



Vegetation Classification and Mapping Project

Minidoka National Historic Site

Natural Resource Technical Report NPS/UCBN/NRTR—2009/XXX



ON THE COVER

View of the entrance station at Minidoka National Historic site
NPS-Photo

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Special recognition goes to Dr. Karl Brown with NPS for prioritizing the need for UCBN projects and providing funding for eight of the nine parks in the network. Without the financial support for HAFO from the USGS-NPS Vegetation Mapping Program (NVMP) this donated project would not have been possible at this level of detail.

For these and other contributors to the success of the project, we are grateful.

Executive Summary

Minidoka National Historic Site (MIIN) administrative boundaries encompass approximately 78 acres of the Snake River Plain in south-central Idaho. It is managed by staff from Hagerman Fossil Beds National Monument (HAFO) located to the west near Hagerman, Idaho in the Snake River canyon. Of the nine parks that comprise the Upper Columbia Basin Network (UCBN) MIIN is the only one that is not eligible for funding a vegetation classification and mapping project under the NVMP because it was recently designated as a National Historic Site (2001). The NVMP selected 270 park units for classification and mapping in the early 1990s and are presently funding that selection list, exclusive of MIIN. This vegetation mapping database is being donated to the NPS-UCBN by CTI at no cost, recognizing the value of this database for natural resources management within this newly emerging site.

MIIN is located approximately 40 miles east of Hagerman, near the city of Burley in Jerome County. This terrain supports approximately 250 species of vascular plants and includes examples of native plant communities indigenous to this area and semi-natural plant communities that have become established since settlement by ranchers and farmers and later use as an internment camp. The site presently consists of a small acreage within the formerly 33,000-acre Minidoka Internment Camp which housed an estimated 13,000 Nikkei during World War II. To better understand the distribution of the plant assemblages located on HAFO (some of which also occur at MIIN), the NPS-UCBN started a vegetation classification and mapping project at HAFO in 2006.

A three-year program was initiated to complete the task of classifying and mapping the vegetation at HAFO; the results of the HAFO project are being used to develop this volunteer project for MIIN. Phase One which was directed by HAFO and network staff in conjunction with NatureServe developed a vegetation classification using the National Vegetation Classification System (NVCS). Phase Two, directed by Northwest Management, Inc.'s (NMI) GIS Laboratory and Cogan Technology, Incorporated (CTI) produced a digital vegetation map for HAFO. To classify the HAFO vegetation, 85 representative plots located throughout the monument were sampled during the summer of 2006. Analysis of the plot data by the Idaho Conservation Data Center (ICDC) in the winter of 2006-2007 produced 34 distinct plant associations. In addition, CTI described two additional alliances and one distinctive stand of vegetation (i.e. Park Special) that primarily occurred outside of the monument boundary in the HAFO environs. Vegetation descriptions and a field key for all plant assemblages for HAFO (NPS 2009) are used for reference in this report and included in **Appendix C**.

To produce the digital map, 1:12,000-scale true color digital ortho-imagery acquired in 2004 and 2006 by the U.S. Department of Agriculture - Farm Service Agency Aerial Photography Field Office and the National Agriculture Imagery Program (NAIP) were acquired and interpreted. For the final map, 20 map units (11 vegetated and nine land use) were developed from the HAFO database and a field reconnaissance survey, then directly cross-walked or matched to their corresponding plant associations and land use classes. All of the interpreted and remotely sensed data were converted to Geographic Information System (GIS) databases using ArcGIS®

software. Final maps were printed for use by the UCBN, HAFO, and MIIN managers. There was no accuracy assessment of this donated project, as discussed herein.

Products developed for MIIN are described and presented in this report, as well as stored on the accompanying DVD. These include:

- A *Final Report* that includes a background discussion, a key to the vegetation and imagery signatures, selected portions of the HAFO project database as appendices, and the methods and results of the project;
- A *Spatial GIS Database* containing spatial data for the vegetation and land use units;
- *Digital Photos* from miscellaneous monument views;
- *Metadata* for all spatial data [Federal Geographic Data Committee (FGDC)-compliant];
- *Vegetation Summaries and Photo Signature Key* to the map classes and associations/alliances.

In addition, HAFO/MIIN and the UCBN both received copies of:

- The final project report and digital data files and
- Hardcopy vegetation maps.

Additional data not included in this report can be found on the attached DVD which includes text and metadata files, spatial data, the vegetation map, and digital ground photos. Please access the following USGS website for posting of this information:

<http://biology.usgs.gov/npsveg/index.html>. For additional information on the National Vegetation Classification Standard (NVCS) and National Vegetation Classification (NVC) alliances/associations in the United States please visit NatureServe's website: <http://www.natureserve.org>.

A summary of the project statistics is included below:

Classification:

Seven NVCS Plant Associations and Alliances

GIS Database 2002-2005:

Project Size: Minidoka National Historic Site = 78 acres; U.S Bureau of Reclamation = 2 acres; Environs area = 4,510 acres

Base Imagery acquired from the USDA FSA Aerial Photography Field Office acquired through the National Agriculture Imagery Program:

2006 - 1:12,000-scale true color ortho-rectified imagery, compressed county mosaic, 2 meter pixel resolution

2004 - 1:12,000-scale color infrared digital ortho-imagery, compressed county mosaic, 1 meter pixel resolution

20 Map Classes

11 Vegetated

9 Non-vegetated

Minimum Mapping Unit = ½ hectare (1.24 acres) is the program standard but was modified at MIIN to 0.25 acre for most map units.

Total Size = 572 Polygons

Average Polygon Size = 8 acres

Project Completion Date: August 2009

Introduction

Vegetation Classification and Mapping Project, Minidoka National Historic Site

The MIIN Vegetation Classification and Mapping Project was organized and coordinated by CTI at no cost for the NVMP and the UCBN Inventory and Monitoring (I&M) Program during 2009. The purpose of this project was to describe and map existing plant associations on approximately 78 acres within the MIIN administrative boundary and approximately 4,510 acres in the adjacent environs, and to provide this information in written, tabular, digital, and spatial formats useful to NPS resource managers, the UCBN I&M Program, HAFO staff, and other users. The basic project components consisted of vegetation classification at HAFO adapted to MIIN, background and vegetation description, and spatial database development.

In 2006, the UCBN I&M Program launched a multi-year project to complete vegetation classifications and maps for eight network park units with funding provided by the NVMP and the UCBN. The MIIN Vegetation Classification and Mapping Project will be completed during 2009 for the UCBN by CTI. The vegetation classification data used were from HAFO where sampling occurred in 2006.

Project methods, results, and products are documented in this report. This introductory section describes the NPS I&M Program and the USGS-NPS Vegetation Mapping Program, as well as the MIIN mapping project site. Later sections document the methods and results for each of the major steps in the project: scoping, vegetation classification and description at HAFO, vegetation mapping, and accuracy assessment as applied at HAFO.

USGS-NPS Vegetation Mapping Program

In 1994, the USGS and NPS formed the USGS-NPS Vegetation Mapping Program (NVMP) to cooperatively inventory and map the vegetation in selected National Parks. The goals of this program are to provide baseline ecological data for park resource managers, obtain data that can be examined in a regional and national context, and provide opportunities for future inventory, monitoring, and research activities (FGDC 1997, Grossman et al. 1998).

In the same year, the NVMP also adopted the U.S. National Vegetation Classification (USNVC) (The Nature Conservancy and Environmental Systems Research Institute 1994a, Grossman et al. 1998) as a basis for the *a priori* definition of vegetation units to be inventoried. The Federal Geographic Data Committee (FGDC) adopted a modified version of the upper (physiognomic) levels as a federal standard (FGDC-STD-005) (FGDC 1997). This standard was hereafter termed the National Vegetation Classification Standard (NVCS). The NVCS established a federal standard for a complete taxonomic treatment of vegetation in the U.S. at physiognomic levels. It also established conceptual taxonomic levels for the floristic units of alliance and association, largely following the USNVC, but did not offer a taxonomic treatment for the floristic levels because of the immense scope of establishing robust floristic units for the entire U.S. The FGDC standard requires that federally funded vegetation classification efforts collect data in a manner that enables crosswalking the data to the NVCS (i.e., the physiognomic levels) and sharing between agencies, but does not require use of that standard by agencies for internal mission needs. NatureServe maintains a treatment of floristic units (alliances and associations), which,

though not a federal standard, are used as classification and mapping units by the NVMP whenever feasible. For purposes of this document, the federal standard (FGDC 1997) is denoted as the NVCS; the USNVC will refer exclusively to NatureServe's treatment for vegetation floristic units (alliances and associations only) (see **Table 1**).

Table 1. National Vegetation Classification System hierarchy for terrestrial vegetation (FGDC 1997).

Level	Criteria Delineating Level	Example
Class	Structure (height, cover) of dominant vegetation strata	Woodland
Subclass	Growth form characters including leaf type (evergreen, deciduous) for woody plants and persistence (perennial, annual) for herbaceous species	Evergreen woodland
Group	Leaf morphology (broad leaf, microphyllous, xeromorphic), leaf phenology, and climate conditions	Temperate or subpolar needle-leaved evergreen woodland
Subgroup	Relative degree of human disturbance	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland
Formation	Additional physiognomic characteristics, general environmental conditions, relative landscape position, and hydrologic regimes	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland
Alliance	Dominant or diagnostic species of uppermost or dominant stratum	<i>Salix (exigua, interior)</i> Temporarily Flooded Shrubland Alliance
Association	Other dominant or diagnostic species from any stratum	<i>Salix exigua</i> Temporarily Flooded Shrubland

The NVCS as the standard vegetation classification system is central to fulfilling the goals of the NVMP. This system:

- is vegetation based;
- uses a systematic approach to classify a continuum;
- emphasizes natural and existing vegetation;
- uses a combined physiognomic-floristic hierarchy;
- identifies vegetation units based on both qualitative and quantitative data; and
- is appropriate for mapping at multiple scales.

The use of the NVCS and the NVMP mapping protocols facilitate effective resource stewardship by ensuring compatibility and widespread use of the information throughout the NPS as well as by other federal and state agencies. These vegetation maps and associated information support a wide variety of resource assessment, park management, and planning needs. In addition they can be used to provide a structure for framing and answering critical scientific questions about vegetation communities and their relationship to environmental conditions and ecological processes across the landscape.

The NVCS has primarily been developed and implemented by TNC and the network of State Natural Heritage Programs over the past thirty years (TNC 1994a; Grossman et al. 1998). The NVCS is currently supported and endorsed by multiple federal agencies, the FGDC, NatureServe, State Heritage Programs, and the Ecological Society of America. Refinements to

the classification occur in the process of application, which lead to ongoing revisions that are reviewed both locally and nationally. TNC and NatureServe have made available a 2-volume publication presenting the standardized classification, providing a thorough introduction to the classification, its structure, and the list of vegetation types occurring across the United States as of April 1997 (Grossman et al. 1998). *Volume I: The National Vegetation Classification Standard* can be retrieved from the Internet at:

<http://www.natureserve.org/publications/library.jsp>. NatureServe has since superseded *Volume II* of the publication (the classification listing), providing regular updates to ecological communities in the United States and Canada. This online database server, NatureServe Explorer®, can be accessed on the Internet at: <http://www.natureserve.org/explorer>.

NPS Vegetation Mapping Program

The Director of the NPS approved the Natural Resource Challenge in 1999 to encourage national parks to focus on the preservation of the nation's natural heritage through science, natural resource inventories, and expanded resource monitoring (NPS 1999). The Natural Resource Challenge provided funding for 12 baseline inventories to be completed in each of 270 parks with significant natural resources. The vegetation mapping inventory is considered one of the baseline inventories. Also due to the Challenge, the 270 parks were organized into 32 networks for the purpose of accomplishing natural resource inventory and monitoring projects, the UCBN is one of the networks.

The Vegetation Mapping Inventory is a cooperative effort between the USGS and NPS to classify, describe, and map vegetation communities; vegetation species and communities are often unique from park to park. The inventory of these resources helps park managers conserve plant biodiversity; manage challenges including exotic species, insect outbreaks, and diseases; and understand resources and processes including wildlife habitat relationships, drought, and wildland fires.

The primary objective of the Vegetation Mapping Inventory is to produce high-quality, standardized maps and associated data sets of vegetation and other land cover occurring within parks. This digital information fills datagaps and complements a wide variety of resource assessments, park management, and conservation needs. For example, in Sequoia and Kings Canyon national parks, the 2007 vegetation map and digital database provided tools to better manage foxtail pine (*Pinus balfouriana* ssp. *austrina*), a tree species endemic to the southern Sierra Nevada Mountains. Foxtail pine can survive more than 1,000 years and the tree rings contain valuable information about past climate fluctuations and other environmental factors. In Rocky Mountain National Park, vegetation map and inventory data aid in the study of American elk (*Cervus elaphus*) foraging damage to quaking aspen (*Populus tremuloides*) and willow (*Salix* spp.) trees and shrubs within American elk wintering grounds and summer habitats.

NPS vegetation mapping projects adhere to well-established procedures that are compatible with other agencies and organizations. The inventory uses the NVCS, a system that is integrated with the major scientific efforts in the taxonomic classification of vegetation, and is a FGDC standard. In addition, stringent quality control procedures ensure the reliability of the vegetation data and encourage the use of resulting maps, reports, and databases at multiple scales.

A complete vegetation mapping project for a park typically includes the following products:

- Detailed vegetation report
- Digital vegetation map
- Vegetation classification plot data and MS Access database
- Accuracy assessment data and analyses
- Dichotomous vegetation key
- Photo-interpretation key

Maps are produced in Universal Transverse Mercator (UTM) coordinates (NAD 83) with a 1:24,000 scale and a minimum mapping unit of 0.5 hectares (1.24 acres). The vegetation maps must meet the National Map Accuracy Standards for positional accuracy, and the minimum class accuracy goal across all vegetation and land cover classes of 80 percent.

Minidoka National Historic Site

Minidoka National Historic Site (MIIN) was designated by presidential proclamation in 2001 as Minidoka Internment National Monument (NPS-GMP 2006). The name was formally changed to that of a national historic site in 2008. It was established to preserve the historic features and interpret the history of the former Minidoka Relocation Center (established by the War Relocation Authority in 1942), which held 13,000 Nikkei (Japanese-American citizens and legal resident aliens of Japanese ancestry) from the states of Washington, Oregon, California, and Alaska during World War II. At that time, the 33,000-acre relocation center represented the seventh largest population in Idaho.

Administratively, MIIN occupies approximately 78 acres, less than one per cent of the original 33,000 acres; the remainder of the site is privately owned or is managed by the American Falls Reservoir Irrigation District #2, U.S. Bureau of Reclamation, or U.S. Bureau of Land Management (NPS-GMP 2006). Much of the former MIIN land has been planted to crops requiring irrigation including alfalfa, field corn, sweet corn, sugar beets, barley, rye, wheat, beans, and potatoes (USDA-NRCS 1998; USDI-BOR undated). During the time of construction (1942) and occupation (through 1945) this site was heavily disturbed to build transportation/access routes, site buildings, water facilities, farm fields, gardens, landfill, and security fencing which is reflected in the composition of the existing vegetation onsite. The site is located on the relatively flat Snake River Plain of south-central Idaho and the southern boundary is formed by the North Side Main Canal which conveys irrigation water from the Minidoka Dam/Lake Walcott constructed approximately 35 miles upriver.

