the genus level and 329 to species. These vascular flora represent 210 genera and 59 families. The numbers of newly observed species in each year were: 159 (1983), 87 (2000), 16 (2001), and 79 (2002). Life-form categories include five spore-bearing taxa, six tree species, 29 shrub species, 67 graminoid (grass, sedge, rush) taxa, and 234 species of forbs. Eighty-six species are exotic to North America and constitute 25 percent of the taxa. Of those exotic species, 11

Figure 28: Grant-Kohrs Ranch Vegetation Map

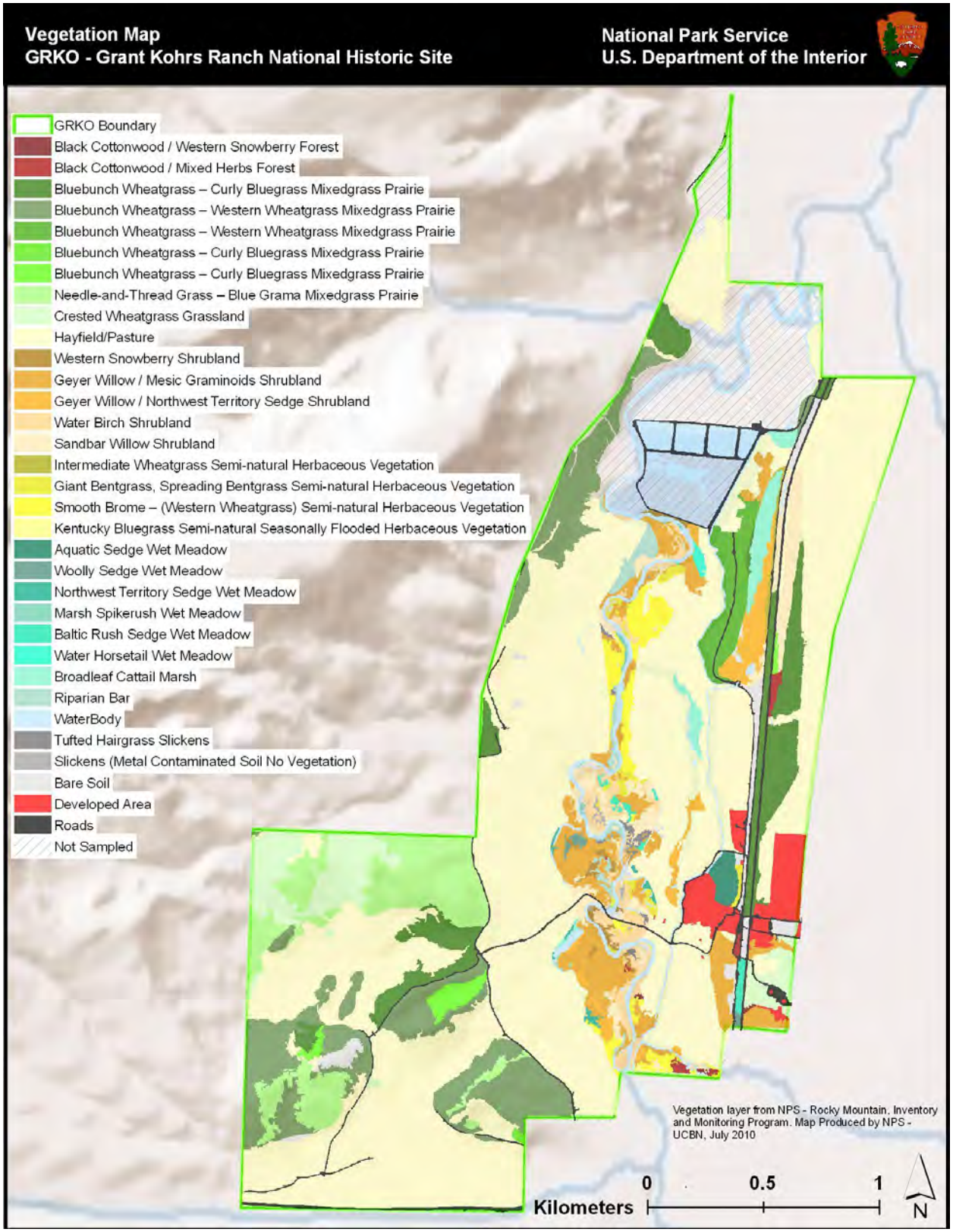
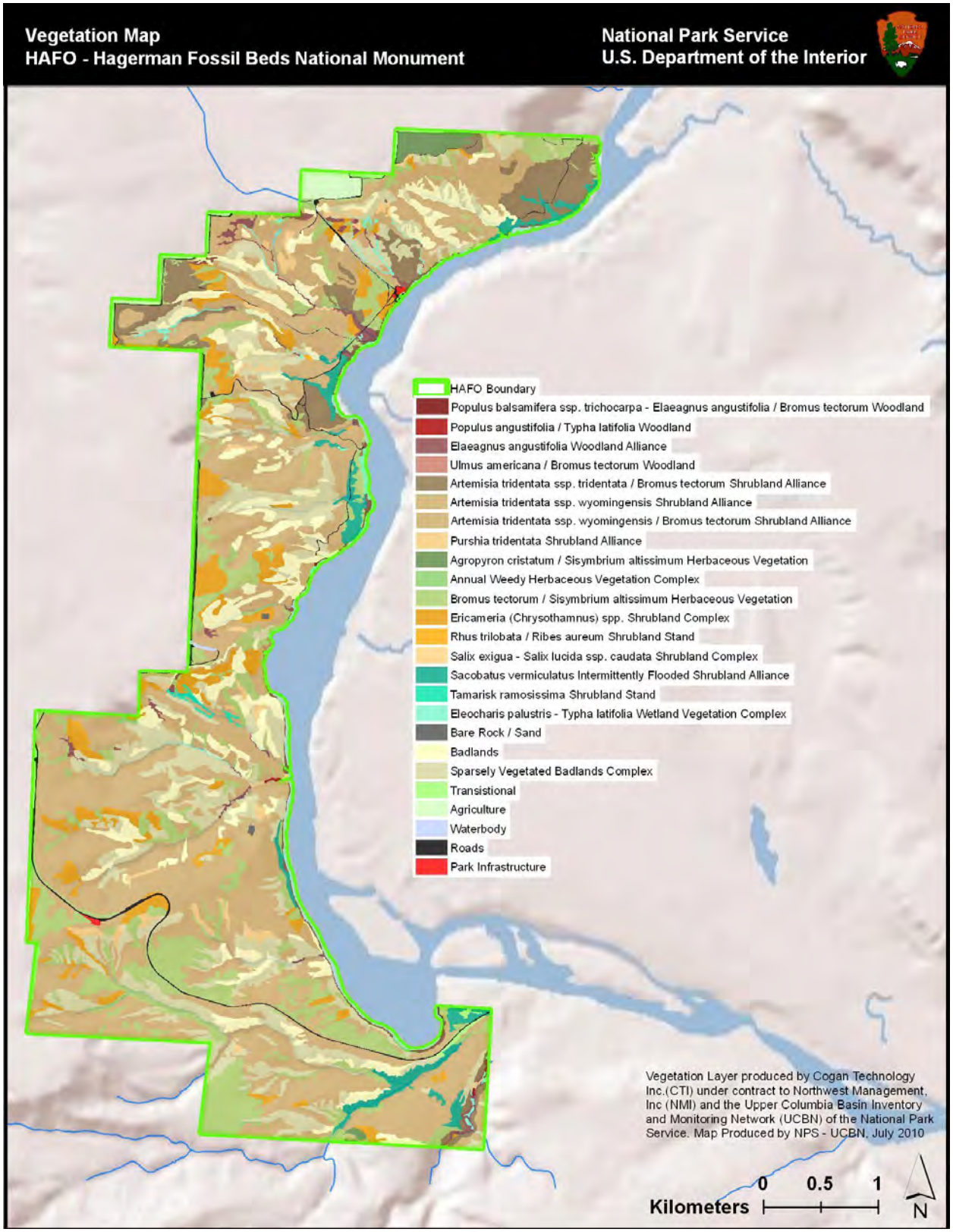


Figure 29: Hagerman Fossil Beds Vegetation Map



are designated as noxious in the state of Montana, and a total of 57 species are considered noxious by various state and provincial governments in some portion of their North American distribution.

The number of taxa reflects the management history and complex environment encompassed by the ranch. These include areas highly impacted by humans and livestock (roads, railroads, borrow pits, home sites, corrals, pastures and hayfields), as well as areas in which recognizable native plant communities remain. The most complex and vegetatively diverse of these is the riparian zone. Despite the damaging impacts of mining wastes deposited from upstream, the riparian zone includes 185 plant taxa (54 percent of the species documented on the ranch) in 22 community types. It also supports the greatest concentration of exotic weeds. The dry upland benches of the west side have primarily been used for grazing, and retain much of the character of natural grassland communities. These are primarily the bluebunch wheatgrass / western wheatgrass habitat type and the bluebunch wheatgrass/Sandberg's bluegrass type (needle-and-thread grass phase). These community types also occur to a lesser degree east of the river, in the strip of land owned by the railroad and in the non-irrigated area between the Kohrs-Manning Ditch and the borrow pit (now a wetland). The fences around the riparian zone and the non-irrigated uplands help maintain these areas in a condition approaching the potential natural communities.

Fire risk is currently low within the park. Historic fire occurrence has been predominantly human caused. Through grazing and mowing, fuel loads in the historic ranch complex, grass rangelands and pasture/hayfields have been minimized. Additional work could be done to further reduce hazards around structures. Fire behavior in riparian/woodland areas is also limited by virtue of high live fuel moisture, though there are portions where dead and downed wood is dominant. Larger fuel particles (logs and shrub branches) represent the greatest current potential risk as sources of windblown embers if they are burned under a wildfire situation (NPS GRKO 2004b).

f. Hagerman Fossil Beds Vegetation

The monument is comprised primarily of high-desert scrub, with riparian habitats along the Snake River (Figure 29). Vegetation is typical of the intermountain region and its high desert scrub and sagebrush communities (NPS HAFO 1996:40). The sagebrush community is the most extensive vegetation type in the monument.