MIIN is located approximately 17 miles northeast of Twin Falls, 21 miles east of Jerome, and six miles west of Eden (NPS-GMP 2006). Jerome (population 7,780) is the county seat of Jerome County which has a low population density of 31 people per square mile. The monument is accessed from Hunt Road via Interstate 84 at the US Highway 93 junction traveling north to US Highway 25 to Hunt Road. The current Visitor Center is located in Hagerman, Idaho.

Natural Setting

MIIN is located along the northern bank of the North Side Main Canal north of the Snake River occupying its extensive and undulating alluvial plain. The Snake River is a major tributary of the Columbia River system that flows through the physiographic region of Idaho known as the Snake River Plain (also known as the Columbia Plateau physiographic province of authors), a topographic depression that cuts across Basin and Mountain structures paralleling the North American tectonic plate and filled with alluvium. The Snake River Plain is underlain entirely by basalt deposited during eruptions from the large shield volcanoes of the region (Snake River Basalts geologic section). Beneath the basalt deposits lay rhyolite flows and ignimbrites that erupted as the lithosphere passed over the volcanic hotspot. The average elevation within the mapping project boundary is approximately 3,960 feet.

Using average data recorded over a 93-year period at Jerome and the Jerome Airport (Station 104670, WRCC 2009), MIIN typically experiences hot, dry summers with temperatures sometimes exceeding 100 degrees F (°F). The average maximum temperatures range between 35.8°F during January to 91.7°F during July and the average minimum temperatures range between 18.2°F during January to 56.1°F during July. Precipitation averages 9.7 inches annually and ranges from a low of 0.2 inches during July to 1.2 inches in December and January. The area receives an average of 16.3 inches of snowfall annually. Windspeed ranges from 7.4 to 12.5 miles-per-hour (mph) and averages 10.1 mph annually, contributing to evaporation of moisture from the ground surface and vegetation.

The dry, continental climate creates a need for water sources for irrigation and livestock grazing in the area. Numerous dams have been constructed on the Snake River, including the Minidoka Dam, which forms Lake Walcott and diverts water to the North Side Main Canal, among other irrigation canals in the vicinity of MIIN. Water is diverted from the north side of Lake Walcott into the North Side Main Canal, a gravity canal and lateral system serving 72,000 acres of land called the Gravity Division, in the vicinity of Rupert (USDI-BOR undated). The 8-mile main canal has an initial capacity of 1,700 cubic feet per second that is managed by the American Falls Reservoir Irrigation District #2. In general, Snake River dams primarily support/facilitate water storage, irrigation, energy production, and recreation. In addition to the diversion of surface flows from the Snake River, farmers and ranchers utilize ground water through pumping via deep wells.

Soils of the MIIN vegetation mapping area are described under the general soil map unit of Power-McCain-Paulville, 1-8% slopes and are predominantly of the Barrymore-Starbuck silt loam complex, 1-4% slopes (USDA-NRCS 1998, NPS-GMP 2006). These soils are shallow to moderate in depth, well drained, and formed over fractured bedrock at 18-25 inches deep. Along the northern MIIN mapping project boundary there also occur very deep and well drained Barrymore silt loam, 1-4% slopes, Power silt loam, 1-4% slopes, and Power-McCain Complex, 1-6% slopes soils. All soils types are classified as Prime Farmland if irrigated, however the historic site has no water rights and does not irrigate these or other arable soils; outside the historic site administrative boundary, these soils are irrigated and are classified as Prime Farmland (NPS-GMP 2006).

Vegetation

The flat to undulating terrain around MIIN supports up to 250 species of vascular plants and includes examples of native and non-native plant communities indigenous to this area. The potential native vegetation of the MIIN site, based on the common soils, consisted of sagebrush steppe characterized by Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), other sagebrush species, Thurber needlegrass (*Achnatherum thurberianum*), and bluebunch wheatgrass (*Pseudoroegneria spicata*) (USDA-NRCS 1998). Extant vegetation includes a mosaic of native species, species introduced by grazing livestock, remnants from plantings introduced by the interneers, non-native invasive species, and noxious weed species (NPS-GMP 2006). A domestic groundwater well is used for drinking water and to irrigate turf grasses and trees at the American Falls Reservoir Irrigation District #2 building within MIIN. There has been no focused inventory of plant species to date.

The most common native shrubs of upland flats include species of rabbitbrush (*Chrysothamnus* spp. or *Ericameria* spp.), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), black greasewood (*Sarcobatus vermiculatus*), and Wyoming big sagebrush. Common native upland herbaceous species include bluebunch wheatgrass, Thurber needlegrass, Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Elymus elymoides*), Indian ricegrass (*Achnatherum hymenoides*), inland saltgrass (*Distichlis spicata*), basin wildrye (*Leymus cinereus*), phlox (*Phlox* spp.), and arrowleaf balsamroot (*Balsamorhiza sagittata*). Tree species introduced to and persisting on the landscape include black locust (*Robinia pseudoacacia*), Siberian elm (*Ulmus pumila*), Russian-olive (*Elaeagnus angustifolia*), and cottonwood (*Populus* spp.). The saturated banks of the North Side Main Canal support the trees cottonwood, Siberian elm, and Russian-olive, willow (*Salix* spp.) shrubs, and herbaceous vegetation that include species of sedge (*Carex* spp.) and remnant turf grasses (NPS-GMP 2006). The canal carries irrigation water to about 72,000 acres of farmland between the months of April and October, annually.

There are seven noxious weed species that occur within the MIIN boundary and will require management prescriptions (NPS-GMP), they include: (1) Canada thistle (*Cirsium arvense*), (2) field bindweed (*Convolvulus arvensis*), (3) Scotch thistle (*Onopordum acanthium*), (4) Russian knapweed (*Acroptilon repens*), (5) musk thistle (*Carduus nutans*), (6) yellow starthistle (*Centaurea solstitialis*), and (7) rush skeletonweed (*Chondrilla juncea*). An additional list of five common weeds occurring within MIIN is: (1) prickly sowthistle (*Sonchus asper*), (2) common mullein (*Verbascum thapsus*), (3) burdock (*Arctium minus*), (4) bull thistle (*Cirsium vulgare*), and (5) cheatgrass (*Bromus tectorum*). Cheatgrass is often associated with the non-native annual forb tumble mustard (*Sisymbrium altissimum*).

MIIN has a high fire frequency of approximately 15 years resulting in the perpetuation of expanses of the annual non-native cheatgrass and other annual and biennial non-native plant species (NPS-GMP 2006). Fire management will include full suppression during the months of July and August and limited suppression in other months.

Minidoka National Historic Site Vegetation Mapping Project

The specific decision to classify and map the vegetation at MIIN using data sampled in HAFO was made by CTI on a volunteer basis using guidelines set forth by the NVMP and implemented by CTI and the UCBN; nine National Park units within four states in the Inland Northwest, e.g., Idaho, Montana, Oregon, and Washington (**Figure 1**). This network was formed to create and centralize necessary information about the nature and status of selected biological resources occurring within park boundaries. The information is used for informing management decisions, scientific research, and educating the public. One of the goals of this network is to provide baseline inventory information for resource management and to help monitor the health of park ecosystems. Stemming from this goal, development of a vegetation classification to the plant association to vegetation complex levels and associated GIS map and database for each park was viewed as a high priority.

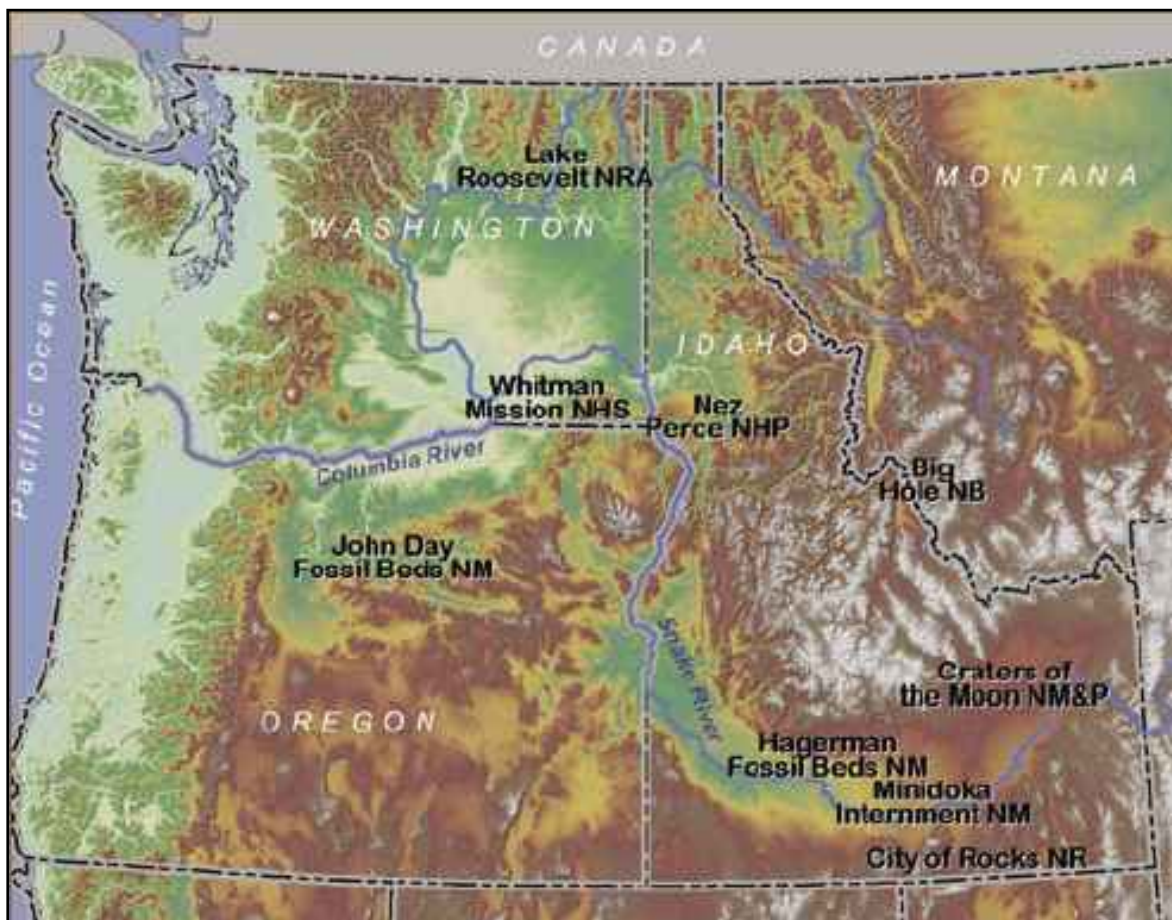


Figure 1. Map of UCBN showing the location of the park units in the network.

MIIN is one of nine parks served by the UCBN I&M Program, however due to its small size and new status (designated in 2001) was excluded from the funded vegetation mapping effort which selected parks for mapping in the 1990s. CTI determined that a quality vegetation map could be produced to represent the existing plant communities using data sampled at HAFO and a brief site reconnaissance visit by an experienced vegetation mapping ecologist. Classification plots were sampled at HAFO in the spring of 2006 and AA data were collected in 2008. This report summarizes the voluntary effort of CTI owner, Dan Cogan, to provide a digital vegetation database and summary report for MIIN based on the HAFO experience.

An initial multi-year work plan was developed for the UCBN by CTI which provided recommendations for completing the plant community classification, digital database, and map products for eight of the UCBN member parks, excluding MIIN. The work plan received approval from the Washington Area Service Office (WASO) Inventory Coordinator in May 2006.

An initial scoping or kick-off meeting was held at Craters of the Moon National Monument & Preserve (CRMO) May 3-4, 2006 to discuss the preliminary vegetation classification for both CRMO and HAFO. NMI was contracted to complete vegetation plot field data collection during May-July 2006 and contracted a portion of the work to engineering-environmental Management, Incorporated (e²M) ecologists who provided NVMP sampling expertise and NMI staff training. The ICDC provided the preliminary and final vegetation classification as part of a cooperative agreement with the UCBN. CTI, as part of an interagency agreement with the USDI-BOR, provided photo interpretation services. In September 2007, the UCBN entered into a contract with NMI to provide all the vegetation mapping services designated by the work plan and to administer and coordinate the UCBN vegetation mapping projects for the eight park units designated under the NVMP.

CTI objectives were to produce data for MIIN consistent with the NVMP guidelines by using the results obtained from HAFO, including:

Spatial Data

- Aerial photography (NAIP imagery)
- Map classification based on HAFO/MIIN-specific requirements
- Map classification descriptions and key based on HAFO
- Spatial database of vegetation communities of HAFO/MIIN
- Digital and hardcopy maps of vegetation communities
- Metadata for spatial databases
- Complete accuracy assessment of spatial data for HAFO, with implied acceptable accuracy for the MIIN volunteer database

Vegetation Information

- Vegetation classification based on HAFO research
- Dichotomous field key of vegetation classes produced for HAFO
- Formal description for each vegetation class from HAFO data
- Ground photos of vegetation classes
- HAFO field data in database format

Scope of Work

Vegetation mapping for MIIN occurred within an approximately 78 acre historic site encompassing the boundary provided by the UCBN. An environs area was also mapped, which included 4,510 acres of mostly agricultural land. Mapping was conducted on a volunteer basis as work on this site could not be funded by the USGS-NPS because MIIN is a new monument. Rather, project time was donated by the CTI owner and GIS specialist relying on classification data sampled at HAFO and a field overview by the USDI-BOR ecologist and mapping specialist. The final project area determination was based on known and perceived future site management needs (Figure 3). The mapping project area is approximately 78 acres of managed land and an environs area of approximately 4,510 acres (**Figure 2**).

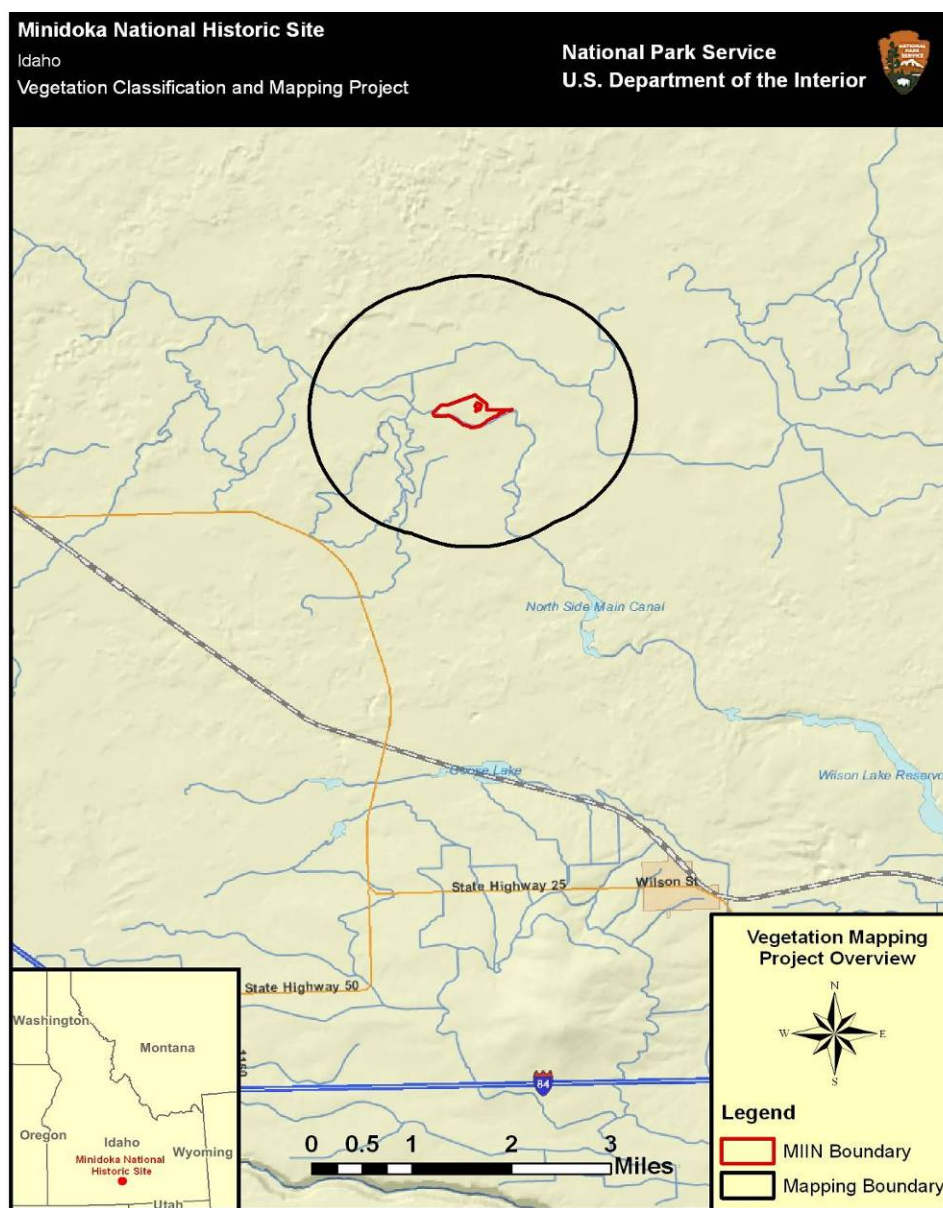


Figure 2. Map of the MIIN Project Area and Environs.

Methods

The vegetation mapping project at MIIN was considered to be in the “small park” category based on the overall size of the respective project area (TNC 1994b). In contrast, the HAFO vegetation mapping project was considered to be in the “medium park” category. As such, the standard methodology for sampling and mapping small- and medium-sized sites is to visit the entire site and select representative stands that are used to characterize the vegetation types and explain their distribution across the monument/historic site without having to survey each stand of vegetation. This approach was applied at the funded HAFO project site and extrapolated to the unfunded MIIN project site. The assignment of responsibilities at HAFO and extrapolated to MIIN included five major steps following the flowchart produced for the NVMP by the USGS (**Appendix A**), they are:

1. Plan, visit sites, gather data, and coordinate tasks;
2. Survey HAFO to understand and sample the vegetation, apply results to MIIN;
3. Classify the HAFO vegetation field data to NVCS standard associations and alliances and crosswalk these to recognizable map units at HAFO and MIIN;
4. Acquire current digital imagery and interpret the vegetation using the classification scheme and a map unit crosswalk;
5. Assess the accuracy of the final map product at HAFO to imply map accuracy at MIIN

All protocols for this project as outlined in the following sections can be reviewed in documents produced by The Nature Conservancy (1994a, 1994b, and 1994c) for the NVMP and are electronically available online at: <http://biology.usgs.gov/npsveg>.

Planning, Data Gathering and Coordination

A series of planning conference calls and meetings were held throughout 2006 and attended by representative CTI, NMI, UCBN, and CRMO staff which assisted in the development of the HAFO project that is being used to inform this MIIN project. The planning goals were to: (1) discuss the NVMP with the UCBN/CRMO/HAFO staffs, (2) learn about the management issues and concerns, (3) discuss availability of existing data, (4) develop a schedule, (5) discuss procedural issues and data, (6) define potential cooperators, and (7) define a project scope.

Once project boundaries were finalized all of the latest NAIP imagery for this area was ordered from the USDA Geospatial Gateway website (<http://datagateway.nrcs.usda.gov>). The imagery included both the county mosaics and the corresponding individual quarter quadrangles. The remaining work responsibilities for contributors to the HAFO project and ultimately this MIIN project were assigned to the following participants:

HAFO/MIIN-UCBN-NPS Responsibilities

- Provide oversight and project funding;
- Provide HAFO plant list;
- Supply digital boundary files and ancillary data files;
- Assist with fieldwork and logistical considerations;
- Work with ICDC to develop the vegetation classification;
- Compile, review, and update drafts of the vegetation map, classification and report;
- Accept the final products and close the project.

NMI Responsibilities at HAFO

- Provide project management,
- Coordinate the field work with HAFO;
- Collect representative classification plot data;
- Collect less detailed observations about the draft vegetation map;
- Write descriptions of the vegetation types classified at HAFO;
- Write a field key to the vegetation types classified at HAFO;
- Collect accuracy assessment data;
- Provide a final report describing all aspects of the project;
- Create a DVD with reports, metadata, guides, vegetation classification, plot data, spatial data, vegetation database (map), graphics, and ground photos.

ICDC Responsibilities at HAFO

- Work with NPS to develop a vegetation classification for the study area based on the NVCS using quantitative analyses and ecological interpretation of the field data;
- Provide guidance regarding the crosswalk of vegetation types to map units;
- Review the local vegetation descriptions and field key;
- Review the final database containing the field data.

CTI Responsibilities for HAFO and MIIN

- Help with overall project facilitation and coordination for HAFO and conduct volunteer project for MIIN;
- Verify vegetation and land use/land cover signatures on the imagery;
- Develop map units linked to the NVCS;
- Provide field maps and GIS support to the field crews at HAFO;
- Interpret and delineate the final vegetation and land use types;
- Transfer and automate interpreted data to a digital spatial database;
- Produce spatial layers of classification plot and accuracy assessment site locations at HAFO;
- Assist with the HAFO accuracy assessment by picking the stratified random target points, creating field maps and providing GIS support;
- Provide final report sections describing the mapping aspects of the project;
- Provide a visual guide to the photo signatures of each map unit;
- Document FGDC-compliant metadata for all vegetation data;
- Assist in creating the project DVD.

Field Survey

Survey of plant communities at MIIN consisted of a reconnaissance-level site visit by the USDI-BOR vegetation mapping ecologist in 2008. Additional site vegetation and natural resource information and photographs were derived from the MIIN General Management Plan (2006). It was the intent of this volunteer project to rely heavily on classification plot data sampled for HAFO that led to the development of mapping units. The ensuing discussion summarizes the HAFO field survey program which is discussed in detail in the HAFO final report.

The field methods used for developing the classification and conducting the accuracy assessment at HAFO followed the methodology outlined by the NVMP (TNC 1994b) for medium-sized parks. First, ICDC provided a preliminary list of vegetation associations and alliances from the NVCS based on previous studies and local knowledge. It was field reviewed during the summer of 2006 by NMI/e²M botanists and ecologists who surveyed the entire site for stands of vegetation represented on the list and previously unidentified associations and alliances.

When a stand of vegetation was observed that was representative of the onsite plant communities, a Relevé macroplot was laid out to record its characteristics. Recorded data were collected electronically and/or on a modified classification plot form (**Appendix B**). Included on the classification plot form were environmental information, unvegetated ground surface data, and vegetation structure and species composition information. At each classification plot a species list was developed and recorded on field forms, UTM coordinates were recorded, field notes were documented, and environmental descriptions and a plot map were recorded. Vegetation cover data were recorded using an Archer Field PC loaded with a Microsoft Windows Mobile 5.0 operating system and using DataPlus software 2.5. A provisional vegetation type was assigned to each classification plot and representative digital photographs were acquired. During the summer of 2006, a total of 85 vegetation classification plots were sampled across HAFO on both sides of the Snake River.

Vegetation Classification

Field data for the HAFO project was collected digitally and on hard-copy forms. Electronic data were transferred directly from the recorders into Database Files (DBF) and hand-recorded data were entered manually into the project database. All electronic data were transferred and managed in a Microsoft Access database developed by e²M for Northern Colorado Plateau Network parks. The MS Access database is a modified PLOTS2 database initially developed specifically for the NVMP, so that the electronic data entry fields mirrored the standard field form. Scientific names were updated according to the vascular plant list maintained on the UCBN website, <http://science.nature.nps.gov/im/units/ucbn/inventory/index.cfm#table>.

At the onset of the HAFO vegetation mapping project, a search for existing (legacy) data was completed (sensu TNC 1996). No existing relevant data were located therefore classification analyses were conducted using the 137 vegetation classification plot and observation point samples collected in 2006.

Analytical methods for the HAFO classification data were employed in a manner consistent with the objective of identifying natural associations of existing vegetation (TNC and ESRI 1994b;

Tart *et al.* 2005; Jennings *et al.* 2006). Multivariate statistical analyses were conducted using PC-ORD (McCune and Mefford 1999). Initial plant community groups were identified using hierarchical cluster analysis. Plant community groups were successively partitioned to optimize within-group homogeneity, between-group difference, and the number of groups. These three factors were evaluated using statistics generated by indicator species analysis (the mean p-value and number of significant [$p < 0.05$] indicator species) and multi-response permutation procedures (T, a measure of separation between groups; the chance-corrected within-group agreement [A], a measure of within-group homogeneity; and the compositional similarity of samples within a group [as measured by average relative Sorensen distance]). Environmental relations, within-group homogeneity, and between-group difference were evaluated graphically using indirect gradient analysis through detrended correspondence analysis (McCune and Grace 2002). Final decisions regarding the naming of plant associations were informed by cross-walking candidate community groupings to the NVCS (NatureServe 2007). Classification and regression tree analysis (recursive partitioning) were employed in the development of dichotomous keys and the evaluation of classification results using the rpart package in R Development Core Team (2007).

The plant species nomenclature standard identified by the UCBN was maintained for the analysis to reflect local and regional taxonomic distinctions. Plant nomenclature of the Integrated Taxonomic Information System (ITIS) as reflected by the PLANTS Database (USDA, NRCS 2007) was employed in the naming of plant associations. This process represents the NVCS and is necessary to discriminate differences among associations currently reported within the NVC (ICDC 2008).

Digital Imagery and Interpretation

Since HAFO and MIIN represent small and accessible sites, no new imagery or aerial photography were acquired; existing sources of imagery were evaluated and two NAIP products were selected to be used as base maps. The NAIP products selected were the 2004 and 2006 images (**Figure 3**). The 2004 products had 1-meter resolution and were acquired at 1:12,000-scale, which is adequate for vegetation mapping purposes. The 2006 product had 2-meter resolution and was acquired in true-color infrared format. The 2006 imagery was more recent than the 2004 and although it had a coarser resolution, it did highlight recent changes to the landscape including fires, new roads, tree removals, etc.

After obtaining both imagery sets, the 2006 imagery was color balanced in Imagine Software to remove some of the edge-matching issues and sharpen the image. The 2004 imagery was also color balanced, but edge-matching was unnecessary. The resulting image from the 2006 imagery was mosaiced and clipped to the extent of the project boundary.

Interpretation of the vegetation at HAFO and MIIN involved a three step process: (1) image segmentation, (2) cleaning and smoothing, and (3) ground-truthing of the data (HAFO only). First, the 2006 imagery was re-sampled to a 3-meter pixel resolution to reduce noise and to generalize the vegetation signatures. Next, this imagery was segmented using eCognition software to delineate obvious landforms (e.g. open water and fields) and physiognomic features (e.g. grasslands versus woodlands). The initial segments were created using a series of trial and error multi-resolution segmentation routines in the software. The settings for scale and shape were manipulated until a desired network of images resulted. The objective of the segmentation



Figure 3. Examples of the NAIP 2004 and 2006 imagery for MIIN.

was to create a system of lines with as coarse a scale as possible without omitting most of the small, important and obvious land cover patches. By incrementally increasing segmentation size within the program, small image objects (i.e. preliminary polygons) were continuously merged into larger ones.

Completion of the segmentation was based on visual judgment of the analyst when obvious, distinct features were lost. At this point in the process, the previous segmentation was adopted as the final treatment.

Following segmentation, the lines were exported as ArcInfo shapefiles and converted to ArcInfo coverages. The resulting coverages were run through a series of smoothing routines provided in the ArcGIS software. Smoothing was conducted to reduce the stair-stepping pattern of the lines resulting from the large pixel size. Smoothing ended when no obvious artificial or relict breaks in the lines were visible. Following smoothing, the line-work was manually cleaned to remove extraneous lines, small polygons, and polygons that obviously split a homogenous stand of vegetation. The cleaning stage was considered complete when all resulting polygons matched homogenous stands of vegetation apparent on the 2006 imagery

The lines resulting from the 2004 imagery segmentation were visually inspected in ArcInfo comparing them to the more detailed 2006 imagery. Any obvious problems in the mapping (such as shifting) between the two years were edited and resolved. Review of the merged polygon layer revealed that the roads and the facilities were not adequately separated from the surrounding vegetation. To resolve separation issues, all developed areas, roads, canals, and other linear or rectangular features were manually digitized directly from the 2006 imagery and incorporated into the final segmentation. After merging the digitized lines with the segmented linework the resulting preliminary GIS layer was considered complete and ready to be ground-truthed in the field.

Ground-truthing was performed at MIIN by David Salas, an ecologist with the Bureau of Reclamation, in conjunction with his ground-truthing at HAFO. Ground truthing the preliminary vegetation layer involved printing 1:6,000-scale hardcopy maps containing the 2006 basemaps and the linework as an overlay. During five days in 2007, David visited representative polygons at both HAFO and MIIN. Ground-truthing consisted of verifying the maps against the actual vegetation on the ground to ensure that the polygons were labeled properly and to locate any extra or missing vegetation polygons. More general observations were also recorded during this trip to help write map unit descriptions and ultimately create the mapping scheme. All the information from this trip was subsequently applied to the final GIS layer to correct any errors.

CTI staff used the final classification supplied by NMI/ICDC to create the mapping scheme for HAFO and MIIN. In most cases, the map units were derived on a 1 association or alliance to 1 map unit basis. Due to the limitations of the imagery, some of the associations could not be recognized consistently. This issue was addressed by either scaling up the NVCS to the alliance level or combining similar associations/alliances into vegetation complexes. All of the resulting map units were then correlated or “crosswalked” by noting when plant associations were used as a map unit or when they were grouped. To round-out the mapping scheme, map units were created for land use types based on a mapping system developed by Anderson et al. (1976 as

amended in 2002). Land use units included unvegetated lands not in the NVCS, e.g., roads, facilities, canals, ditches, farmsteads, and agricultural fields. All of the resulting map unit names, map unit codes, NVCS information, and other relevant attributes were added to each polygon in the GIS layer (**Table 2**).