Four main vegetation types were identified by Prentice (1995 in NPS HAFO1995:69):

1. Shadscale association dominated by fourwing saltbush (*Atriplex canescens*), shadscale saltbrush (*Atriplex confertifolia*), green rabbitbrush (*Chrysothamnus viscidiflorus*), and Indian rice grass (*Oryzopsis hymenoides*);
2. Greasewood association dominated by greasewood (*Sarcobatus vermiculatus*), shadscale saltbrush,, poverty weed (*Iva axillaris*), and Russian thistle (*Salsola kali*);
3. Sagebrush association dominated by Basin Big Sagebrush and Wyoming sagebrush (*Artemisia tridentata* ssp. *tridentata and A. tridentata* ssp. *wyomingensis*), rubber rabbitbrush (*Chrysothamnus nauseosus*), green rabbitbrush (*Chrysothamnus viscidiflorus*); and the a mix of remnant native grasses (*Poa secunda, Pseudoroegneria spicata, Stipa sp.*) and native forbs (*Penstemon* sp., *buckwheat (Eriogonum* sp.), *globemallow* (*Sphaeralcea* sp.), yarrow (*Achillea millefolium*).
4. Wetland association found primarily along the Snake River dominated by willows (*Salix sp.*), cottonwood (*Populus sp.*), Russian olive (*Elaeagnus angustifolia*), grasses, rushes (*Juncus sp.*) and sedges (*Carex sp.*).

Nonnative species of plants have been introduced to the monument from several sources. Eurasian milfoil was introduced to Lower Salmon Falls Reservoir by motorboats. Numerous nonnative terrestrial plant species have been introduced along roads and by agriculture, and at other sites of ground disturbance (NPS HAFO 2003:30).

g. Little Bighorn Vegetation

Over 200 species of native vascular plants are found at the battlefield (Figure 30 and Figure 31). The battlefield is located along the banks of the Little Bighorn River in a northern high plains environment. Natural resources at the battlefield are heavily influenced by climate and topography. Moderate precipitation with abundant sunshine, low relative humidity, and clay soils combine to produce a suitable environment for middle to tall grass prairies. Two community types found in Little Bighorn were identified by Bock *et al.* (1987 in NPS LIBI 2007:17) as the Northern Mixed Grass Prairie with sections of sagebrush-dominated shrub steppe. Cottonwood and sedge riparian areas exist along the Little Bighorn River.

A threat is the alteration of the natural fire regime (Bock and Bock 2006 in NPS LIBI 2007:17). A fire in 1983 removed vegetation from 90 percent of the area. This presented a unique opportunity to determine post-fire responses of a high plains ecosystem protected from livestock grazing. Other fires burned over the entire Reno-Benteen site and the east side of Battle Ridge on the battlefield. Fire at the Custer Battlefield, because of the virtual 100 percent mortality of big sagebrush (*Artemisia tridentata*), converted what appeared to be a shrub-steppe ecosystem into a grassland. Sagebrush mortality was the single most dramatic result of the 1983 fire (Bock *et al.* 1987 in NPS LIBI 2007:17) with a return to native and nonnative grasses.

Northern Mixed Grass Prairie: Mixed-grass prairie is typically dominated by Bluebunch wheatgrass (*Pseudoroegneria spicata*) which makes up about one-third of the vegetation at Little Bighorn. Bouteloua-Stipa-*Pseudoroegneria* is the dominant cover type on the battlefield. Other grasses include Idaho fescue (*Festuca idahoensis*), western wheatgrass (*Agropyron smithii*), green needlegrass (*Stipa viridula*), prairie Junegrass (*Koelaria cristata*), and blue grama (*Bouteloua gracilis*). The main shrubs are hawthorn (*Crataegus sp.*), chokeberry (*Prunus sp.*), silver sage and big sagebrush (*Artemisia sp.*). Spruce trees, used for landscaping line the sidewalks in the national cemetery. Cottonwood trees are prominent in areas along the Little Bighorn River, very little of which lies within the present monument boundary (NPS 2007:17).

Native willows (*Salix* sp.) appear to have declined since the time of the Battle, and these are candidates for judicious re-introductions into riparian bottomlands. Willows are deserving of special attention at Little Bighorn not only for their intrinsic value as part of the native flora, but also because of their particular significance to native peoples (Bock and Bock 2006 in NPS LIBI 2007:17).

Nonnative Invasive Plants: Approximately 51 species of nonnative plants occur within Little Bighorn.

The following was summarized from the RMP (NPS LIBI 2007: 20).

> Informal surveys have found several nonnative species including Kentucky bluegrass, yellow sweetclover, prickly lettuce, flixweed, tumble mustard, curly dock, dandelion, and western salsify. Formal surveys have documented several other nonnative species including Japanese brome, smooth brome, cheatgrass, bulbous bluegrass, field bindweed, St. Johnswort, knapweeds, thistles, houndstongue, whitetop, and Dalmatian toadflax. These nonnatives tend to occur along roadsides and in previously disturbed areas. Because there is limited visitor use disturbance (i.e. trampling) away from roads and trails due to visitor restrictions from overland foot or vehicle travel, the park lands remain relatively weed free.
>
> Other nonnatives include ornamental trees planted in the cemetery and Tatarian honeysuckle, Canada thistle, Russian olive, and salt cedar in the riparian area of the battlefield. MSU (Bozeman) completed a nonnative plant survey in 2005 as a baseline inventory of weeds in the park. The invasive species were added to the NPSpecies database in 2007. The survey area did not include the riparian area, approximately 25 acres. . . Seasonal park staff mapped three weed species including Russian olive, salt cedar, and Tatarian honeysuckle in the riparian area. No formal comprehensive survey has

Figure 30: Little Bighorn Battlefield (Custer Battlefield) Draft Vegetation Map

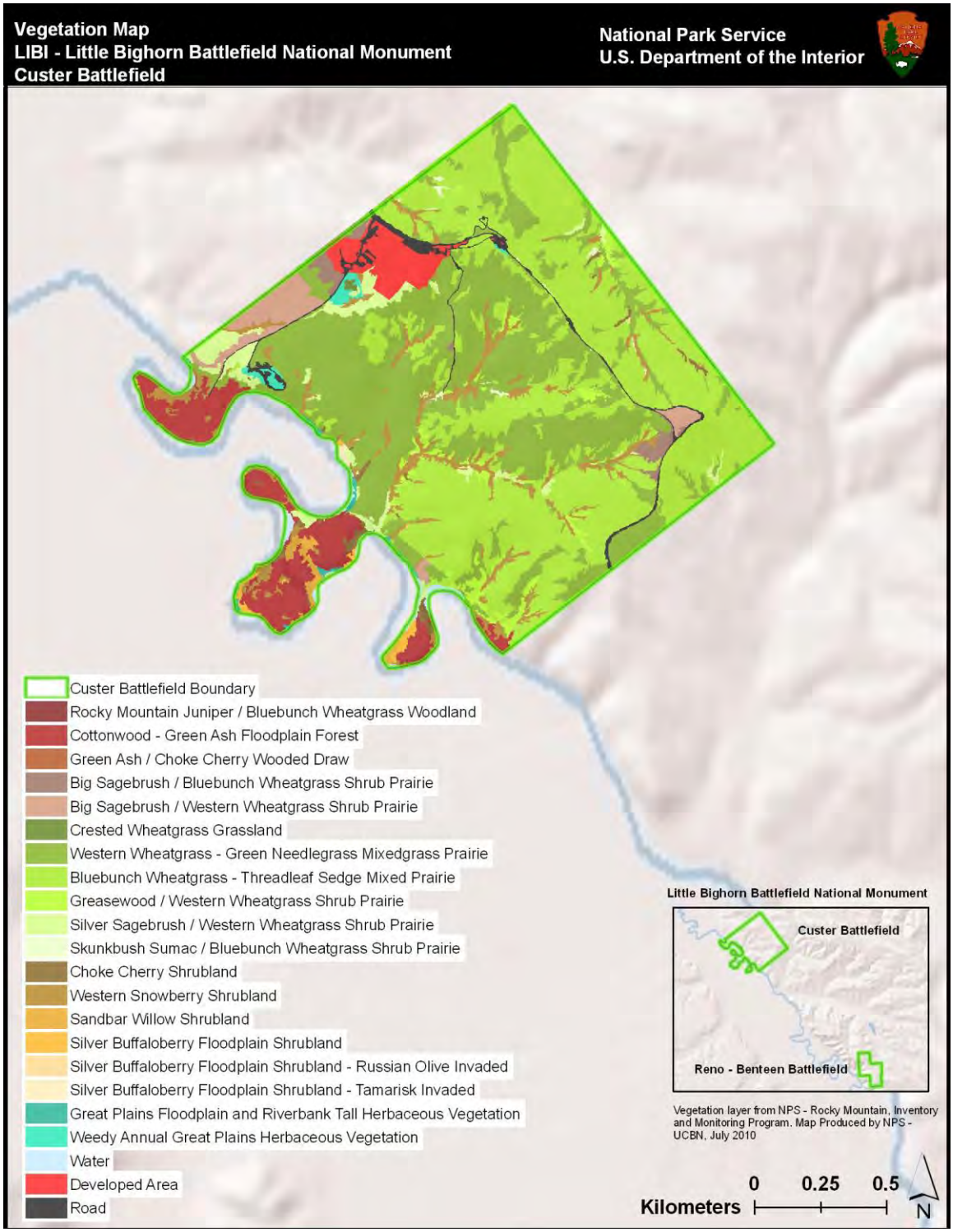
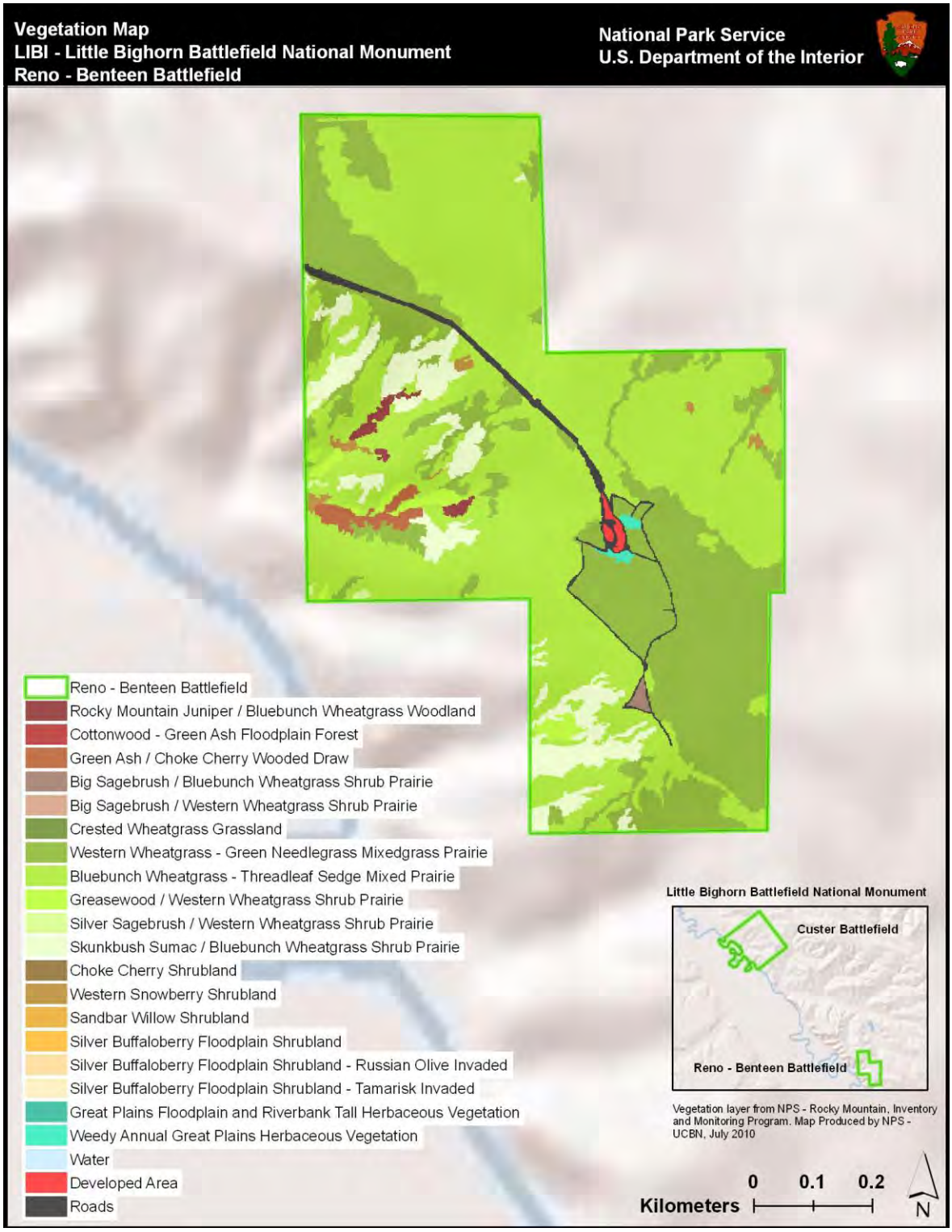