Table 2. Polygon attribute items and descriptions used in the MIIN GIS coverage.

<u>ATTRIBUTE</u>	<u>DESCRIPTION</u>
AREA*	Surface area of the polygon in meters squared
PERIMETER*	Perimeter of the polygon in meters
HAFO_VEG#*	Unique code for each polygon
HAFO_VEG-ID*	Unique identification code for each polygon
VEG_CODE	Final Map Unit Codes – Project specific
MAP_DESC	Map Unit Common Description Name – Project specific
DENS_MOD	Modifier - Percent cover of the upper stratum layer in the polygon Percent cover classes: Sparse 10 - 25% , Open 25 - 60% , Discontinuous - Closed > 60%
PTRN_MOD	Modifier - Vegetation pattern within the polygon Vegetation pattern classes: Evenly Dispersed = Homogeneous Grouped Stands of Vegetation = Bunched / Clumped , String of Vegetation = Linear
HT_MOD	Modifier - Height range of the dominant vegetation layer Height classes: < 1, 1-5, 5-15 meters
CES_CODE	Ecological Systems Code – NVCS derived (NatureServe)
CES_NAME	Ecological Systems Name – NVCS derived (NatureServe)
NVC_ELCODE	Corresponding Association Code – NVCS derived (NatureServe) Association = Community Element Global Code – Elcode link to the NVCS
ASSN_NAME	Project Community Name - NVCS Association(s)
ASSN_CNAME	Project Common Community Name - synonym name of Association(s)
NVCS_CODE	NVCS Code - to NVCS Formation level
ALL_CODE	Alliance Name Code – NVCS derived (NatureServe) Alliance = Alliance Global Code – Alliance Link to the NVCS
ALL_NAME	Project Alliance Name = NVCS Alliance(s)
ALL_CNAME	Project Common Alliance Name = NVCS Alliance(s)
FORMATION	NVCS Formation = Formation name NVCS Code – Formation name
SUBGROUP	NVCS Formation Subgroup = NVCS Code – Subgroup name
GROUP	NVCS Formation Group = NVCS Code – Group name
SUBCLASS	NVCS Formation Subclass = NVCS Code – Subclass name
CLASS	Formation Class = NVCS Code – Class name
LUC_II_GEN	General Land Use and Land Cover Classification System Name Project specific based on Level I or II of Anderson et al. (1976)
LUC_II	Specific Land Use and Land Cover Classification System Name Project specific Level II or Level III of Anderson et al. (1976)
COMMENTS	Additional Comments about the Vegetation in Individual Polygons
ACRES	Surface area of the polygon in acres
(*ArcInfo® default items)	

Accuracy Assessment

No formal accuracy assessment of the MIIN vegetation map was performed due to lack of funding for this newly designated site. Since most of the vegetation map unit signatures and the base imagery were identical to those used in the HAFO project, some idea of the thematic accuracy at MIIN can be inferred by examining the HAFO project.

The spatial accuracy for these types of projects is typically not formally assessed. Instead it is usually implied that since the basemap meets the national standards, therefore the map based on this imagery should also meet the standards. In this case, for 1:12,000-scale imagery the lines are within ± 30 feet.

Results

Vegetation Classification

Thirty-four plant associations and vegetation alliances were determined for HAFO (see HAFO Final Vegetation Classification and Mapping Report) and a subset of 12 of these, mostly semi-natural communities, were used to represent and map the vegetation of MIIN. Only a type dominated by saltgrass (*Distichlis spicata*) was added to MIIN project based on field reconnaissance. The vegetation of MIIN has been extensively disturbed historically by livestock grazing, irrigated farming, and internment camp establishment/landscaping so the dominance of non-native species (semi-natural communities) was expected. **Table 3** provides the summary of the associations/alliances/complexes/mapping units described for MIIN.

Plant communities are named for the indicator (dominant or diagnostic) species of the vegetative strata present. The indicator species of the uppermost strata (tree, shrub, graminoid, forb) is listed first, followed by successively lower strata. Species that occur in the same strata (or are the same lifeform) are separated by a hyphen (-). Indicator species that occur in different strata (or are a different lifeform) are separated by a slash (/). Plant association names incorporate the physiognomic class in which the association is classified (e.g., Forest, Woodland, Shrubland, or Herbaceous Vegetation) (FGDC 1997, 2006).

Roughly forty percent of the associations observed and mapped within HAFO that could occur within MIIN are currently listed in the NVC as indicated by an assigned alliance [A.] or association element [CEGL] code (NatureServe 2009). These vegetation alliances/plant associations are known from other sites within the region, including HAFO, and are well-documented. A summary of previous classification work regarding vegetation that occurs within the study region is provided in the HAFO Final Vegetation Classification and Mapping Report and the subset of plant associations and vegetation alliances classified for HAFO that could occur at MIIN are presented below (because of lack of detailed field survey, these types cannot be verified onsite at MIIN):

Table 3. List of NVCS Plant Associations and Alliances found at HAFO.

NVCS Name	NVCS Common Name	NVCS Level	NVCS Code
Forest and Woodlands			
<i>Ulmus americana</i> Semi-natural Woodland Alliance	American Elm Semi-natural Woodland Alliance	Alliance	Provisional
<i>Ulmus americana</i> / <i>Bromus tectorum</i> Semi-natural Woodland	American Elm / Cheatgrass Semi-natural Woodland	Association	Provisional
<i>Elaeagnus angustifolia</i> Semi-natural Woodland Alliance	Russian-olive Semi-natural Woodland Alliance	Alliance	A.3566
<i>Elaeagnus angustifolia</i> / <i>Bromus tectorum</i> Semi-natural Woodland	Russian-olive / Cheatgrass Semi-natural Woodland	Association	Provisional
<i>Elaeagnus angustifolia</i> / <i>Equisetum laevigatum</i> Semi-natural Woodland	Russian-olive / Smooth Horsetail Semi-natural Woodland	Association	Provisional
<i>Elaeagnus angustifolia</i> / <i>Leymus cinereus</i> Semi-natural Woodland	Russian-olive / Basin Wildrye Semi-natural Woodland	Association	Provisional
<i>Elaeagnus angustifolia</i> / <i>Poa secunda</i> Semi-natural Woodland	Russian-olive / Sandberg Bluegrass Semi-natural Woodland	Association	Provisional
<i>Elaeagnus angustifolia</i> / <i>Purshia tridentata</i> / <i>Leymus cinereus</i> Semi-natural Woodland	Russian-olive / Bitterbrush / Basin Wildrye Semi-natural Woodland	Association	Provisional
<i>Elaeagnus angustifolia</i> / <i>Rhus trilobata</i> var. <i>trilobata</i> - <i>Rosa woodsii</i> Semi-natural Woodland	Russian-olive / Skunkbush – Wood’s Rose Semi-natural Woodland	Association	Provisional
<i>Elaeagnus angustifolia</i> / <i>Sarcobatus vermiculatus</i> / Mesic Graminoids Semi-natural Woodland	Russian-olive / Black Greasewood / Mesic Graminoids Semi-natural Woodland	Association	Provisional
<i>Populus angustifolia</i> Temporarily Flooded Woodland Alliance	Narrowleaf Cottonwood Temporarily Flooded Woodland Alliance	Alliance	A.641
<i>Populus angustifolia</i> / <i>Typha latifolia</i> Woodland	Narrowleaf Cottonwood / Broadleaf Cattail Woodland	Association	Provisional
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> Temporarily Flooded Forest Alliance	Black Cottonwood Temporarily Flooded Forest Alliance	Alliance	A.311
<i>Populus balsamifera</i> ssp. <i>trichocarpa</i> - <i>Elaeagnus angustifolia</i> / <i>Bromus tectorum</i> Woodland	Black Cottonwood – Russian-olive / Cheatgrass Woodland	Association	Provisional

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Shrublands			
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrubland Alliance	Wyoming Big Sagebrush Shrubland Alliance	Alliance	A.832
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Achnatherum hymenoides</i> Shrubland	Wyoming Big Sagebrush / Ricegrass Shrubland	Association	CEGL001046
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Hesperostipa comata</i> Shrubland	Wyoming Big Sagebrush / Needle-and Thread Grass Shrubland	Association	CEGL001051
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Poa secunda</i> Shrubland	Wyoming Big Sagebrush / Sandberg Bluegrass Shrubland	Association	CEGL001049
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> - <i>Atriplex confertifolia</i> Shrubland	Wyoming Big Sagebrush - Fourwing Saltbush Shrubland	Association	CEGL001040
<i>Artemisia tridentata</i> spp. <i>wyomingensis</i> - <i>Chrysothamnus viscidiflorus</i> / <i>Achnatherum hymenoides</i> Shrubland	Wyoming Big Sagebrush - Green Rabbitbrush / Ricegrass Shrubland	Association	Provisional
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Bromus tectorum</i> Semi-natural Shrubland	Wyoming Big Sagebrush / Cheatgrass Semi-natural Shrubland	Association	Provisional
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> Shrub Herbaceous Alliance	Wyoming Big Sagebrush Shrub Herbaceous Alliance	Alliance	A.1527
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Bromus tectorum</i> Semi-natural Shrub Herbaceous Vegetation	Wyoming Big Sagebrush / Cheatgrass Semi-natural Shrub Herbaceous Vegetation	Association	Provisional
<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Bromus tectorum</i> Shrubland Alliance	Basin Big Sagebrush / Cheatgrass Shrubland Alliance	Alliance	A.830
<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Bromus tectorum</i> Semi-natural Shrubland	Basin Big Sagebrush / Cheatgrass Semi-natural Shrubland	Association	Provisional
<i>Atriplex canescens</i> Shrubland Alliance	Fourwing Saltbush Shrubland Alliance	Alliance	A.869
<i>Atriplex canescens</i> / <i>Achnatherum hymenoides</i> Shrubland	Fourwing / Ricegrass Shrubland	Association	CEGL001289
<i>Atriplex canescens</i> / <i>Leymus cinereus</i> Shrubland	Fourwing / Basin Wildrye Shrubland	Association	Provisional
<i>Atriplex canescens</i> / <i>Poa secunda</i> - <i>Bromus tectorum</i> Shrubland	Fourwing / Sandberg Bluegrass - Cheatgrass Shrubland	Association	Provisional

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<i>Atriplex confertifolia</i> Shrubland Alliance	Shadscale Shrubland Alliance	Alliance	A.870
<i>Atriplex confertifolia</i> / <i>Achnatherum hymenoides</i> Shrubland	Shadscale / Ricegrass Shrubland	Association	CEGL001311
<i>Atriplex confertifolia</i> - <i>Picrothamnus desertorum</i> / (<i>Achnatherum hymenoides</i>) - <i>Bromus tectorum</i> Semi-natural Shrubland	Shadscale - Bud Sagebrush / (Ricegrass) - Cheatgrass Semi-natural Shrubland	Association	Provisional
<i>Eriogonum microthecum</i> Dwarf-shrubland Alliance	Slender Buckwheat Dwarf-shrubland Alliance	Alliance	A.1107
<i>Eriogonum microthecum</i> / <i>Achnatherum hymenoides</i> Dwarf-shrubland	Slender Buckwheat / Ricegrass Dwarf-shrubland	Association	Provisional
<i>Eriogonum ovalifolium</i> Dwarf-shrubland Alliance	Cushion Buckwheat Dwarf-shrubland Alliance	Alliance	Provisional
<i>Eriogonum ovalifolium</i> / <i>Achnatherum hymenoides</i> Dwarf-shrubland	Cushion Buckwheat / Ricegrass Dwarf-shrubland	Association	Provisional
<i>Krascheninnikovia lanata</i> Dwarf-shrub Herbaceous Alliance	Winter-fat Dwarf-shrub Herbaceous Alliance	Alliance	A.1565
<i>Krascheninnikovia lanata</i> / <i>Poa secunda</i> Dwarf-shrubland Dwarf-shrubland	Winter-fat / Sandberg Bluegrass Dwarf-shrubland Dwarf-shrubland	Association	CEGL001326
<i>Tamarisk ramosissima</i> Semi-natural Temporarily Flooded Shrubland Alliance	Salt-cedar species Semi-natural Temporarily Flooded Shrubland Alliance	Alliance	A.842
<i>Ericameria nauseosa</i> Shrubland Alliance	Rubber Rabbitbrush Shrubland Alliance	Alliance	A.835
<i>Ericameria nauseosa</i> - <i>Chrysothamnus viscidiflorus</i> / (<i>Achnatherum hymenoides</i>) - <i>Bromus tectorum</i> Semi-natural Shrubland	Rubber Rabbitbrush – Green Rabbitbrush / (Ricegrass) – Cheatgrass Semi-natural Shrubland	Association	Provisional
<i>Chrysothamnus viscidiflorus</i> Shrubland Alliance	Green Rabbitbrush Shrubland Alliance	Alliance	A.2651
<i>Chrysothamnus viscidiflorus</i> / <i>Hesperostipa comata</i> Shrubland	Green Rabbitbrush / Needle-and-thread Grass Shrubland	Association	CEGL002799
<i>Purshia tridentata</i> Shrubland Alliance	Bitterbrush Shrubland Alliance	Alliance	A.825
<i>Purshia tridentata</i> / <i>Achnatherum hymenoides</i> Shrubland	Bitterbrush / Ricegrass Shrubland	Association	CEGL001058
<i>Purshia tridentata</i> / <i>Elymus elymoides</i> Shrubland	Bitterbrush / Squirrealtail Shrubland	Association	Provisional

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<i>Salix exigua</i> Temporarily Flooded Woodland Alliance	Coyote Willow Temporarily Flooded Woodland Alliance	Alliance	A.639
<i>Salix exigua</i> / Barren Shrubland	Coyote Willow / Barren Shrubland	Association	CEGL001200
<i>Salix exigua</i> / Mesic Forbs Shrubland	Coyote Willow / Mesic Forbs Shrubland	Association	CEGL001202
<i>Salix lucida</i> Temporarily Flooded Shrubland Alliance	Whiplash Willow Temporarily Flooded Shrubland Alliance	Alliance	A.979
<i>Salix lucida</i> ssp. <i>caudata</i> / <i>Thinopyrum intermedium</i> Semi-natural Shrubland	Whiplash Willow / Intermediate Wheatgrass Semi-natural Shrubland	Association	Provisional
<i>Sarcobatus vermiculatus</i> Shrubland Alliance	Black Greasewood Shrubland Alliance	Alliance	A.1041
<i>Sarcobatus vermiculatus</i> / <i>Bromus tectorum</i> Semi-natural Shrubland	Black Greasewood Cheatgrass Semi-natural Shrubland	Association	Provisional
<i>Sarcobatus vermiculatus</i> / <i>Leymus cinereus</i> Shrubland	Black Greasewood / Basin Wildrye Semi-natural Shrubland	Association	CEGL001366
<i>Rhus trilobata</i> Intermittently Flooded Shrubland Alliance	Skunkbush Intermittently Flooded Shrubland Alliance	Alliance	A.938
Herbaceous Vegetation			
<i>Agropyron cristatum</i> Semi-natural Herbaceous Alliance	Crested Wheatgrass Semi-natural Herbaceous Alliance	Alliance	Provisional
<i>Agropyron cristatum</i> - <i>Sisymbrium altissimum</i> Semi-Natural Vegetation	Crested Wheatgrass / Tumble Mustard Semi-natural Vegetation	Association	Provisional
<i>Bromus tectorum</i> Semi-natural Herbaceous Alliance	Cheatgrass Semi-natural Herbaceous Alliance	Alliance	A.1814
<i>Bromus tectorum</i> - <i>Sisymbrium altissimum</i> Semi-Natural Vegetation	Cheatgrass / Tumble Mustard Semi-natural Vegetation	Association	Provisional
<i>Eleocharis palustris</i> Seasonally Flooded Herbaceous Alliance	Marsh Spikerush Seasonally Flooded Herbaceous Alliance	Alliance	A.1422
<i>Eleocharis palustris</i> Herbaceous Vegetation	Marsh Spikerush Herbaceous Vegetation	Association	CEGL001833