Figure 31: Little Bighorn Battlefield (Reno-Benteen Battlefield) Draft Vegetation Map



been done on nonnatives in the riparian area of the battlefield. . . A scattered infestation of Canada thistle is known to occur within the riparian area.

MSU resurveyed the park in 2010 and included the riparian area, report pending. Preliminary data shows cheatgrass occurs widely across the park, bulbous bluegrass is prevalent on the northeast side of the Custer battlefield, new populations of St. Johnswort occur across the Custer battlefield, and new populations of Dalmatian toadflax occur across the park. Russian olive, salt cedar, and Tatarian honeysuckle have largely been removed from the riparian area, since it was first inventoried in 2006.

h. Minidoka Vegetation

The Snake River Plain is a high desert that naturally supports sagebrush steppe vegetation: a mosaic of dominant shrubs interspersed with open areas occupied by perennial grasses and other understory vegetation (Figure 32). The predominant potential natural vegetation is sagebrush steppe composed of big sagebrush (*Artemisia sp.*) and wheatgrass (*Agropyron sp.*) (Kuchler1964 in NPS MIIN 2005). Few large blocks of this natural vegetation remain, however, having been replaced by agriculture, depleted by overgrazing of livestock, altered by an increase in fire frequency and intensity, and invaded by nonnative, annual grasses (NPS MIIN 2005).

The present-day vegetation of the national monument is a mosaic of remnant native plants, scattered trees and shrubs that were planted by internees during World War II and nonnative invasive species, including noxious weeds. Although no systematic inventory of vegetation on the national monument has been completed, examples of each of these types are readily observed. In terms of native vegetation, the national monument is a highly disturbed site. Virtually every part of the national monument has been altered by human activity at least once and often several times in the past. The most significant disturbance to the natural vegetation of the site was the development and operation of the Minidoka WRA Center (NPS MIIN 2005).

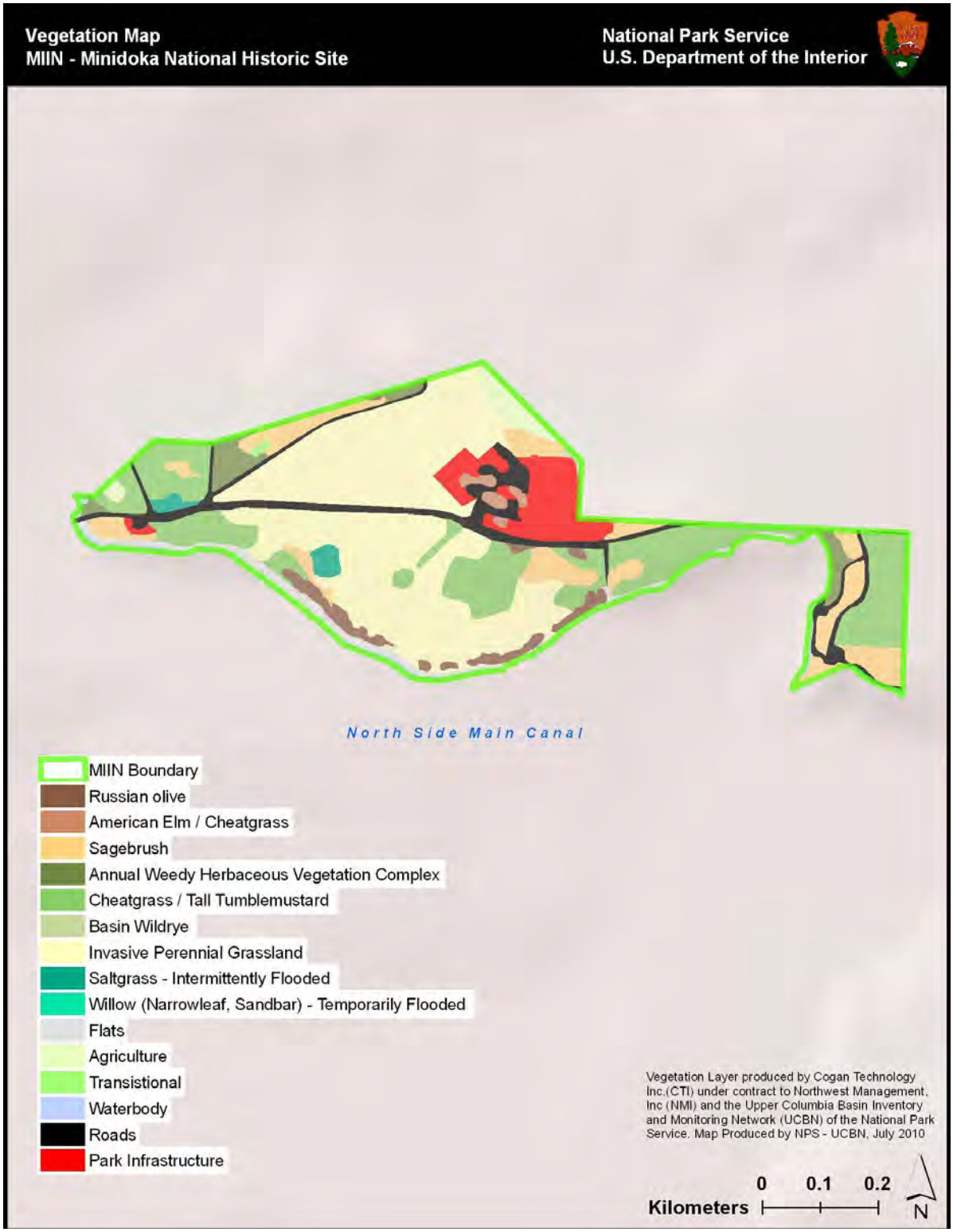
Native vegetation remaining on the site is a small remnant of the vast sagebrush steppe plant communities that once existed on the Snake River Plain. Sagebrush, including both basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) and Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) can be found scattered throughout the national monument, especially in the historic open space south of Hunt Road. Rabbitbrush (*Chrysothamnus* sp.), a native shrub that is quick to occupy disturbed sites, can also be found on the national monument. Grasses and forbs characteristic of the native sagebrush steppe vegetation are still found on the site in varying degrees. These include bluebunch wheatgrass, Thurber needlegrass, Sandberg bluegrass, bottlebrush squirreltail, Indian ricegrass, phlox, arrowleaf balsamroot, and others (NPS MIIN 2005).

A few live trees and shrubs planted during the historic period of the Minidoka Relocation Center are still found on the site. Scattered historic black locust (*Robinia pseudoacacia*) trees exist in the entrance area, administration area, and staff housing area. In addition, a few ornamental shrubs still survive in the administration and staff housing area, including wild rose and lilac bushes (NPS MIIN 2005).

Much of the vegetation present on the national monument is not native to the Snake River Plain. Cheatgrass an exotic annual grass that displaces native vegetation is well established throughout the site, as it is in much of the region. In addition to cheatgrass, 11 other species of weeds have been documented on the national monument by the NRM-EPMT. Seven of these species are classified as noxious weeds by the state of Idaho. Not only are these weeds problematic to management of the national monument, but they pose a potential risk to adjacent agricultural lands if not contained or controlled (NPS MIIN 2005).

Various other plants not native to the site are found growing on the national monument. Russian olive trees have colonized relatively moist habitats along portions of the North Side Canal. Other water-loving plant species that are typically found in riparian zones are now established along portions of the canal. These include willows (*Salix sp.*) and sedges (*Carex sp.*), among others. Shade and ornamental vegetation,

Figure 32: Minidoka Vegetation Map



including cottonwood (*Populus sp.*) and Siberian elm (*Ulnus sp.*) trees and turf grass, have been cultivated on the three-acre site (NPS MIIN 2005).

Virtually all the land surrounding the national monument is in some form of agricultural production, much of it irrigated. Crops, the primary vegetation on these areas, include alfalfa hay, corn, barley, rye, potatoes, sugar beets, wheat, and dry beans (NPS MIIN 2005).

Russian knapweed and yellow starthistle represent the greatest noxious weed threats to the historic site. The park is also threatened by musk and Canada thistles, white bryony and Russian olive trees. Surrounding areas are infested by purple loosestrife, saltcedar, spotted and diffuse knapweeds, rush skeletonweed, and leafy spurge; these species are constantly threatening to invade the site (NPS MIIN 2005).

i. Nez Perce: Bear Paw Vegetation

Bear Paw Battlefield is located in the high plains, in a transition area containing both short- and tall-grass prairie in west central Montana (Figure 33). The shortgrass prairie encompassing much of the battlefield site is characterized by flat or rolling expanses of low to moderate relief. Because the region is relatively dry (receiving about 12-13 inches of annual precipitation), it is dominated by species such as bluebunch wheatgrass (*Pseudoroegneria spicata*), needle and thread grass (*Stipa comata*), and blue grama (*Bouteloua gracilis*) (NPS NEPE 2002:79). Because the area was withdrawn from settlement under the Homestead Act due to its historic significance, it represents a relict area of shortgrass prairie surrounded by agricultural / ranch land development. Except for the removal of natural grazing (primarily by buffalo) and wildfire, it can be considered relatively untouched and pristine. Although the site does contain exotic or nonnative plant species, they are few in number and have a limited areal extent. Surrounding the park are the bench lands of the Bear Paw Mountains, considered to be one of the most extensive and productive stock ranges in the western U.S. (Visitors Guide: 41).

There are two main vegetation communities at Bear Paw, including:

- Dry Sagebrush Hillsides (~85 percent)
- Riparian Area (~15 percent)

Dry Sagebrush Hillsides: The dry hillside from County Highway 240 east to the trailhead contains a mixture of native and nonnative grasses. Native species such as prairie Junegrass (*Koeleria cristata*), thickspike wheatgrass (*Agropyron dasystachyum*), blue grama, needle and thread and Sandberg bluegrass (*Poa sandbergii*) are found in the unmowed areas adjacent to the mowed areas. Sage (*Artemisia* sp.), lupine (*Lupinus* sp.), vetch (*Astragalus* sp.), flax (*Linum perenne*), prickly pear cactus (*Opuntia polyacantha*), pin cushion cactus (*Mamillaria vivipara*), blanketflower (*Gallardia aristata*), and penstemon (*Penstemon* sp.) are some of the native forbs found intermixed with the grasses.

Buckwheat (*Eriogonum* sp.), scarlet globemallow (*Sphaeralcea coccinea*), and arnica (*Arnica cordifolia*) are some of the native species present that should be protected from erosion.

Riparian Area: The Snake Creek riparian wetland comprised of willows and other species of low-growing water-dependent riparian species (native species include: willow (*Salix sp.*), roses (*Rosa acicularis, R. Arkansana or R. woodsii*), currant (*Ribes* sp.), snowberry(*Symphoricarpos alba*), buttercup (*Ranunculus sp.*), horsetail (*Equisetum sp.*), stinging nettle (*Urtica dioica*), milkweed (*Asclepias speciosa*), blue-eyed grass (*Sisyrinchium montanum*), cattail (*Typha latifolia*), and cottonwood (*Populus* sp.).

Nonnative Invasive Plants: Currently less than 0.1 acre of the battlefield is infested with nonnative vegetation. Some nonnative grass species present are smooth brome, crested wheatgrass, oats (*Avena* sp.), and foxtail. Nonnative species present across the site are Canada thistle, prickly lettuce, field bindweed, spotted knapweed, kochia, Russian thistle, and rush skeletonweed. Species escaped from cultivation and found along the trail throughout the site are white and yellow sweetclovers and alfalfa (*Medicago* sp.).

Nonnative species that grow primarily in the riparian area include curly dock (*Rumex crispus*), and reed canarygrass (*Phalaris arundinacea*).

j. Nez Perce: Big Hole Vegetation

At the time of the 1877 Battle of the Big Hole, vegetation included grassy hillsides, isolated patches of willow along riparian areas, and mature stands of lodgepole pines (NPS 2000a in NPS BIHO 2005) (Figure 34). Since then, overgrazing has led to an increase in sagebrush, leaking irrigation canals have encouraged willows, cottonwoods, and conifers to encroach into thick stands in riparian areas and along canals, and a beetle epidemic killed off mature lodgepole pines (NPS 2000a in NPS BIHO 2005). Prescribed fire and herbicides have been used in an attempt to return the vegetation to a more historical regime; however, historic livestock grazing, invasion of exotic weeds, and fire suppression have modified the natural succession of vegetation within Big Hole (NPS 2000a in NPS BIHO 2005).

The current vegetation can be divided into four main landscape types from southeast to northwest:

- sagebrush bench (~30 percent)
- riparian and wetland areas (~30 percent)
- sandy hillside (~20%)
- coniferous forest (~20 percent) (NPS 2002a in NPS BIHO 2005).

Sagebrush Bench: The sagebrush bench encompasses Canals 1 and 2, the visitor center, and residential and office buildings that are bordered by mowed lawn grasses. The remainder of the sagebrush bench area consists of sparse, somewhat drought-tolerant species such as big sage (*Artemisia tridentata*) and gray and green rabbit-brush (*Chrysothamnus nauseosus* and *viscidiflorus*). Due to the sparse vegetation, bare soil is susceptible to invasive species, particularly knapweed (*Centaurea stoebe*) (NPS 2002a in NPS BIHO 2005). Buckwheat (*Eriogonum umbellatum*), evening-primrose (*Oenothera* sp.), low pussy-toes (*Antennaria dimorpha*), large-leaved avens (*Geum macrophyllum*), and lomatium (*Lomatium* sp.) are some other natives present.

Over time, canal leakage has contributed to species proliferating on the sagebrush bench that would normally be associated with the wetlands area. These species include cottonwood and willow. Conifers have also encroached in this area (NPS BIHO 2005).

Riparian and Wetland Areas: To the northwest of the sagebrush bench, the riparian and wetland areas dominate the center of the park. The riparian and wetland areas consist of water-tolerant species including cottonwood (*Populus* sp.), willow species (*Salix* sp.), quaking aspen (*Populus tremuloides*), rush (*Juncus* sp.), sedge, (*Carex* sp.) cattails (*Typha latifolia*), mannagrass (*Glyceria* sp.), fireweed (*Epilobium angustifolium*), golden current (*Ribes aureum*), snowberry (*Symphoricarpos*), and iris (*Iris* sp.) species. The less-saturated surrounding meadows contain vegetation such as camas (*Camassia quamash*), elk thistle (*Cirsium scariosum*), mountain bistort (*Polygonum bistortoides*), and various grasses (NPS 2002a in NPS BIHO 2005).

Sandy Hillside: The sandy hillside lies between the riparian and wetland areas and the coniferous forest. The sandy hillside area contains drought-tolerant species including arrowleaf balsamroot (*Balsamorhiza sagittata*), buckwheat, low pussy toes, sage, rabbit-brush, lomatium, creeping Oregon grape (*Mahonia repens*), lupine (*Lupinus* sp.), owl clover (*Orthocarpus tenuifolius*), paintbrush (*Castilleja* sp.), shooting star (*Dodecatheon pulchellum*), and goldenrod (*Solidago* sp.) (NPS 2002a in NPS BIHO 2005).

Coniferous Forest: The coniferous forest is dominated by lodgepole pine (*Pinus contorta*), ponderosa pine (*Pinus ponderosa*), and Douglas fir (*Pseudotsuga menziesii*). As a result of fire suppression, these stands have grown dense and evenly-aged to create a level canopy that stunts understory vegetation. Understory growth consists of huckleberry species (*Vaccinium* spp.), currant (*Ribes* sp.), sedge, rush, horsetail (*Equisetum arvense*), buttercup, and paintbrush (NPS 2002a in NPS BIHO 2005).