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<i>Typha (angustifolia, latifolia)</i> - (<i>Schoenoplectus</i> spp.) Semipermanently Flooded Herbaceous Alliance	Narrowleaf Cattail, Broadleaf Cattail - (Clubrush species) Semipermanently Flooded Herbaceous Alliance	Alliance	A.1436
<i>Equisetum laevigatum</i> Semipermanently Flooded Herbaceous Alliance	Smooth Horsetail Semipermanently Flooded Herbaceous Alliance	Alliance	A.2648
<i>Lactuca tatarica</i> var. <i>pulchella</i> Herbaceous Alliance	Blue Lettuce Herbaceous Alliance	Alliance	Provisional
<i>Lactuca tatarica</i> var. <i>pulchella</i> Herbaceous Vegetation	Blue Lettuce Herbaceous Vegetation	Association	Provisional
<i>Pascopyrum smithii</i> Herbaceous Alliance	Western Wheatgrass Herbaceous Alliance	Alliance	A.1232
<i>Pascopyrum smithii</i> - <i>Achnatherum hymenoides</i> Herbaceous Vegetation	Western Wheatgrass - Ricegrass Herbaceous Vegetation	Association	Provisional

Approximately one-half of the associations described in this classification are not recognized by the NVC or have not been previously described and are considered provisional vegetation types. These associations include: (1) semi-natural vegetation that, due to the priority of conserving natural vegetation, has not been systematically reviewed nor incorporated into the NVC and (2) plant communities that have not been described previously at the association level.

Digital Imagery and Interpretation

For MIIN, 20 map units were developed and directly cross-walked or matched to corresponding vegetation alliances/plant associations and land use classes (**Table 4**). These classes were predominantly included in a 1 map unit to 1 NVCS association/alliance relationship. The detailed descriptions and representative photos for all vegetation map units are provided later in the Results section.

Relationship between Map Units and Plant Associations/Alliances

The MIIN map units represent a compromise between the lack of onsite data, detail of the NVCS, the needs of the monument, and the limitations of the imagery. As a result, the mapping scheme does not exactly match the NVCS. Rather, the vegetation map units were linked (i.e. “crosswalked”) to the NVCS plant associations or alliances when possible. When the NVCS link was not feasible, unique map units were created (**Table 4**).

The following are the possible map scenarios that were encountered at MIIN:

1. When a plant association or alliance had a unique photo signature and could be readily delineated on the photos, the map unit adopted the plant association/alliance name. This was considered a one-to-one relationship.
2. When plant associations occurred in stands too small to map or when related plant associations shared the same signature and could not be distinguished on the photos, several plant associations were collapsed into a single alliance. This was considered a one-to-many relationship.
3. Non-vegetated areas and vegetation types not recognized by the NVCS received Anderson et al. (1976 as amended in 2002) Land Use – Land Cover map unit designations.
4. When unique areas did not fit with an NVCS association/alliance or Anderson land-use designation these were considered “park specials”.

Table 4. MIIN Map Units.

The units are organized into ecological groups. “Level” refers to whether the map unit represents a NVCS plant association/alliance (NVCS unless otherwise noted) or a local plant community/plant population (Park Special), or a land use class. Anderson Land Use Classes are identified by Roman numerals.

Map Code	Map Unit Name	Map Unit Common Name	Level
Forest and Woodlands			
1	<i>Ulmus americana</i> / <i>Bromus tectorum</i> Woodland	American Elm / Cheatgrass Woodland	Association
2	<i>Elaeagnus angustifolia</i> Semi-natural Woodland Alliance	Russian-olive Semi-natural Woodland	Alliance
Shrublands			
3	<i>Artemisia</i> spp. / (<i>Bromus tectorum</i>) Shrubland Complex	Big Sagebrush Species / (Cheatgrass) Shrubland Complex	Complex
4	<i>Sarcobatus vermiculatus</i> Intermittently Flooded Shrubland Alliance	Black Greasewood Intermittently Flooded Shrubland Alliance	Alliance
5	<i>Salix exigua</i> - <i>Salix lucida</i> ssp. <i>caudata</i> Shrubland Complex	Sandbar Willow – Whiplash Willow Shrubland Complex	Complex
6	<i>Ericameria</i> (<i>Chrysothamnus</i>) spp. Shrubland Complex	Rabbitbrush Species Shrubland Complex	Complex
Herbaceous Vegetation			
7	<i>Distichlis spicata</i> Herbaceous Vegetation	Inland Saltgrass Herbaceous Vegetation	Association
8	<i>Eleocharis palustris</i> - <i>Typha latifolia</i> Wetland Vegetation Complex	Marsh Spikerush - Broadleaf Cattail Wetland Vegetation Complex	Complex
9	<i>Bromus tectorum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation	Cheatgrass / Tumble Mustard Herbaceous Vegetation	Association
10	<i>Agropyron cristatum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation	Crested Wheatgrass / Tumble Mustard Semi-Natural Vegetation	Association
11	Annual Weedy Herbaceous Vegetation Complex	Annual Weedy Herbaceous Vegetation Complex	Complex
Land Use – Land Cover			
12	Stream / River	Stream / River	Level II
13	Canal / Ditch	Canal / Ditch	Level II
14	Lake / Pond	Lake / Pond	Level II

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15	Agricultural Business	Agricultural Business	Level II
16	Transportation	Transportation	Level II
17	Planted / Cultivated	Planted / Cultivated	Level II
18	Transistional	Transistional	Level II
19	Flats	Flats	Level II
20	NPS Facilities	NPS Facilities	Park Special

*Park Special: Represents either unvegetated areas or discrete stands of vegetation that were too small and/or occurred too infrequently to classify.

Map Units

Below is a comprehensive breakdown of the crosswalking of the NVCS associations to the map units for MIIN:

Map Units Representing Single NVCS Units (either existing or new) (One Alliance/Association-to-One Map Class)

The following map units were created from the NVCS and represent established or provisional plant associations/alliances that could be discerned and delineated on the imagery.

Map Code	Map Unit Name	NVCS Plant Alliance / Association(s)
1	<i>Ulmus americana</i> / <i>Bromus tectorum</i> Woodland	<i>Ulmus americana</i> / <i>Bromus tectorum</i> Woodland
9	<i>Bromus tectorum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation	<i>Bromus tectorum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation
10	<i>Agropyron cristatum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation	<i>Agropyron cristatum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation
11	Annual Weedy Herbaceous Vegetation Complex	<i>Lactuca tatarica</i> var. <i>pulchella</i> Herbaceous Vegetation

Map Units Representing Aggregations of Plant Associations/Alliances (Many Alliances /Associations-to-One Map Class)

In cases where closely related plant associations could not be distinguished on the photos, they were combined into a single map unit. Often these occurred from the inability to recognize the understory species or to distinguish between very similar species.

Map Code	Map Unit Name	NVCS Plant Alliance / Association(s)
2	<i>Elaeagnus angustifolia</i> Woodland Alliance	<i>Elaeagnus angustifolia</i> / <i>Bromus tectorum</i> Semi-natural Woodland <i>Elaeagnus angustifolia</i> / <i>Equisetum laevigatum</i> Semi-natural Woodland <i>Elaeagnus angustifolia</i> / <i>Leymus cinereus</i> Semi-natural Woodland <i>Elaeagnus angustifolia</i> / <i>Poa secunda</i> Semi-natural Woodland <i>Elaeagnus angustifolia</i> / <i>Rhus trilobata</i> var. <i>trilobata</i> - <i>Rosa woodsii</i> Semi-natural Woodland <i>Elaeagnus angustifolia</i> / <i>Sarcobatus vermiculatus</i> / Mesic Graminoids Semi-natural Woodland

- 3 ***Artemisia tridentata* ssp. / (*Bromus tectorum*) Shrubland Complex**
 Artemisia tridentata ssp. *wyomingensis* / *Achnatherum hymenoides* Shrubland
 Artemisia tridentata ssp. *wyomingensis* / *Hesperostipa comata* Shrubland
 Artemisia tridentata ssp. *wyomingensis* / *Poa secunda* Shrubland
 Artemisia tridentata ssp. *wyomingensis* - *Atriplex confertifolia*
 Artemisia tridentata ssp. *wyomingensis* - *Chrysothamnus viscidiflorus* /
 Achnatherum hymenoides Shrubland
 Artemisia tridentata ssp. *wyomingensis* / *Bromus tectorum* Semi-natural
 Shrubland
 Artemisia tridentata ssp. *wyomingensis* / *Bromus tectorum* Semi-natural Shrub
 Herbaceous Vegetation
 Artemisia tridentata ssp. *tridentata* / *Bromus tectorum* Semi-natural
 Shrubland
- 4 ***Sarcobatus vermiculatus* Intermittently Flooded Shrubland Alliance**
 Sarcobatus vermiculatus / *Bromus tectorum* Semi-natural Shrubland
 Sarcobatus vermiculatus / *Leymus cinereus* Shrubland
- 5 ***Salix exigua* - *Salix lucida* ssp. *caudata* Shrubland Complex**
 Salix exigua / Barren Shrubland
 Salix exigua / Mesic Forbs Shrubland
 Salix lucida ssp. *caudata* / *Thinopyrum intermedium* Semi-natural Shrubland
- 6 ***Ericameria* (*Chrysothamnus*) spp. Shrubland Complex**
 Chrysothamnus viscidiflorus / *Hesperostipa comata* Shrubland
 Ericameria nauseosa - *Chrysothamnus viscidiflorus* / (*Achnatherum*
 hymenoids) - *Bromus tectorum* Semi-natural Shrubland
- 8 ***Eleocharis palustris* - *Typha latifolia* Wetland Vegetation Complex**
 Eleocharis palustris Herbaceous Vegetation
 Typha (*angustifolia*, *latifolia*) - (*Schoenoplectus* spp.) Semipermanently
 Flooded Herbaceous Alliance
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Vegetation Map

Approximately 78 acres in the current boundary of MIIN and an additional 4,512 acres in the environs were mapped using 20 map classes (**Appendix G**). The map units included nine land cover classes and 11 vegetation classes. Of all the map units, the most frequent was the Annual Weedy Herbaceous Vegetation Complex with 145 polygons. The most abundant map unit in terms of area was the Planted / Cultivated map unit (2,855 acres) representing agricultural fields in the environs. All of the frequencies for each map unit (i.e., number of polygons) along with their acreages are listed in **Table 5**.

Table 5. Total acreage and frequency of map units for MIIN.

Map Code	Map Unit Description	MIIN Boundary			Total Project Area		
		Freq.	Acres	HA	Freq.	Acres	HA
1	<i>Ulmus americana</i> / <i>Bromus tectorum</i> Woodland	4	0.8	0.3	10	3.1	1.3
2	<i>Elaeagnus angustifolia</i> Semi-natural Woodland Alliance	9	2.2	0.9	32	10.3	4.2
3	<i>Artemisia</i> spp. – (<i>Bromus tectorum</i>) Shrubland Complex	9	13.5	5.5	69	295.4	119.6
4	<i>Sarcobatus vermiculatus</i> Intermittently Flooded Shrubland Alliance	0	0	0	18	19.4	7.9
5	<i>Salix exigua</i> - <i>Salix lucida</i> ssp. <i>caudata</i> Shrubland Complex	0	0	0	6	4.4	1.8
6	<i>Ericameria</i> (<i>Chrysothamnus</i>) spp. Shrubland Complex	2	2.3	0.9	2	2.4	1.0
7	<i>Distichlis spicata</i> Herbaceous Vegetation	4	1.3	0.5	10	10.4	4.2
8	<i>Eleocharis palustris</i> - <i>Typha latifolia</i> Wetland Vegetation Complex	0	0	0	5	10.3	4.2
9	<i>Bromus tectorum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation	14	14.9	6.0	106	328.5	133.0
10	<i>Agropyron cristatum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation	3	23.2	9.4	41	521.4	211.2
11	Annual Weedy Herbaceous Vegetation Complex	3	0.8	0.3	145	179.8	72.8
12	Stream / River	4	5.2	2.1	3	103.8	42.0
13	Canal / Ditch	0	0	0	13	42.4	17.2
14	Lake / Pond	0	0	0	10	10.8	4.4
15	Agricultural Business	1	0.1	0.0	35	45.3	18.3
16	Transportation	2	6.2	2.5	8	90.6	36.7
17	Planted / Cultivated	0	0	0	33	2855.4	1156.4
18	Transitional	1	0.1	0.0	19	44.9	18.2
19	Flats	5	2.1	0.9	1	3.7	1.5
20	NPS Facilities	6	5.1	2.1	6	7.6	3.1
Total Natural Vegetation		47	57	23	443	1,385	561
Total Land use / Land Cover		20	21	8	129	3,205	1,298
Totals		67	78	32	572	4,590	1,859

Normally the standard minimum mapping unit for NPS vegetation mapping projects is defined as 0.5 hectare. However, this is a nominal unit and due to the small size of MIIN and the resolution of the imagery, it was reduced to 0.25 acre for most classes. This size allowed for more detail in the mapping and allowed for better delineation of important stands of vegetation such as riparian habitat and wetlands along the North Side Main Canal, weedy patches, and shrub patches. This ability to recognize small patches of vegetation is reflected in the high number of polygons created (572) and the average size of the polygons for this project, (8 acres or 3 hectares).

Accuracy Assessment

Due to lack of funding no field verification or AA was performed for the MIIN vegetation map and database resulting from this CTI volunteer project. It is anticipated that the database accuracy would be ascertained by UCBN and HAFO/MIIN staff during future I&M work which will allow the map and database to be updated and more detailed vegetation descriptions to be prepared for the existing monument and any newly acquired parcels.

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Discussion

The MIIN site represents an important time in U.S. history that must be honored and interpreted. As a result of the intensive human activity from ranching and water distribution project/irrigated farming to internment camp use, the vegetation is disturbed and consists of a large number of non-native plants including landscape introductions and noxious weed species in addition to remnant native plant species. Goals of managing plant communities to a relatively natural condition and managing noxious weed stands will greatly benefit from having this baseline vegetation and land use map.