Figure 33: Bear Paw Vegetation Map

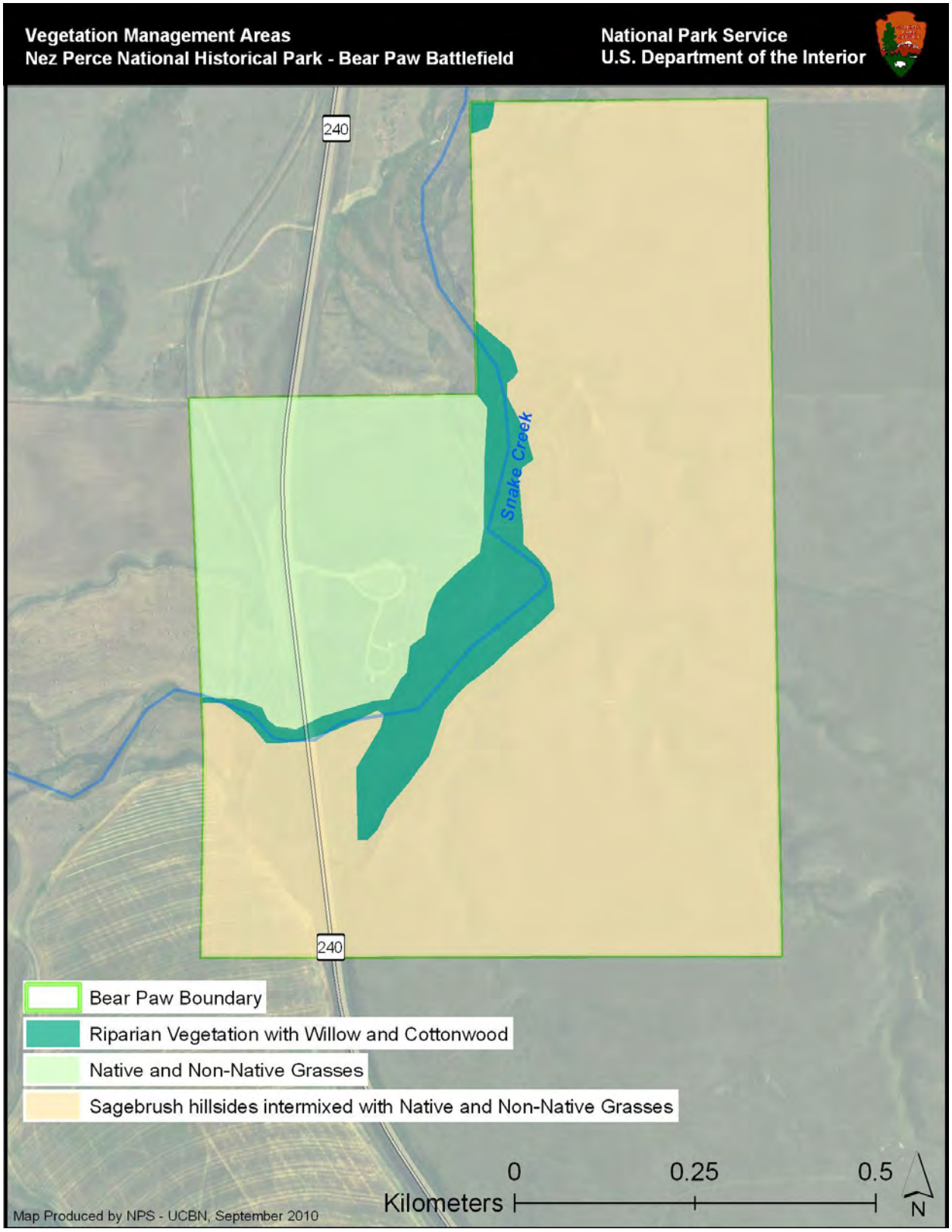
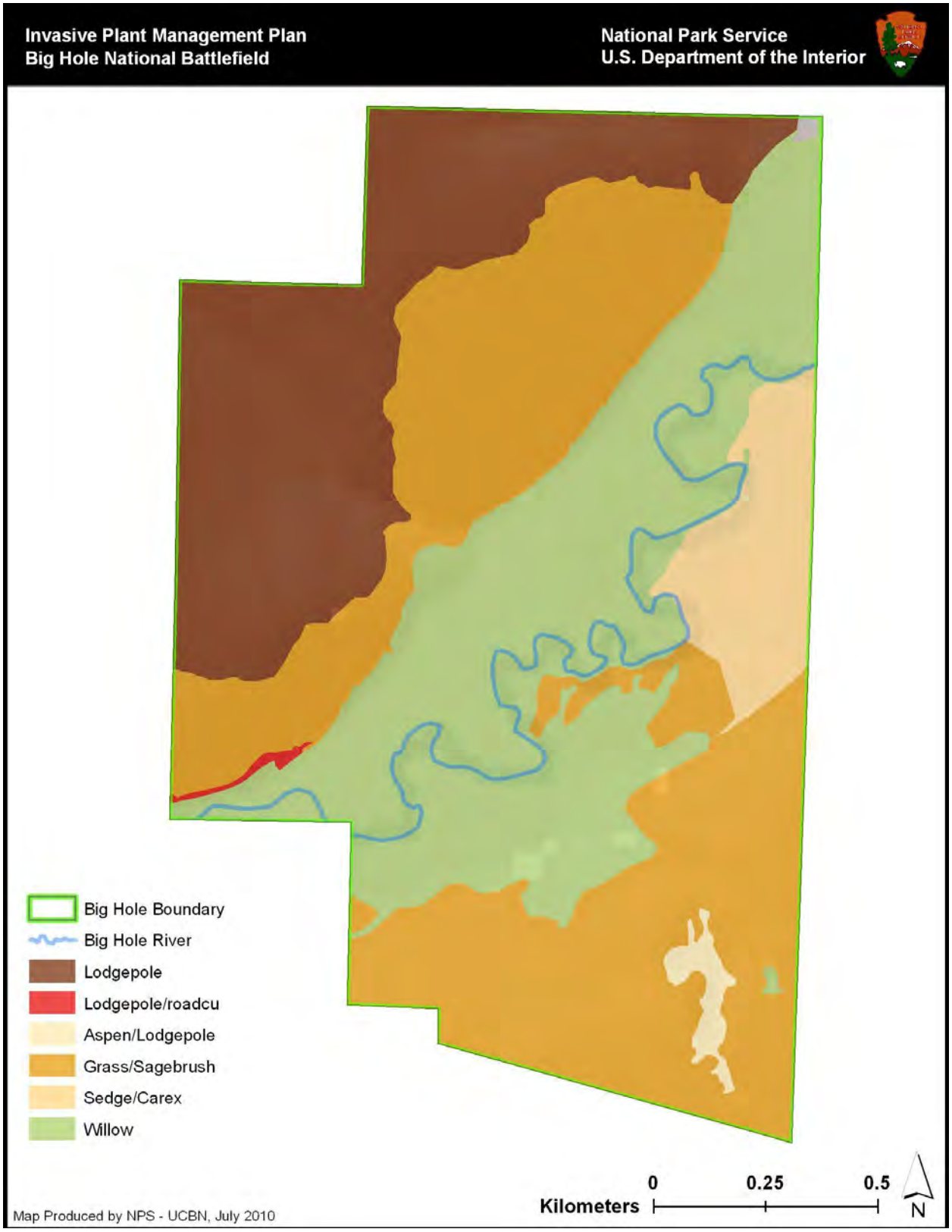


Figure 34: Big Hole Vegetation Map



Nonnative Invasive Plants: Approximately two acres are infested with nonnative invasive species, including spotted knapweed, leafy spurge, Canada thistle and tamarisk. Other noxious weeds include yellow sweet clover, dandelion, mallow (*Malva neglecta)*, field bindweed, common tansy, and knotweed (NPS 2002a in NPS BIHO 2005). The encroachment of woody vegetation and noxious weed species limits the function of historical grasslands which are currently imperiled throughout Montana. According to the USDA, 1.1 million acres of Montana's limited grasslands have been converted to other uses since 1982 (The Nature Conservancy 2004 in NPS BIHO 2005).

2. Wildlife

a. City of Rocks Wildlife

Approximately 142 species of birds, 35 mammals, 11 reptiles and 3 amphibians are found in the reserve.

Birds: The reserve provides excellent breeding and prey habitat for many raptors. Among these include the golden eagle, prairie falcon, red-tailed hawk, northern harrier, sharp-shinned hawk, Cooper's hawk, American kestrel, turkey vulture, and great-horned owl. Other less common raptors are the Swainson's hawk and ferruginous hawk. Other common birds include: dusky grouse and sage-grouse, pinon jay, Clark's nutcracker, common nighthawk, rock pigeon and mourning dove, cliff swallow, mountain chickadee, rock and house wrens, mountain bluebird, hermit thrush, solitary and warbling vireos, green-tailed towhee, Virginia's warbler, Brewer's blackbird, and various sparrows. Surveys in 1991 found six breeding pairs of golden eagles and six breeding pairs of red-tailed hawks.

Important habitats and some representative breeding birds are listed below:

- Sagebrush: sage thrasher, green-tailed Towhee, Brewer's sparrow, and vesper sparrow.
- Pinon-juniper woodland and mountain mahogany: chipping sparrow, western scrub jay, robin, and Cassin's finch.
- Aspen-chokecherry: red-naped sapsucker, mountain bluebird, and mountain chickadee.
- Coniferous forest: Clark's nutcracker, red-breasted nuthatch, and yellow-rumped warbler.
- Riparian: house wren, yellow warbler, Lazuli bunting, and red-winged blackbird.
- Rock cliffs and ledges: white-throated swift, violet-green and cliff swallows, and red-tailed hawk (NPS CIRO 2010)

Mammals: Among the mammals found in the reserve include mountain lions, mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus*), coyotes(*Canis latrans*), bobcats (*Lynx rufus*), badgers (*Taxidea taxus*), porcupine (*Erethizon dorsatum*), red foxes (*Vulpes vulpes*), cliff chipmunks (*Tamias dorsalis*), mountain cottontail (*Sylvilagus nuttallii)* and pygmy rabbits (*Brachylagus idahoensis)*, blacktail jackrabbits (*Lepus californicus)*, snowshoe hare (*Lepus americanus*), northern grasshopper mice (*Onychomys leucogaster*), Merriam's shrew (*Sorex merriamii*), and a variety of small mammals, including the deer mouse (*Peromyscus maniculatus*), Great Basin pocket mouse (*Perognathus parvus*), and pinon mouse (*Peromyscus truei*), and bats, including the spotted bat (*Euderma maculatum*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), and pallid bat (*Antrozous pallidous*). Bison (*Bison bison*), pronghorn (*Antilocapra americana*) and bighorn sheep (*Ovis Canadensis*) have been extirpated.

Reptiles: Reptiles in the reserve include western whiptail (*Cnemidophorus tigris*), western fence lizard (*Sceloporus occidentalis*), long-nose leopard lizard (*Gambelia wislizenii*), common sagebrush lizard (*Sceloporus graciosus*), western skink (*Eumeces skiltonianus*), northern desert horned lizard (*Phrynosoma platyrhinos*), western rattlesnake (*Crotalus oreganus*), rubber boa (*Charina bottae*), Great Basin gopher snake (*Pituophis catenifer*), striped whipsnake (*Masticophis taeniatus*) and wandering garter snake (*Thamnophis elegans*).

Amphibians: Among the amphibians that could be found include the boreal chorus frog (*Pseudacris maculata*), Great Basin spadefoot toad (*Scaphiopus intermontanus*), and northern leopard frog (*Rana pipiens*).

b. Craters of the Moon Wildlife

Approximately 225 species of birds, 60 mammals, 10 reptiles and at least three amphibians are found in the monument. In addition, more than 2,500 insect species have been identified (NPS CRMO 2005:131). Many species are sagebrush obligates (restricted to sagebrush during breeding or year-round) or near obligates (occur in sagebrush and grassland habitats).

Birds: Birds occupy all available habitats. The many species include breeding, migratory and wintering species. Numerous sagebrush obligate and dependent species occur. Limber pine, Douglas-fir and aspen forests contain numerous forest and woodland species and are important migration corridors for even more species. Wetland sites are rare in the area and those that do occur are important breeding and migratory stop-over sites for many species of waterfowl.

As of July 2010, 212 species protected under the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*) have been identified.

Mammals: Large mammals include mule deer, pronghorn, elk, cougar, black bear and moose. Medium-sized mammals include red and kit foxes, coyotes and bobcats, badgers, raccoons, and yellow-bellied marmots. The monument also provides habitat for 11 species of bats. Small mammals include ground squirrels, pikas, chipmunks, deer mice, voles, and gophers. Mule deer, elk and pronghorn all use and migrate through the monument.