MIIN vegetation was historically a mix of the big sagebrush-bunchgrass steppe on the uplands of the Snake River Plain, composed of sagebrush (*Artemisia* spp.) with a bunchgrass understory of bluebunch and other wheatgrasses (*Agropyron* spp.), bluegrasses (*Poa* spp.), needlegrasses (*Achnatherum* spp., *Stipa* spp. or *Hesperostipa* spp.), and/or Indian ricegrass (*Oryzopsis hymenoides*). Also included in this semiarid landscape were the swales and drainages supporting western wheatgrass (*Pascopyrum smithii*) and basin wildrye (*Leymus cinereus*) and narrow bands of riparian and wetland vegetation that had become established in saturated soils near seeps, springs, and perennial streams and rivers. Species of mesic sites included cottonwoods (*Populus* spp.), willows (*Salix* spp.), rushes (*Juncus* spp.), sedges (*Carex* spp.), spike rushes (*Eleocharis* spp.), bulrushes (*Schoenoplectus* spp.), and cattails (*Typha* spp.).

Field Survey

Vegetation data presented in this project is cursory and meant to represent the dominant and very common plant species occurring within MIIN. The resulting vegetation map is therefore moderate in complexity and should be used as a “baseline” to build upon as ground data of non-native species populations and other vegetation research is conducted. Using a future accuracy assessment as a guide, map classes with lower accuracy could be further surveyed in the field to create more accurate delineations and new vegetation alliances and plant associations will likely be observed and should be described using classification plot data.

NVCS Classification

In addition to access onto adjacent private and federal lands another important classification challenge at MIIN is documenting rapid changes to plant life caused by weed control and other anthropogenic disturbance. The main changes would result from re-establishing the 1942-1945 replication of internment camp living quarters and support facilities and wildfire. After these events occur, new data should be collected to reflect the changes.

Digital Imagery and Interpretation

The vegetation map for MIIN was based primarily on the 2006 NAIP imagery. Therefore, all resulting mapping products correspond to when that imagery was acquired (i.e. snapshot in time). The decision to use existing NAIP imagery as the basemap for this project was based on cost savings. Although the imagery proved adequate, it was not acquired by the USDA for vegetation classification and mapping purposes. In the future, it may be beneficial to purchase new orthophotos or aerial photos exclusively for mapping the vegetation at MIIN, which would allow the timing to better match the phenology of the vegetation and a finer scale (such as 1:6,000) could be acquired allowing for more precise delineations.

Inherent to all vegetation mapping projects is the need to produce both a consistent vegetation classification and a comprehensive set of map units. Typically, the systems are very similar, but when using a national classification such as the NVCS there is usually not a strict 1:1 correspondence. Nonconformity is due to the remote sensing nature of the interpretation and its ability to delineate map units based on complex photo signatures. Subtle vegetation characteristics that can be observed on the ground are not necessarily the same as those apparent on the imagery. Canopy closure, shadows, reflections and the timing of the imagery acquisition can all affect the vegetation signatures. At MIIN, these issues can be offset not only by acquiring new imagery, but also by conducting more map verification or ground-truthing. Providing a budget to make the time for verification of the map would greatly improve the accuracy and level of detail. The present project should be viewed as an initial mapping effort that needs to be refined and periodically updated. To perform field checking, the existing map could be examined on the ground by qualified park or contract staff, changes could be made to the map, and these could be incorporated into updated versions.

Accuracy Assessment

An important and necessary aspect of this project is the accuracy assessment. Collecting independent ground data determines the usefulness of the vegetation map. As such, users of this product should remember that the GIS mapping was not based on classification sampling within MIIN, rather extrapolating from data collected at HAFO and a reconnaissance level site review by a vegetation mapping ecologist.

Actual errors in the MIIN mapping project will stem from the lack of site-specific data, limitations of the ortho-photography as previously described, natural changes in the vegetation that occurred since the acquisition date of the imagery, or the difficulty in obtaining an overhead perspective to exactly match the view on the ground. It is also important for users to remember that since the mapping portion of this project is primarily a remotely sensed exercise and no field work was conducted on site, all resulting products are scale dependent. The mapping project should be viewed as a more general overview at the 1:12,000-scale. Although one can zoom in further than 1:12,000 using GIS software, the actual mapping was conducted at this scale. As such, any future work undertaken with this product at a finer scale could lead to some confusion. In contrast, field work will be conducted at individual future locations on a specific date and any extrapolation from these locations to out-lying areas or using them to determine annual vegetation changes is less reliable. Future users should fully appreciate imagery/database scale limitations and balance their research efforts accordingly.

Future Recommendations

In summary, the MIIN project represents the best volunteer efforts put forth by the small staff of CTI over a relatively short period in time to insure a base product for this newly designated and small UCBN site. In order to create the best possible “long-term” vegetation classification for MIIN and the most accurate and detailed GIS layer, this project should be viewed as a place to start rather than an end product. In other words, present and future NPS staff should be encouraged to scrutinize this project, building from its strengths and bolstering its weaknesses. By keeping in mind that this project was only a snapshot in time based on cursory field information and 2004/2006 imagery, future efforts can help complete our understanding of the

vegetation in and around MIIN and how it changes over time. It is the hope of the producers that the products presented here will help focus and direct future efforts. Recommendations for future projects are summarized below:

1. The diversity of plant species and dynamic nature of the site with respect to erosion, outside influences and fire warrants initial and periodic **field surveys** by experienced ecologists. A classification based on NVMP standards and detailed plot data should be developed. Furthermore the inaccessibility of the private lands in the environs should be addressed by seeking permission to sample and verify the vegetation. In this way, new plant associations could be discovered and existing types could be updated.
2. Remote sensing does not replace on-the-ground knowledge provided by GPS-linked plots, observations, photographs, and ground verification. Time and funding limitations inhibited map **ground-truthing** performance for this project. As opportunities arise, vegetation and land use maps should be examined in the field by experienced crews. Also, GPS receiver data and other GIS layers should be used to improve and update the spatial data. This map product should not be viewed as static but should be periodically updated with more current and accurate information.
3. To better understand the limitations of the map, an **accuracy assessment** should be performed based on an inventory and classification of plant communities and creation of a detailed field key to plant associations by the network or park staff. Map classes with low accuracy should be examined to see if they could be improved with future studies using ground-truthing or other remote-sensing formats (i.e. fine-scale imagery, hyperspectral, etc). Also, landscape modeling may help tease out the location of specific types based on specific habitat information. Finally, for some applications it may make sense to combine map classes into higher units, such as alliances or ecological systems to improve their accuracy.
4. For monitoring purposes, **change over time** could be addressed by similar remote sensing projects. New aerial photos or NAIP imagery acquired every year could be used in regular intervals to capture change. Specifically, this new imagery could be used to create up-to-date vegetation layers that could be used to compare changes in both individual vegetation stands and across the entire site. As site interpretation and re-establishment of representative facilities occurs, the changes to the vegetation and landscape can be documented in a meaningful manner.
5. In the future, resource management personnel could link the habitat for **species of concern** to specific associations and map units. These map units could then be used to help locate potential sites of important species in the field, monitor native plant introductions, or identify areas for non-native plant removal or treatment.

Research Opportunities

Having an accurate and current vegetation classification and map presents many new and exciting research opportunities. Research could include map validation surveys and classification plot data collection onsite to support the map and create more detailed descriptions of the plant communities. Following classification work and updates to the digital map, an accuracy assessment could be conducted to determine overall map accuracy and expose any map weaknesses. Additional research could include expanding or linking the GIS layer to derive other information such as fire models, habitat monitoring locations, and inventorying areas that likely contain exotic or invasive plant species. The map could also be enhanced by overlaying other existing GIS layers including site development, soils, geology, hydrology, and elevation. In this manner, interactions between these layers could be examined and yield important information about native plant introductions, vegetation growth rates, regeneration after disturbance, and biomass distribution. Finally, through innovative analyses, the vegetation layer could possibly be used as a springboard for other ecological studies such as examining how the vegetation interacts with drought, insect invasions, soil chemistry, historic land uses, prehistoric archeological sites, weather patterns, etc.

Literature Cited

- Anderson, J.R., E.E. Hardy, J.T. Roach, R.E. Witmer. 1976, amended in 2002. A land use and land cover classification system for use with remote sensor data. *Geological Survey Professional Paper 964*. Washington, DC: U.S. Government Printing Office.
- Cole, N.K. 1995. Cover type map and vegetation classification of the Hagerman study area, southwestern Idaho. Technical appendix E3.3-A for new license application: Upeer Salmon Falls (FERC no. 2777), Lower Salmon Falls (FERC no. 2061), Bliss (FERC no. 1975). Volume 4. Idaho Power Company, Boise, ID.
- Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Biological Service Program. FWS/OBS-79/31. Washington, DC. 103 pp.
- Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. *Northwest Science*. 23: 69-82.
- Dufrêne M. and P. Legendre. 1997. Species Assemblages and indicator species: the need for a flexible asymmetrical approach. *Ecological Monographs* 61:345-366
- Federal Geographic Data Committee Vegetation Subcommittee. 1997. Vegetation Classification Standard. June 1997. FGDC-STD-005. Available:
<http://www.fs.fed.us/research/fgdc/fgdcindex2.htm>.
- Grossman, D.H., D. Faber-Langendoen, A.W. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, K. Metzler, K.D. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. *International Classification of Ecological Communities: Terrestrial Vegetation of the United States. Volume I: The National Vegetation Classification Standard*. (Draft June 1997.) The Nature Conservancy, Arlington, VA. Available:
<http://www.natureserve.org/publications/library.jsp#nspubs>.
- Hansen, Monica, J. Coles, K. Thomas, D. Cogan, M. Ried, J. Von Loh, and K. Schulz. 2004. USGS-NPS National Vegetation Mapping Program: Wupatki National Monument, Arizona, Vegetation Classification and Distribution. Final Report. U.S. Geological Survey Southwest Biological Science Center. Flagstaff, AZ.
- Idaho Data Conservation Center. 2008. Classification of the plant communities of Hagerman Fossil Beds National Monument, Idaho. Natural Resource Technical Report NPS/UCBN/NRTR-2008/097. National Park Service, Fort Collins, Colorado.
- Jennings, M.D., D. Farber-Langendoen, R.K. Peet, O.L. Loucks, D.C. Glew-Lewin, A. Damman, M.G. Barbour, R. Pfister, D.H. Grossman, D. Roberts and others. 2006. Description, documentation and evaluation of association and alliances within the U.S. National

- Vegetation Classification, Version 4.5. Ecological Society of America, Vegetation Classification Panel, Washington D.C.
- McCune, B. and M.J. Mefford. 1997. PC-ORD. *Multivariate Analysis of Ecological Data, Version 3.0*. Gleneden Beach, OR: MJM Software Design, Gleneden Beach, OR.
- McCune, B. and J.B. Grace. 2002. Analysis of Ecological Communities. With contribution from Dean L. Urban. Software Design, Gleneden Beach, OR. 300 pp.
- National Park Service. 1999. Natural Resource Challenge: The National Park Service's Action Plan for Preserving Natural Resources. National Park Service, Natural Resource Stewardship and Science Division, Washington D.C.
- National Park Service. 2006. Minidoka Internment National Monument General Management Plan. NPS Pacific West Region; Park Planning and Compliance Division; Seattle, WA.
- NatureServe. 2008. NPS PLOTS Database Version 2.0. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>.
- NatureServe. 2006. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A
- Northwest Management, Inc. 2006. Report of the NPS Vegetation Mapping Project at Hagerman Fossil Beds National Monument. Unpublished report prepared for the U.S. Department of Interior, Inventory and Monitoring Program, Upper Columbia Basin Network, Moscow, ID.
- Salas, D., J. Stevens, K. Schulz. 2004. USGS-NPS National Vegetation Mapping Program: Rocky Mountain National Park. Final Report. U.S. Bureau of Reclamation Remote Sensing and GIS Group Technical Memorandum 8260-05-02. Denver, Colorado.
- Svancara, J. 2005. Inventory of Upper Columbia Basin Network Fire Information. University of Idaho, Moscow, Idaho.
- Tart, D., C. Williams, J. DiBenedetto, E. Crowe, M. Girard, H. Gordon, K. Sleavin, M. Manning, J. Haglund, B. Short and D. Wheeler. 2005. Section 2: Existing vegetation classification protocol. In: R. Broham and L. Bryant, eds. Existing Vegetation Classification and Mapping Technical Guide. USDA Forest Service, Ecosystem Management Coordination Staff Gen. Tech. Rep. WO-67. Washington D.C.
- The Nature Conservancy and Environmental Research Systems Institute. 1994a. NBS/NPS Vegetation Mapping Program: Standardized National Vegetation Classification System. Arlington, VA.
- The Nature Conservancy and Environmental Research Systems Institute. 1994b. NBS/NPS Vegetation Mapping Program: Field Methods for Vegetation Mapping. Arlington,

The Nature Conservancy and Environmental Research Systems Institute. 1994c. NBS/NPS Vegetation Mapping Program: Accuracy Assessment Procedures. Arlington, VA.

The Nature Conservancy. 1996. Methodology for assessing the utility of existing data for vegetation mapping. Unpublished report prepared for the U.S. Department of Interior, Biological Survey and National Park Service by The Nature Conservancy and Environmental Systems Research Institute, Arlington, VA.

United States Department of Agriculture, Natural Resources Conservation Service. 2008. Custom Soil Resource Report for Jerome County and Part of Twin Falls County Idaho – Hagerman. USDA , NRCS. 26 pp.

United States Department of Agriculture, Natural Resources Conservation Service. 1998. Soil Survey of Jerome County and Part of Twin Falls County, Idaho. In cooperation with USDI-Bureau of Land Management, University of Idaho College of Agriculture, and Idaho Soil Conservation Commission. Boise, ID. 254 pp.

United States Department of Interior, Bureau of Reclamation. Undated. Minidoka Project, Idaho. Accessed online at: <http://www.usbr.gov/dataweb/html/minidoka.html>.

United States Department of Interior, Bureau of Reclamation. 2004. Minidoka North Side Resource Management Plan Final Environmental Assessment and Finding of No Significant Impact. Pacific Northwest Region, Snake River Area Office. Boise, ID.

Western Region Climate Center. 2009. Climate Summaries for the Jerome, Idaho Station (104670). Accessed online at: <http://www.wrcc.dri.edu/>.

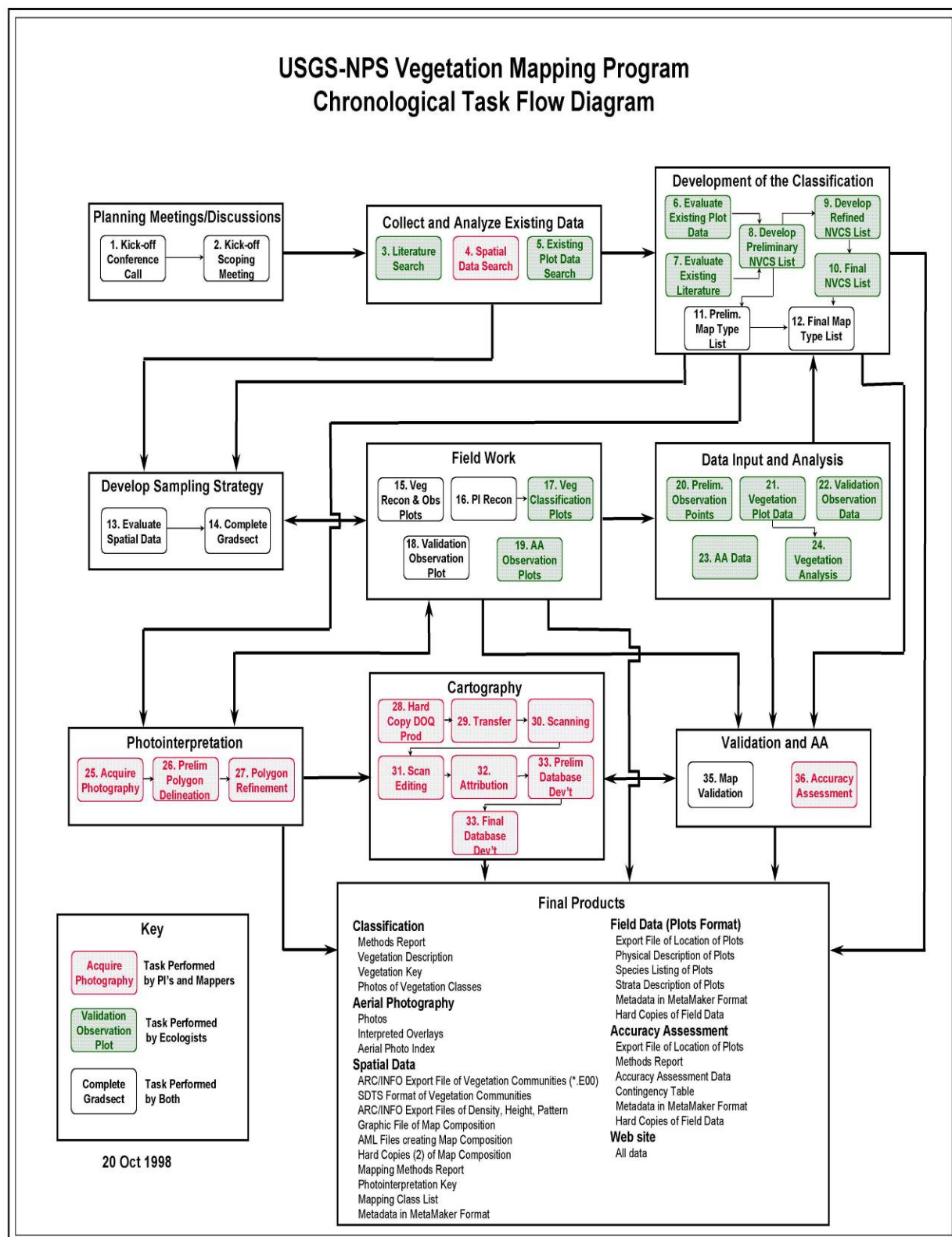
List of Abbreviation and Acronyms

AA	Accuracy Assessment
AML	Arc Macro Language
AOI	Area of Interest
BRD	Biological Resource Division (of the USGS)
CBI	Center for Biological Informatics (of the USGS/BRD)
CTI	Cogan Technology, Incorporated
E ² M	engineering-environmental Management, Incorporated
ESRI	Environmental Systems Research Institute
FGDC	Federal Geographic Data Committee
FSA	Farm Service Agency
GIS	Geographic Information System(s)
GPS	Global Positioning System
HAFO	Hagerman Fossil Beds National Monument
I&M	NPS Inventory and Monitoring Network
MIIN	Minidoka National Historic Site
MMU	Minimum Mapping Unit
NAD	North American Datum
NAIP	National Agriculture Imagery Program
NBII	National Biological Information Infrastructure
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NVC	National Vegetation Classification
NVCS	National Vegetation Classification System
RSGIG	Remote Sensing and Geographic Information Group
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
UCBN	Upper Columbia Basin Inventory and Monitoring Network
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
WRCC	Western Region Climate Center

Links

http://science.nature.nps.gov/im/units/ucbn	Upper Columbia Basin Inventory and Monitoring Network
http://biology.usgs.gov/npsveg/index.html	USGS-NPS Vegetation Mapping Program
http://www.nps.gov	The National Park Service
http://usgs.gov	United States Geologic Survey
http://biology.usgs.gov/cbi	USGS Center for Biological Informatics
http://biology.usgs.gov/cbi/nbii	National Biological Information Infrastructure
http://www.nps.gov/hafo	Hagerman Fossil Beds National Monument
http://www.nps.gov/miin	Minidoka National Historic Site
http://www.natureserve.org/explorer	NatureServe Explorer® online database server
http://plants.usda.gov	NRCS PLANTS Database

APPENDIX A: Components and Flow Diagram of the Vegetation Classification and Mapping Program



APPENDIX B: Field Data Forms and Instructions

General instructions for filling out fields in the PLOT SURVEY FORM (adapted from Salas et al. 2004)

IDENTIFIERS/LOCATORS

Plot Code

Code indicating the specific plot within the vegetation polygon.

Surveyors

Names of surveyors, with principal surveyor listed first.

Date

Date the survey was taken; year, month and day.

BPU Code

The biophysical unit identified.

Provisional Community Name

Using the provisional classification of the park that was provided, assign the name of the vegetation type which most closely resembles this type. Enter the finest level of the classification possible. If it's a new type, name it based on the two or three most dominant species in the plot.

Quad Name

Appropriate name/scale from survey map used; use 7.5-minute quadrangle if possible.

Park Site Name

Provisional name assigned by field worker that describes where the data were collected. It should represent an identifiable feature on a topographic map.

GPS Rover File

Record the number of the file from the GPS unit.

Field UTM X

Use GPS; do not estimate. If you can't get a GPS reading, estimate coordinates from a topo map and note on the form that this method was used.

Field UTM Y

Use GPS; do not estimate. If you can't get a GPS reading, estimate coordinates from a topo map and note on the form that this method was used.

Error

Error is recorded from the GPS unit.

Plot Length and Plot Width

Enter width and length dimensions for square or rectangular plots. Choose the appropriate plot size based on the following:

Vegetation Class	Standard Plot Dimensions	PLOT AREA
Forest	20 m x 20 m	400 m ²
Woodland	20 m x 20 m	400 m ²
Shrubland	20 m x 20 m	400 m ²
Dwarf-shrubland (heath)	10 m x 10 m	100 m ²
Herbaceous	10 m x 10 m	100 m ²
Nonvascular	5 m x 5 m	25 m ²

Photo numbers

If photos of the plot have been taken at the time of sampling, indicate their numbers from the ones the camera assigns.

Plot Permanent

Note if the plot has been permanently marked.

Plot Representativeness

Does this plot represent the full variability of the polygon? If not, were additional plots taken?

Note: we distinguish in this section the plot's ability to represent the stand or polygon you are sampling as one component and the ability of this sample to represent the range of variability of the association in the entire mapping area. The former comment may be ascertained by reconnaissance of the stand. The latter comment comes only after some familiarity with the vegetation type throughout the mapping area and may be left blank if you have no opinion at this time.

ENVIRONMENTAL DESCRIPTION

Elevation

Elevation of the plot obtained from the GPS

Slope

Measure the slope in percent using a clinometer.

Aspect

Measure the aspect using a compass (be sure compass is set to correct for the magnetic declination).

Topographic Position

Choose one:

INTERFLUVE (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two fluves (drainageways) that sheds water to the drainageways.

SHOULDER (shoulder slope, upper slope, convex creep slope).
Geomorphic component that forms the uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.

BACKSLOPE. Subset of midslopes that are steep, linear and may include cliff segments (fall faces).

FOOTSLOPE (lower slope, foot slope, colluvial footslope). Inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between backslope and toeslope.

TOESLOPE (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.

TERRACE Valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

CHANNEL (narrow valley bottom, gully, arroyo). Bed of single or braided watercourses commonly barren of vegetation and formed of modern alluvium.

BASIN FLOOR (depression). Nearly level to gently sloping, bottom surface of a basin.

Describe Topographic Position (Optional)

Give more details here, if needed.

Cowardin System

Indicate “upland” if the system is not a wetland. If the system is a wetland, check off the name of the USFWS system which best describes its hydrology and landform.

- Riverine: Below the high water mark on a moving water system (a creek bed). A community of *Eleocharis* on a sand bar would be in this category.
- Palustrine: In the riparian zone. Plants regularly have wet roots through much of the summer. A community of willows and sedges would be in this category.
- Lacustrine: Below the high water mark of a lake. The marshy debris on the edge of a lake would be in this category.

Assess the hydrologic regime of the plot using the descriptions below (adapted from Cowardin et al. 1979).

PERMANENTLY FLOODED - Water covers the land surface at all times of the year in all years. Equivalent to Cowardin's “permanently flooded.”

SEMI-PERMANENTLY FLOODED - Surface water persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface. Includes Cowardin's Intermittently Exposed and Semipermanently Flooded modifiers.

SEASONALLY FLOODED - Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases and is very variable, extending from saturated to a water table well below the ground surface. Includes Cowardin's Seasonal, Seasonal-Saturated, and Seasonal-Well Drained modifiers.

SATURATED - Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season. Equivalent to Cowardin's Saturated modifier.

TEMPORARILY FLOODED - Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes floodplain wetlands. Equivalent to Cowardin's Temporary modifier.

INTERMITTENTLY FLOODED - Substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rain storms. This modifier was developed for use in the arid West for water regimes of Playa lakes, intermittent streams, and dry washes, but can be used in other parts of the U.S. where

appropriate. This modifier can be applied to both wetland and non-wetland situations. Equivalent to Cowardin's Intermittently Flooded modifier.

UNKNOWN - The water regime of the area is not known. The unit is simply described as a non-tidal wetland.

Unvegetated Surface

Estimate the approximate percentage of the *total* surface area covered by each category.

Soil Texture

Using the key below, assess average soil texture.

Simplified Key to Soil Texture

Soil does not remain in a ball when squeezed.....sand

Soil remains in a ball when squeezed.....2

Squeeze the ball between your thumb and forefinger, attempting to make a ribbon that you can push up over your finger.

2. Soil makes no ribbon.....loamy sand

2. Soil makes a ribbon (may be very short).....3

3. Ribbon extends less than 1 inch before breaking.....4

Add excess water to small amount of soil:

4. Soil feels smooth.....silt loam

4. Soil feels at least slightly gritty.....5

Squeeze a moistened ball:

5. Cast is formed which can be handled CAREFULLY without breaking..... sandy loam

5. Cast is formed which can be handled FREELY without breaking.....loam

3. Ribbon extends 1 inch or more before breaking.....6

5. Soil makes a ribbon that breaks when 1 to 2 inches long;
cracks if bent into a ring.....7

Add excess water to small amount of soil:

7. Soil feels at least slightly gritty.....clay loam

7. Soil feels smooth.....silt

6. Soil makes a ribbon 2+ inches long;
does NOT crack when bent into a ring..... 8

Add excess water to a small amount of soil:

8. Soil feels at least slightly gritty.....clay

8. Soil feels smooth.....silty clay

HANDBOOK ON SOILS

In the field, soil texture is determined by the feel of a moist soil when it is rubbed between the thumb and fingers. While sand particles feel gritty, silt particles have a smooth velvety feel and clay is both sticky and plastic, an estimate of the relative proportions of the separates may be made. This procedure, of course, will not give the exact percentage of sand, silt, and clay, but, with a little practice on samples of known composition, the relative proportions of the individual separates can be closely estimated. Practice with known samples is the only way to acquire this knowledge.

The outstanding physical characteristics of the main textural grades as determined by the feel of the soil are described below.

1. Sandy Soil. A sandy soil is loose and single grained. The individual grains can be seen readily or felt. Squeezed in the hand when dry, it will fall apart when pressure is released. Squeezed when moist, it will form a cast, but will crumble when touched.
2. Sandy Loam Soil. A sandy loam soil contains much sand, but has enough silt and clay to make it somewhat coherent. Individual sand grains can be easily seen and felt. Squeezed when dry, it will form a cast which will readily fall apart; but if squeezed when moist a cast can be formed which will bear careful handling without breaking.
3. Loam Soil. A loam soil is about an equal mixture of the sand and silt with the clay content being between 7 and 27 percent. A loam is mellow with a somewhat sandy feel, yet fairly smooth and slightly plastic. Squeezed when moist, it will form a cast which can be handled freely without breaking.
4. Silt Loam Soil. A silt loam soil, when dry, may appear cloddy, but lumps are readily broken, and when pulverized, it feels soft and floury. When wet, the soil readily runs together. Either dry or moist, it will form casts which can be handled freely without breaking, but when moistened and extruded between the thumb and fingers, it will not form a ribbon, but will give a broken appearance.
5. Clay Loam Soil. A clay loam soil is fine-textured and usually breaks into clods or lumps that are hard when dry. When moist and extruded between the thumb and fingers, it will form a thin "ribbon" which will break readily, barely sustaining its own weight. The moist soil is plastic and will form a cast that will bear much handling. When kneaded in the hand, it does not crumble readily, but tends to work into a heavy, compact mass.
6. Clay Soil. A clay soil is fine-textured and usually forms very hard lumps or clods when dry and is plastic and sticky when wet. When the moist soil is ribboned out between the thumb and fingers, it will form a long flexible strip. A clay soil leaves a "slick" surface on the thumb and fingers when rubbed together and tends to hold the thumb and fingers together due to the stickiness of the clay.

The characteristics described above are suggestive only, and will only apply to a group of similar soils. The characteristics of clay vary with the kind of clay mineral. For this reason, textural

grades may exhibit different properties from region to region. For instance, clays of the montmorillonite group are very sticky and plastic; those of the oxide group are plastic and waxy with relatively little stickiness.

The preceding discussion has been directed to those soil particles whose diameters are less than 2 millimeters--the sands, silts, and clays. Soils may also contain larger sized particles that may be collectively called coarse fragments. These large particles may on occasion exceed the smaller soil particles in volume.

Soil Drainage

The soil drainage classes are defined in terms of (1) actual moisture content (in excess of field moisture capacity) and (2) the extent of the period during which excess water is present in the plant-root zone. It is recognized that permeability, level of groundwater, and seepage are factors affecting moisture status. However, because these are not easily observed or measured in the field, they cannot generally be used as criteria of moisture status. It is further recognized that soil profile morphology, for example mottling, normally, but not always, reflects soil moisture status. Although soil morphology may be a valuable field indication of moisture status, it should not be the overriding criterion. Soil drainage classes cannot be based solely on the presence or absence of mottling. Topographic position and vegetation as well as soil morphology are useful field criteria for assessing soil moisture status.

WELL DRAINED - The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year.