Reptiles: Reptiles include rubber boas (*Charina bottae*), gopher snakes (*Pituophis catenifer*), night snakes (*Hypsiglena torquata*), western skinks (*Eumeces skiltonianus*), short- and desert-horned lizards (*Phrynosoma sp*), and long-nosed leopard lizards (*Gambelia wislizenii*).

Amphibians: Amphibians include the boreal chorus frog (*Pseudacris maculata*) and the Pacific tree frog (*Pseudacris regilla*) (NPS CRMO 2005:132 *et seq.*).

Important Wildlife Habitats: Sagebrush steppe is a highly valued crucial winter range habitat for elk, mule deer and pronghorn; and is essential habitat for sagebrush-obligate species (restricted to sagebrush habitats year-round or during the breeding season) such as the greater sage-grouse, sage sparrow, black-throated sparrow, Brewer's sparrow, sage thrasher, sagebrush vole, pygmy rabbit, and the sagebrush lizard; as well as for watershed recharge; and for recreation (NPS CRMO 2005:116 and 131).

In winter, the evergreen foliage of sagebrush often provides available green vegetation, and its protein level and digestibility are higher than that of most other shrubs and grasses (Peterson 1995 in NPS CRMO 2005:131). Pronghorn, pygmy rabbits and sage-grouse may exclusively eat sagebrush during the winter. Sagebrush also comprises a large portion of mule deer and elk diets. Sagebrush, which can be over five feet tall, also provides cover for mammals, such as fawns, pygmy rabbits, and grouse and often contains an understory of grasses favored by small mammals.

The monument has adopted (as part of the MMP) interagency habitat guidelines for sage-grouse and sagebrush steppe obligate species to guide sagebrush steppe management (NPS CRMO 2005:79). The primary goal of the Idaho Sage-grouse plan is to "maintain, improve, and where possible, increase sage-grouse populations and habitats in Idaho, while considering the predictability and long-term sustainability of a variety of other land uses" (see Special Status Species section below).

Low elevation limber pine forest provides essential habitat for both migratory and residential bird species. As an alpine area, it provides habitat for other species normally found at higher elevations. It is the only known habitat for the craters chipmunk (*Tamias amoenus cratericus)*. Other pine dependent species in the monument include red crossbill, western jumping mouse, snowshoe hare and 76 bird species. Birds include dusky grouse, Clark's nutcracker, rufous hummingbird, Cassin's finch and several warbler and

woodpecker species. Limber pine is one of the most at risk communities in the Rocky Mountains and the monument is an important refuge for the species and its associated fauna.

Other major habitats include the extensive lava flows including associated caves.

Aquatic systems while rare are critical to many animal species. These include small marshes, streams, a portion of one lake, and many small ponds and waterholes. Many of the smaller features are ephemeral in nature but are critical to numerous animal species. Species such as moose, amphibians and many aquatic invertebrates are totally dependent on these systems while other such as deer and bats drinking water but would likely spend most of their time away from water.

c. Fossil Butte Wildlife

Approximately 93 species of birds, 44 mammals, two reptiles and three amphibian species are found in the monument.

Fossil Butte contains a variety of wildlife typical of the high plains and Rocky Mountain area. Mammals frequenting the area include elk (*Cervus elaphus*), moose (*Alces alces*), mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), cottontail (*Syvilagus* sp.), jackrabbit (*Lepus* sp.), and several rodents. Birds include a suite of passerines, waterfowl, sage-grouse, woodpeckers, and raptors. An increasing number of elk have been observed in the monument during past winters. In 2002, over 350 were present by October (NPS FOBU:14)

Birds: Diverse plant communities provide food, shelter and nesting sites for the 93 species of birds observed in the monument. Commonly seen birds include: golden eagle, red-tailed hawk, northern harrier, black-billed magpie, common raven, gray jay, green-tailed towhee, sage-grouse, mountain bluebird, western meadowlark, Brewer's sparrow, and the American robin.

Important Wildlife Habitats: Aspen communities occupy only a small portion of the monument, but sustain the greatest variety of birds (52.7 percent of all species) of all monument vegetation types. Aspen tend to grow where water is available. They have a structurally complex and diverse community of understory plants that provide food and favorable breeding habitat for a variety of bird species. Birds typically associated with aspen groves in Fossil Butte are the house wren, tree swallow, black-capped chickadee, black-headed grosbeak, orange-crowned warbler, yellow warbler, and the red-napped sapsucker.

Fifty percent of the bird species were observed in areas dominated by sagebrush, and 11 species were seen only in sagebrush. Grassland had slightly lower species richness (38 species) and mixed-conifer habitat had significantly fewer species than sagebrush, providing habitat for only 25 percent of all species observed.

Despite its low species diversity, mixed-conifer had the highest number of obligate bird species (species dependent upon a specific habitat, and rarely seen elsewhere) of any of the monument's habitats. Nearly 44 percent of the species detected in mixed-conifer forests were observed only in that habitat.

The relative number of birds using different habitats differs from species richness. Aspen forests had the highest species richness, yet aspen ranked only third in the numbers of birds (9.28) detected per count unit. The mixed-conifer habitat had the highest numbers of birds per count unit. Serviceberry vegetation had the second highest average number of bird detections (10 individuals per unit counted). The importance of this habitat for birds like the green-tailed towhee, that depend on dense shrubs for nesting, and American robin and western tanagers that eat serviceberries could account for the high numbers of birds observed where serviceberry shrubs are common.

Species found most commonly in Douglas fir forests include yellow-rumped warbler, common raven, chipping sparrow, Steller's jay, red-breasted nuthatch and white-breasted nuthatch. Those detected most

in mixed conifer include western tanager, mountain bluebird, Clark's nutcracker, and Hammond's flycatcher.

Sage habitats, including vegetation dominated by a mosaic of sagebrush and grass harbor a relatively unique bird community, with many bird species found only where sage is present. This is true of Fossil Butte National Monument's sage habitat. Of the thirteen species more abundant in sage and sage/grass habitats, the sage-grouse, Brewer's sparrow and sage thrasher are considered sagebrush obligates, and would probably not occur here if the sagebrush disappeared. The Vesper sparrow, western meadowlark, and golden eagle also frequent the sagebrush community (www.nps.gov/fobu).

Mammals: Although the presence of 44 species of mammals are documented, American pronghorn, mule deer (*Odocoileus hemionus*), jackrabbits, cotton-tail rabbits, least chipmunks, and Richardson ground squirrels are probably the only mammals the average visitor is likely to see during a casual summer visit. Most mammals are small, active only at night, confined to small isolated habitats, or are so wary of humans that they are only rarely seen.

A few mule deer may reside on the monument throughout the year, but most migrate in late fall to winter range located elsewhere. Pronghorn are usually somewhere on the monument from late spring through late fall or early winter. They also migrate to wintering areas outside the monument as snow accumulates. Elk are seen on the monument occasionally in summer, but are more common in late fall and winter. Sizable herds of elk have spent at least part of the winter on the monument in recent years, and are frequently seen on the western and southern slopes of Fossil Butte and Cundick Ridge. A few moose (*Alces alces*) are usually on or somewhere near the monument at all times of the year (www.nps.gov/fobu).

Reptiles: The wandering garter snake *(Thamnophis elegans vagrans)* and short-horned lizard *(Phrynosoma douglassi brevirostre)* are the only reptiles documented from the monument. Despite the ideal sagebrush steppe landscape no rattlesnakes have been found.

Amphibians: Only three species of amphibians are documented: the Utah tiger salamander *(Ambystoma tigrinum)*, chorus frog *(Pseudacris triseriata maculata)*, and northern leopard frog *(Rana pipiens)* (www.nps.gov/fobu).

d. Golden Spike Wildlife

Approximately 131 species of birds, 50 mammals, 14 reptiles and five amphibians are found at the historic site. Among the most commonly seen wildlife are ground squirrels (*Spermophilus sp.*), mule deer (*Odocoileus hemionus*), kangaroo rats (*Dipodomys sp.*), coyotes (*Canis latrans*) and the introduced ring-necked pheasant. Other common wildlife includes badgers, bobcats and mountain lions.

Birds: A wide variety of birds may be found at Golden Spike, including numerous songbirds, shorebirds and birds of prey such as owls, eagles, and hawks. Among the owls that have been documented at the park include the screech owl, barn owl, great horned owl, short-eared owl and burrowing owl. Barn and great-horned owls can be found in small caves at Golden Spike, while short-eared owls nest in the flat lands near the entrance to Golden Spike. Introduced ring-necked pheasants are common.

Mammals: Among the most commonly seen mammals are northern pocket gopher, desert woodrat, least chipmunk, house mouse, yellow-bellied marmot, kangaroo rat, cottontail, jackrabbit, and little brown myotis. Other mammals seen frequently are the coyote, mountain lion, bobcat, badger, kit fox, mule ear deer, and pronghorn on the west side and elk on the Promontory Mountains.

Reptiles: The most frequently observed reptiles include the Great Basin gopher snake (*Pituophis catenifer*), Western Skink, and Great Basin western rattlesnake (*Crotalus* sp.).

Amphibians: Amphibians include the Great Basin spadefoot (*Scaphiopus intermontanus*) which is commonly found in sagebrush flats and Woodhouse's toad (*Bufo woodhousei*), which is often seen around

the visitor center. The northern leopard frog and tiger salamander are found in the Blue Creek area of the park.

e. Grant-Kohrs Ranch Wildlife

Approximately 230 species of birds, 35 mammals, two reptiles and three amphibians are found at the historic site. There are also eight species of fish. As a working cattle ranch, the most popular of the park's mammals are usually the cattle, horses, chickens and ranch cats. The many pastures around the ranch, however, not only support the cattle herds and horses, but a wide variety of mammals, including the most commonly seen – deer, ground squirrels, and foxes. Beaver, muskrat, and moose, can occasionally be seen within the river and surrounding habitat. The Clark Fork River and the borrow pit area provide open water habitat for resident and migratory waterfowl and shorebirds. Riparian/woodland and wetland vegetation composition and structure provide habitat for a variety of upland birds. Insects, reptiles, and amphibians are limited by short summers and cool climate (NPS 1993 in NPS GRKO 2004).

Birds: More than 230 species of birds pass through seasonally or live on the ranch year-round. Great blue herons, bald and golden eagles, chickadees, magpies, geese, ducks and several species of woodpeckers (downy and hairy woodpeckers, and northern flickers) are among regular residents.

Mammals: At least 35 species of mammals have been observed within the 1,600 acres of Grant-Kohrs Ranch National Historic Site. Mammals using the ranch area include moose (*Alces alces*), elk (*Cervus elaphus*), white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), wild cat (*Felis silvestris*), badger (*Taxidea taxus*), Nuttall's cottontail (*Sylvilagus nuttallii*), beaver (*Castor canadensis*), porcupine (*Erethizon dorsatum*), yellow pine chipmunk (*Tamias amoenus*), Columbian ground squirrel (*Spermophilus columbianus*), northern pocket gopher (*Thomomys talpoides*), northern water shrew (*Sorex palustris*), vagrant shrew (*Sorex vagrans*), masked shrew (*Sorex cinerus*), montane shrew (*Sorex monticolus*), western jumping mouse (*Zapus princeps*), deer mouse (*Peromyscus maniculatus*), house mouse (*Mus musculus*), muskrat (*Ondatra zibethicus*), montane vole (*Microtus montanus*), and meadow vole (*Microtus pennsylvanicus*). Black bear (*Ursus americana*) is also occasionally seen in the area.

Among bats that inhabit the area are big brown bats (*Eptesicus fuscus*), hoary bats (*Lasiurus cinereus*), little brown bats (*Myotis lucifugus*), fringed myotis (*Myotis thysanodes*) and long-legged bats (*Myotis volans*).

Reptiles: Park reptiles include the common garter snake (*Thamnophis sirtalis*) and painted turtle (*Chrysemys picta*).

Amphibians: Park amphibians include the western toad (*Bufo boreas*), Columbia spotted frog (*Rana luteiventris*), and long-toed salamander (*Ambystoma macrodactylum*).

Fish: Creeks, marshes and the Clark Fork River harbor rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), mountain whitefish (*Prosopium williamsoni*), largescale and longnose suckers (*Catostomus macrocheilus* and *Catostomus catostomus*), redside shiner (*Richardsonius balteatus*) and mottled sculpin (*Cottus bairdii*).

f. Hagerman Fossil Beds Wildlife

Approximately 200 species of birds, 27 mammals, 14 reptiles and five amphibians are found in the monument. Only vertebrates have been inventoried in the monument (Oelrich *et al.* 2010). Wildlife use of the monument has been altered by nearby residential, agricultural and hydroelectric development (NPS 2003:9).

Birds: In addition to upland sagebrush steppe the eastern boundary of the monument is defined as the Snake River extensive riparian woodlands along the eastern edge provide habitat for numerous songbirds including both migrant and resident species. Along the Snake River, waterfowl include ducks and Canada geese.

Mammals: Native species include blacktail jackrabbit (*Lepus californicus*), mountain cottontail (*Syvilagus nuttalli*), mule deer (*Odocoileus hemionus*), ground squirrel (*Spermophilus* sp. and *Ammospermophilus leucurus*), white-footed mice (*Peromyscus* sp.), woodrats (*Neotoma* sp.), marmots (*Marmota flaviventris*), and Oord's kangaroo rat (*Dipodomys ordii*). Predators include coyote (*Canis latrans*), badger (*Taxidea taxus*), spotted skunk (*Spilogale putorius*), striped skunk (*Mephitis mephitis*), weasel (*Mustela* sp.), mink (*Mustela* sp.), and bobcat (*Lynx rufus*).

Reptiles: Most of the monument is arid sagebrush steppe which provides habitat for several species of reptile. Reptiles include seven snakes and seven lizards.

Amphibians: Five amphibians have been documented in the monument. These include both riparian or true aquatic species such as the Pacific chorus frog (*Pseudacris regilla*) and desert species such as the Great Basin spadefoot (*Spea intermontana*) and the Woodhouse's toad (*Bufo woodhousei*).

Important Wildlife Habitats: Although the Snake River is outside the monument boundary (it extends only to the former ordinary high water mark), the aquatic ecosystem borders the monument and provides important wildlife habitat for fish and other aquatic species. Fish found in the Snake River include rainbow trout (*Oncorhynchus mykiss*), smallmouth bass (*Micropterus dolomieu*), chubs (*Gila sp.*), suckers (*Catostomus sp.*) and common carp (*Cyprinus carpio*). Carp and smallmouth bass are nonnative species. Sturgeon used to be plentiful on the river, but native populations are now low. Due to the presence of dams, no anadramous fish runs remain this far up-river on the Snake River but landlocked coho salmon (*Oncorhynchus kisutch*) have been identified.

Idaho Power (1995 in NPS HAFO 2003:29), using electrofishing evaluated the status of the game and non-game fish community in the nearby Lower Salmon Falls Reservoir and found: rainbow trout (*Oncorhynchus mykiss*), coho salmon, brown trout (*Salmo trutta*), mountain whitefish (*Prosopium williamsoni*), peamouth (*Mylocheilus caurinus*), northern squawfish (*Ptychocheilus oregonensis*), chiselmouth (*Acrocheilus alutaceus*), redside shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys osculus*), common carp, Utah chub (*Gila atratria*), bridgelip sucker (*Catostomus columbianus*), largescale sucker (*Catostomus macrocheilus*), brown bullhead (*Ictalurus nebulosus*), smallmouth bass, largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), Shoshone sculpin (*Cottus greenei*), mottled sculpin (*Cottus bairdi*), torrent sculpin (*Cottus rhotheus*), sculpin sp. (*Cottus sp.*), and yellow perch (*Perca flavescens*) (NPS HAFO 2003:29).

Rainbow trout were stocked annually from 1978 through 1989 (with an average of about 22,000/year.). Idaho Fish and Game attempted to improve the brown trout fishery in 1988, 1989 and 1992 by stocking fingerlings, but were apparently unsuccessful, according to Idaho Power (1995 in NPS HAFO 2003:29). Other game species include a self-sustaining largemouth bass and bluegill population. Non-game species such as large-scale suckers and yellow perch dominate the fishery (NPS HAFO 2003:29).

g. Little Bighorn Wildlife

Approximately 56 species of birds, 25 mammals, nine reptiles and five amphibians are found at the battlefield. There are also nine species of fish that occur in the Little Bighorn River where it forms a portion of the park boundary.

Birds: Birds most frequently seen within the monument are western meadowlarks, robins, sparrows, sharp- tailed grouse, and magpies (NPS LIBI 2007:21). A bird survey, completed in 2006 by University of Colorado (Boulder), recommended that additional survey work occur in the riparian area. The following was summarized from A Survey of the Vascular Plants and Birds of Little Bighorn National Battlefield (Bock and Bock 2006:13).

> We recorded the presence of 60 species in five different habitat types: open grassland, sage grassland, shrubby swales and ravines, river bottomland, and landscaped areas around the Battlefield headquarters and cemetery.
>
> The 1985 and 1986 observations were part of a study examining habitat selection by songbirds in burned versus unburned sage-grasslands (Bock and Bock 1987), which demonstrated the importance of big sagebrush to birds such as grasshopper sparrow, Brewer's sparrow, lark bunting, and lark sparrow. . . From an avian perspective, loss of big sage from fires at Little Bighorn has had a negative impact on its biological diversity.
>
> By far the richest avian habitat at Little Bighorn is the river bottomland, with its open water, riparian trees, and rich shrubby understory. Riparian habitats have similar value for birds throughout arid parts of western North America, as has long been recognized and studied (e.g., Johnson and Jones 1977, Skagen *et al.* 1998, Saab 1999). Protection of the Little Bighorn River bottomlands from livestock grazing doubtless is responsible for their well developed understory, which can benefit a variety of birds dependent on heavy ground cover (e.g., Saab *et al.* 1995, Stanley and Knopf 2002). Riparian birds likely dependent on understory vegetation at the Battlefield include veery, gray catbird, brown thrasher, spotted towhee, and song sparrow. By contrast, birds such as the ring-neck pheasant, mourning dove, black-billed magpie, American crow, and perhaps some of the flycatchers, are likely to be more abundant in riparian areas outside the Battlefield that are dedicated to agriculture and housing, and that support relatively low and sparse understory vegetation.

Mammals: Mammals such as white-tailed deer (*Odocoileus virginianus*), porcupines (*Erethizon dorsatum*), striped skunks (*Mephitus mephitus*), coyotes (*Canis latrans*), foxes (*Vulpes sp.*), silver-haired bat (*Lasionycteris noctivagans*), and northern grasshopper mouse (*Onychomys leucogaster*) occur in the monument. A prairie dog (*Cynomys ludovicianus*) colony lies adjacent to the northwest boundary of Custer battlefield and one burrow occurs within the park. One active coyote den is known to occur within Custer battlefield. There is evidence of beaver activity on the Little Bighorn River floodplain within Custer battlefield.

A small mammal survey targeting 90 percent census of the small mammal inventory was completed by Dean Pearson of USDA Forest Service Rocky Mountain Research Station in 2003 (NPS LIBI 2007:21). The survey identified seventeen small mammals, some uncommon to rare. Although the survey yielded only a 40 percent census of the small mammal species, it contributed to the reptile species inventory by adding three new species (NPS LIBI 2007:21). A bat survey in 2006 by Utah State University identified five species of bats including big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), little brown myotis, (*Myotis lucifugus*), and long-legged myotis (*Myotis volans*).

Reptiles and Amphibians: The following was summarized from the Resources Management Plan (NPS 2007: 21).

> The amphibian and reptile park species lists were certified February 16, 2005 by Blake Hossack. Rattlesnakes and bull snakes represent 95 percent of the reptile population; bull snakes alone accounts for about 75 percent of all sightings. An amphibian and reptile survey targeting 90 percent census of the amphibian and reptile inventory was completed in 2002 by the USGS Northern Rocky Mountain Science Center. The survey yielded only a partial list of species present, due to the absence of standing water in the riparian corridor.

In 2009 the UM (Missoula) developed a field guide, including inventory and survey methods, and provided on-site training to park staff.

> Two northern leopard frogs (*Rana pipiens*) were observed at the pond, which had not been seen or documented on the monument previously (McCaffery 2009: 2).

Fish: A fish survey completed by the UM (Missoula) in 2002 concluded that the Little Bighorn River consisted primarily of native species and the species diversity represented considerable native biodiversity conservation value (Bramblett and Zale 2002). According to the USFWS, there are no fish present in the three intermittent tributaries that cross the Tour Road via culverts (DEA 2004 in NPS LIBI 2005a:13).

h. Minidoka Wildlife

An unknown number of birds, mammals, reptiles, and amphibian is found in the monument. No systematic inventory of wildlife species has been completed. Most information comes from information about the habitat and wildlife in the region and from casual on-site observations.

Mammals: Mule deer (*Odocoileus hemionus*) are the largest and most easily recognized large mammal found in and around the site. Occasional pronghorn (*Antilocapra americana*) may also be seen. In addition, there is evidence of coyotes (*Canis latrans*), yellow-bellied marmots (*Marmota flaviventris*), mountain cottontail (*Syvilagus nutallii*) and black-tailed jackrabbits (*Lepus californicus*), and a variety of small mammals, including wood rats (*Neotoma* sp.), deer mice (*Peromyscus maniculatus*) and voles (*Microtus* sp.).

Birds: Along the North Side Canal mallards, gadwalls and cinnamon teal have been observed. Because water only flows through the canal during a portion of the year, typically April through October, the canal is of limited value in sustaining populations of waterfowl. The canal contains marginal nonnative riparian habitat (mostly Russian olive trees currently strung with a nonnative invasive vine – white bryony). The only permanent water in the historic site is a small pond approximately one acre in size. This site has a well developed cattails wetland and is used by numerous waterbirds and marsh birds for both migratory stopover and breeding. These include several species of waterfowl as well as red-winged and yellow-headed blackbirds, marsh wrens, and warblers.

Among the terrestrial birds that have been observed at the site include red-tailed and Swainson's hawks, northern harriers, ravens, turkey vultures, Bullock's orioles, killdeer, brown-headed cowbirds, brewer's blackbirds, barn and great-horned owls and the nonnative ring-necked pheasant (hunted in the vicinity of the park).

Reptiles and Amphibians: Although not a naturally occurring habitat, the North Side Canal does provide surface water, which may harbor populations of amphibians, however these have not been inventoried. Reptiles observed at the site include gopher snakes (NPS MIIN 2006).

Fish: Due to the lack of surface water, there are no fish in the park. Oral histories of former Minidoka internees indicate that the North Side Canal did contain fish during the historic period. At that time, Snake River water was diverted through the canal year-round. Modern operation of the canal limits diversion to the growing season and requires the use of fish screens and other methods to prevent the entrainment of fish into the canal. For these reasons, fish are now rarely, if ever, present in the North Side Canal (NPS MIIN 2006)

i. Nez Perce: Bear Paw Wildlife

Approximately 53 species of birds, 14 mammals, five reptiles and 1 amphibian are found at the battlefield.

Birds: Among birds, hawks are abundant, including nesting Northern Harriers, with smaller perching birds as well, including the lark bunting, horned lark, and meadowlarks.

Mammals: The Missouri Basin, the larger topographical setting of Bear Paw Battlefield, was once the home of large herds of bison (*Bison bison*). Now, pronghorn antelope (*Antilocapra americana*) are now the most common large mammal, however black-tailed or mule deer (*Odocoileus hemionus*) are also found along streams and where brush cover is abundant. Other wildlife found at the Battlefield includes: Richardson's ground squirrels (*Spermophilus richardsonii*), coyotes (*Canis latrans*), and badgers (*Taxidea taxus*).

Reptiles and Amphibians: In addition the following amphibians and reptiles may be found: rattlesnakes (*Crotalus viridis*), racer (*Coluber constrictor*), gopher snake (*Pituophis catenifer*), western terrestrial garter snake (*Thamnophis elegans*), plains garter snake (*Thamnophis radix*), and tiger salamander (*Ambystoma tigrinum*)

Important Wildlife Habitat: Many species of prairie grassland vertebrates, which have been documented on or near the battlefield are believed to be in various stages of chronic decline. These include the swift fox (*Vulpes velox*), long-billed curlew, Sprague's pipit, Baird's sparrow, and the lark bunting. The presence of these species at the site could be affected by additional habitat fragmentation.

j. Nez Perce: Big Hole Wildlife

There are approximately 407 birds, 122 mammals, 20 amphibians, and 18 reptiles known to occur as residents or migrants in Montana. A mammal and herpetological inventory of the Big Hole indicates there are approximately 31 mammals (excluding bats), two reptiles, and two amphibians occurring in the Big Hole (Strobl, Garrett, and Rodhouse 2003 *in* NPS BIHO 2005). Another study concluded there are approximately 83 bird species that inhabit or frequent Big Hole (Dixon 2003, in press *in* NPS BIHO 2005).

Birds: The willow flats along the river support concentrations of veery, northern waterthrush, Lincoln's sparrow, and yellow warbler. The lodgepole pine forest on the mountain slope consisted of typical forest species including: Townsend's solitaire, hermit thrush, goldencrowned kinglet, Clark's nutcracker, and western tanager, among others. The sagebrush-steppe of the bench and mountain slope was represented by key sagebrush and/or grassland associated species such as the Brewer's sparrow, vesper sparrow, and savannah sparrow.

Other species recorded include: common merganser, solitary sandpiper, cordilleran flycatcher, ferruginous hawk, black-headed grosbeak, Wilson's warbler, and common yellowthroat (Monello and Wright 1998 and Dixon 2009 in NPS BIHO 2005). Van Sickle (1987) recorded 24 additional species, including the northern goshawk, golden eagle, western screech-owl, MacGillivray's warbler, and spruce grouse. Also recorded were common merganser, solitary sandpiper, ferruginous hawk, and black-headed grosbeak. Dixon (2009) also found two winter residents of note – the American tree sparrow and the common redpoll, as well as the bald eagle, rough-legged hawk, northern pygmy owl, long-eared owl, Hammond's flycatcher, Say's phoebe, and black-billed magpie.

Mammals: Bear Paw and Big Hole were once the home of large herds of bison (*Bison bison*), which the Nez Perce traveled to hunt. In fact, one Nez Perce name for the Big Hole valley was "place of the buffalo calf." Pronghorn antelope (*Antilocapra americana*) are now the most common large mammal, but mule and whitetail deer (*Odocoileus hemionus; Odocoileus virginianus*) may be found along stream channels where brush cover is available. Whitetail jackrabbits (*Lepus townsendii*), desert cottontail (*Sylvilagus audubonii*), ground squirrels (*Spermophilus lateralis*), coyotes (*Canis latrans*), and badgers (*Taxidea taxus*) are common.

Other mammals found in this conifer/alpine meadow ecoregion are gray wolf (*Canis lupus*), elk (*Cervus nippon*), moose (*Alces alces*), black bear (*Ursus americanus*), mountain lion (*Puma concolor*), beaver (*Castor Canadensis*), and porcupine (*Erethizon dorsatum*). Additional small mammals include flying squirrel (*Flaucomys sabrinus*), marten (*Martes Americana*), and woodrats (*Neotoma cinerea*).

Reptiles: Big Hole was inventoried for reptiles over eight days on two separate periods during July and August, 2002. Two species of reptiles were expected to occur in the Big Hole National Battlefield and both were confirmed. The reptile species with the highest abundance during the survey was the common garter snake (*Thamnophis elegans*). The other species was the western terrestrial garter snake (*Thamnophis elegans*).

Amphibians: Big Hole lies in the conifer-alpine ecoregion so the diversity of amphibians is relatively low. Two species are found in the park: the Columbia spotted frog (*Rana luteiventris*) and the western toad (*Bufo boreas).* The number of spotted frogs in a 2002 study was estimated at over 2000 individuals, based on the presence of tadpoles and other life stages in wetlands adjacent to the Big Hole River.

The western toad is a federal species of concern. In the 2002 survey, an individual western toad was found in tall sedges near an oxbow of the Big Hole River. This species was also observed twice during a1987 inventory. In general, however, this species appears to be rare in the battlefield.

Fish: The North Fork is a tributary of the Big Hole River that flows through the Big Hole. Potential fish species in the North Fork include arctic grayling (*Thymallus arcticus*), brook trout (*Salvelinus fontinalis*), burbot (*Lota lota*), longnose dace (*Rhinichthys cataractae*), longnose sucker (*Catostomus catostomus*), mottled sculpin (*Cottus bairdi*), mountain whitefish (*Prosopium williamsoni*), and rainbow trout (*Oncorhynchus mykiss*) (MDFWP 2004 *in* NPS BIHO 2005). Ruby Creek and Trail Creek enter the North Fork just south of the park boundary. Fish species that occur in these creeks include brook trout, sculpin, westslope cutthroat (*Oncorhynchus clarki lewisi*), longnose sucker, and burbot (MDFWP 2004 *in* NPS BIHO 2005). These species may also occur within Big Hole from these creeks. Fishing is allowed within the park with the purchase of a Montana fishing license (NPS BIHO 2005).

3. Special Status Species (including Federally-listed Species)

Special status species are those listed as endangered or threatened under the Endangered Species Act (ESA), candidates or species proposed for listing under the ESA, species listed by states as endangered or threatened, or species of special concern or listed by the parks as sensitive.

a. City of Rocks Special Status Species

There are no federally-listed species known to occur in the reserve. There are, however, two species of special concern that occur in the reserve: the ferruginous hawk and Townsend's big-eared bat.

Three plants identified by the Idaho Natural Heritage Program and the Idaho Native Plant Society are also found in the reserve. These include Simpson's hedgehog cactus (*Pediocactus simpsonii)*, found at its northern extent in the park, it occurs in rocky or sandy soils on a windswept slope. It is threatened by grazing, collectors and disturbance. Narrow-leaved Indian paintbrush (*Castilleja angustifolia*) occurs in shallow, rocky soils and also reaches its northernmost extent in the reserve. It is threatened by disturbance and is unpalatable as a forage species. Kruckeberg's sword fern (*Polystichum kruckebergii)* is found in cool, moist granite microhabitats. It grows in rock crevices and is threatened from trampling or removal by visitor activities, such as rockclimbing.

b. Craters of the Moon Special Status Species

The USFWS provided the following list of species that could be affected by the proposals in this plan: gray wolf (endangered as of August 2010), pika (candidate listing not warranted), and greater sage-grouse (candidate, listing warranted but precluded by higher priorities).

The following list of species was compiled in March 2010:

Species	Status		
	BLM	Idaho	USFWS
MAMMALS			
Merriam's Shrew (*Sorex merriamii)*#		SC	
Gray wolf (*Canis lupus*)	T		T
Townsends's big-eared bat (*Corynorhinus townsendii*)	S	SC	SC
Western small-footed myotis (*Myotis ciliolabrum*)	W		
Long-eared myotis (*Myotis evotis*)	W		