MODERATELY WELL DRAINED - The soil moisture content is in excess of field capacity for a small but significant period of the year.

POORLY DRAINED - The soil moisture content is in excess of field capacity in all horizons for a large part of the year.

VEGETATION DESCRIPTION

Leaf Phenology

Select the value which best describes the leaf phenology of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

EVERGREEN - Greater than 75% of the total woody cover is never without green foliage.

COLD DECIDUOUS - Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

MIXED: EVERGREEN & COLD DECIDUOUS - Evergreen and deciduous species generally contribute 25-75% of the total woody cover. Evergreen and cold-deciduous species are mixed.

PERENNIAL - Herbaceous vegetation composed of more than 50% perennial species.

ANNUAL - Herbaceous vegetation composed of more than 50% annual species.

Leaf Type

Select the value which best describes the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

BROAD-LEAVED - Woody vegetation primarily broad-leaved (generally contributes greater than 50 percent of the total woody cover).

NEEDLE-LEAVED - Woody vegetation primarily needle-leaved (generally contributes greater than 50 percent cover).

GRAMINOID - Herbaceous vegetation composed of more than 50 percent graminoid/stipe leaf species.

FORB (BROAD-LEAF-HERBACEOUS) - Herbaceous vegetation composed of more than 50% broad-leaf forb species.

PTERIDOPHYTE - Herbaceous vegetation composed of more than 50 percent species with frond or frond-like leaves. (Ferns)

Physiognomic Class

Choose one:

Forest: Trees with their crowns overlapping (generally forming 60-100% cover).

Woodland: Open stands of trees with crowns not usually touching (generally forming 25-60% cover). Canopy tree cover may be less than 25% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover.

Shrubland: Shrubs generally greater than 2.5 feet tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 25% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover.

Dwarf-Shrubland: Low-growing shrubs usually under 2.5 feet tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 25% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover.

Herbaceous: Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 25% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover.

Nonvascular: Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and herb cover.

Sparse Vegetation: Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25% and greater than 0%).

Strata, Height Class, Cover Class, Diagnostic Species

Visually divide the community into vegetation layers (strata). Indicate the average height class of the stratum in the first column, using the Height Scale on the form. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale on the form. Height and Cover classes are also listed below.

Trees are defined as single-stemmed woody plants, generally 15 feet in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 15 feet in height at maturity and under optimal growing conditions.

List the dominant species in each stratum.

Animal Use Evidence

Comment on any evidence of wildlife (i.e., tracks, scat, gopher or prairie dog mounds, etc.). Notes on domestic animals should be made in the field below.

Natural and Anthropogenic Disturbance

Comment on any evidence of natural or anthropogenic disturbance and specify the source.

Environmental Comments

Enter any additional noteworthy comments on the environmental setting. This field can be used to describe site history such as fire events (date since last fire or evidence of severity) as well as other disturbance or reproduction factors

Other Comments

Any miscellaneous comments.

Species/Strata/Percent Cover Table

The main use of the strata information is to categorize the plots by life form, in order to subset the data into forest, woodland, shrublands, and herbaceous plots for analysis. It is imperative that things be called the same throughout the data set.

Starting with the uppermost stratum, list all the species present and their cover class using the scale provided below. If a species is in the tree layer (single-stemmed woody plants, generally 15 feet in height or greater at maturity), list whether it is T1 (emergent tree), T2 (tree canopy), or T3 (tree sub-canopy). If a species is in the shrub layer, note if S1 (tall shrub), or S2 (short shrub), or S3 (dwarf shrub). If in the ground layer, note if H (herbaceous) or N (nonvascular). Some species will be in more than one layer. For example, Cottonwoods might have one or two especially tall specimens, which would be in the T1 (emergent tree) layer. Then the majority of the mature trees would be in T2 (tree canopy). The saplings that are coming up in the understory would be in the T3.

Seedlings are defined as trees less than “breast height” or less than 4.5 feet tall. Seedlings between knee height and breast height should be labeled as being in the short shrub layer (S2), and those below knee height should be labeled as being in the dwarf shrub layer (S3).

Cover Scale for Species Percent Cover

Use the cover scales provided on the forms.

USGS-NPS Vegetation Mapping Program
Minidoka National Historical Site

NATIONAL PARK VEGETATION MAPPING PROGRAM: PLOT SURVEY FORM

IDENTIFIERS/LOCATORS

Plot Code _____	Polygon Code _____
Provisional Community Name _____	
State ____ Park Name _____	Park Site Name _____
Quad Name _____ Quad Code _____	
GPS file name _____	Field UTMX _____ m E Field UTM Y _____ m N
Error +/- _____ m	
<i>please do not complete the following information when in the field</i>	
Corrected UTMX _____ m E	Corrected UTM Y _____ m N UTM Zone _____
Survey Date _____ Surveyors _____	
Directions to Plot _____	
Plot length _____	Plot width _____ Plot Photos (y/n) ____ Roll Number _____ Frame Number _____ Plot Permanent (y/n) ____
Plot representativeness _____	

ENVIRONMENTAL DESCRIPTION

Elevation _____	Slope _____	Aspect _____
Topographic Position _____		
Landform _____		
Surficial Geology _____		

Cowardin System	<u>Non-Tidal</u>		
____ Upland	____ Permanently Flooded	____ Saturated	
____ Riverine	____ Semipermanently Flooded	____ Seasonally Flooded/Saturated	
____ Palustrine	____ Seasonally/Temporarily Flooded	____ Intermittently Flooded	
____ Lacustrine			

Environmental Comments:	Soil Taxon/Description
	Unvegetated Surface: <i>(please use the cover scale on next page)</i> ____ Bedrock ____ Litter, duff ____ Wood (> 1 cm) ____ Large rocks (cobbles, boulders > 10 cm) ____ Small rocks (gravel, 0.2-10 cm) ____ Sand (0.1-2 mm) ____ Bare soil ____ Other: _____
Soil Texture ____ sand ____ loamy sand ____ sandy loam ____ loam ____ silt loam ____ silt ____ clay loam ____ silty clay ____ clay ____ peat ____ muck	Soil Drainage ____ Rapidly drained ____ Well drained ____ Moderately well drained ____ Somewhat poorly drained ____ Poorly drained ____ Very poorly drained

USGS-NPS Vegetation Mapping Program
Minidoka National Historical Site

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Strata & Unvegetated Surface		Height Scale for Strata	
<u>Trees and Shrubs</u>	<u>Broad-leaved</u>	<u>Forest</u>	01	5%	01	<0.5 m
<u>Evergreen</u>	<u>Needle-leaved</u>	<u>Woodland</u>	02	10%	02	0.5-1m
<u>Cold-deciduous</u>	<u>Microphyllous</u>	<u>Shrubland</u>	03	20%	03	1-2 m
<u>Drought-deciduous</u>	<u>Graminoid</u>	<u>Dwarf Shrubland</u>	04	30%	04	2-5 m
<u>Mixed evergreen - cold-deciduous</u>	<u>Forb</u>	<u>Herbaceous</u>	05	40%	05	5-10 m
<u>Mixed evergreen - drought-deciduous</u>	<u>Pteridophyte</u>	<u>Nonvascular</u>	06	50%	06	10-15 m
		<u>Sparsely Vegetated</u>	07	60%	07	15-20 m
			08	70%	08	20-35 m
			09	80%	09	35 - 50 m
			10	90%	10	>50 m
<u>Herbs</u>			11	100%		
<u>Annual</u>						
<u>Perennial</u>						

Strata	Height Class	Cover Class	Diagnostic species (if known)
T1 Emergent			
T2 Canopy			
T3 Sub-canopy			
S1 Tall shrub			
S2 Short Shrub			
H Herbaceous			
N Non-vascular			
V Vine/liana			
E Epiphyte			
<i>please see above table for height and cover scales</i>			
Animal Use Evidence			
Natural and Anthropogenic Disturbance Comments			
Other Comments			

Plot Code

[illegible]

T = >0-1%	5 = >45-55%
P = >1-5%	6 = >55-65%
1 = >5-15%	7 = >65-75%
2 = >15-25%	8 = >75-85%
3 = >25-35%	9 = >85-95%
4 = >35-45%	10 = >95%

ACCURACY ASSESSMENT POINT FORM

IDENTIFIERS/LOCATORS

Field Point Code _____	Database Point Code _____
State ____ Park Name _____	Park Site Name _____
Quad Name _____	QuadCode _____
Primary Name Veg Assoc: _____	
Secondary Name Veg Assoc: _____	
Other Veg Assoc within 50 m _____	
Classification Comments: 	
GPS file name _____ Field UTM X _____ m E Field UTM Y _____ m N	
GPS Error _____ m	
<i>please do not complete the following information when in the field</i>	
Corrected UTM X _____ m E	Corrected UTM Y _____ m N UTM Zone _____
Survey Date _____	
Surveyors _____	

ENVIRONMENTAL DESCRIPTION

Elevation _____	Slope _____	Aspect _____
Topographic Position _____		
Landform _____		
Environmental Comments (including hydrology): 	Unvegetated Surface: <i>(please use the cover scale below)</i> ☐ Bedrock ☐ Litter, duff ☐ Wood (> 1 cm) ☐ Large rocks (cobbles, boulders > 10 cm) ☐ Small rocks (gravel, 0.2-10 cm) ☐ Sand (0.1-2 mm) ☐ Bare soil ☐ Other: _____	

USGS-NPS Vegetation Mapping Program
Minidoka National Historical Site

Tree D.B.H Form

Plot Code: _____ Units in cm or inches (circle one)

Record tree diameter over 5 cm at 4.5 feet (1.37 m) height for species that contribute to tree canopy. *Separate measurements of multi-stemmed trees with commas. Can estimate by 5 cm dia. classes*

[illegible][illegible]

APPENDIX C: Dichotomous Key to HAFO Plant Associations

Key to Vegetation types at HAFO (Developed By Steven Rust, Idaho Data Conservation Center)

The field key to plant communities of the monument follows. The key is structured into physiognomic classes (or lifeform groups). These classes do not constraint the classification per se, rather they are employed to assist in applying the classification. In the field, different expressions of a given plant association may occur as different physiognomic classes. Given this, several associations may be found through multiple pathways within the key.

Use of the Key

To use the field key most effectively, identify a representative, homogeneous stand of vegetation. Work through the entire hierarchy of the key beginning with Key to Lifeform Groups to each sequential dichotomous lead and estimate plant cover on an area of approximately 405 m². If a satisfactory determination is not made in stands with low total cover consider adjusting diagnostic species cover break points downward. Assignment of individual species to lifeform follows USDA, NRCS (2007).

In the key the term relative cover is used. In this context relative cover refers to the proportional abundance of the given species (or group of species) with respect to the total abundance of the associated lifeform. The value is calculated by dividing the percent cover of the species (or group of species) under consideration by the total cover of the respective lifeform. For example, the relative cover of native grass species is calculated as follows: (sum of native grass species cover within the sample) / (total cover of all graminoids within the sample) = (relative native grass composition).

Key to Lifeform Groups

- 1a) Tree canopy cover (*Elaeagnus angustifolia*, *Fraxinus pennsylvanica*, *Populus angustifolia*, *Populus balsamifera* ssp. *trichocarpa*, *Salix amygdaloides*, or *Ulmus americana*) $\geq 10\%$, Part A: Forest, Woodland, and Savannah, lead 4a.
- 1b) Tree canopy cover $< 10\%$, lead 2a.
 - 2a) Shrub canopy cover $\geq 10\%$, Part B: Shrublands and Shrub-Steppe, lead 12a.
 - 2b) Shrub canopy cover $< 10\%$, lead 3a.
 - 3a) Vascular plant cover $\geq 10\%$, Part C: Herbaceous Vegetation, lead 31a.
 - 3b) Vascular plant cover $< 10\%$, PASM-ACHY (Sparse Vegetation).

Part A: Forest, Woodland, and Savannah

- 4a) *Populus balsamifera* spp. *trichocarpa* $\geq 5\%$ cover, POBAT-ELAN/BRTE.
- 4b) *Populus balsamifera* spp. *trichocarpa* $< 5\%$ cover, lead 5a.
 - 5a) *Populus angustifolia* $\geq 5\%$ cover, POAN3/TYLA.
 - 5b) *Populus angustifolia* $< 5\%$ cover, lead 6a.
 - 6a) *Elaeagnus angustifolia* $\geq 4\%$ cover, lead 7a.
 - 7a) *Sarcobatus vermiculatus* $\geq 1\%$ cover, ELAN/SAVE4/Mesic Graminoids.
 - 7b) *Sarcobatus vermiculatus* $< 1\%$ cover, lead 8a.
 - 8a) *Rhus trilobata* var. *trilobata* $\geq 4\%$ cover, ELAN/RHTRT-ROWO.
 - 8b) *Rhus trilobata* var. *trilobata* $< 4\%$ cover, lead 9a.

- 9a) *Purshia tridentata* $\geq 4\%$ cover, ELAN/PUTR2/LECI4.
- 9b) *Purshia tridentata* $< 4\%$ cover, 10a.
 - 10a) Native grass composition $\geq 30\%$ relative cover, lead 11a.
 - 11a) *Leymus cinereus* $\geq 1\%$ cover, ELAN/LECI4.
 - 11b) *Leymus cinereus* $< 1\%$ cover, ELAN/POSE.
 - 10b) Native grass composition $< 30\%$ relative cover, ELAN/BRTE.
- 6b) *Elaeagnus angustifolia* $< 4\%$ cover, ULAM/BRTE.

Part B: Shrublands and Shrub-Steppe

- 12a) *Elaeagnus angustifolia* $\geq 5\%$ cover, lead 6a (above).
- 12b) *Elaeagnus angustifolia* $< 5\%$ cover, lead 13a.
 - 13a) *Salix exigua* $\geq 4\%$ cover, SAEX/Mesic Forbs.
 - 13b) *Salix exigua* $< 4\%$ cover, lead 14a.
 - 14a) *Salix lucida* ssp. *caudata* $\geq 5\%$ cover, SALUC/THIN6.
 - 14b) *Salix lucida* ssp. *caudata* $< 5\%$ cover, lead 7a (above).
 - 15a) *Artemisia tridentata* ssp. *wyomingensis* $\geq 4\%$ cover, lead 16a.
 - 16a) Native grass composition $\geq 30\%$ relative cover, lead 17a.
 - 17a) *Hesperostipa comata* ssp. *comata* is present, ARTRW8/HECO26.
 - 17b) *Hesperostipa comata* ssp. *comata* is absent, lead 18a.
 - 18a) *Achnatherum hymenoides* is present, ARTRW8/ACHY.
 - 18b) *Achnatherum hymenoides* is absent, ARTRW8/POSE.
 - 16b) Native grass composition $< 30\%$ relative cover, ARTRW8/BRTE.
 - 15b) *Artemisia tridentata* ssp. *wyomingensis* $< 4\%$ cover, lead 19a.
 - 19a) *Atriplex canescens* var. *canescens* $\geq 2\%$ cover, lead 20a.
 - 20a) *Achnatherum hymenoides* $\geq 2\%$ cover, ATCA2/ACHY.
 - 20b) *Achnatherum hymenoides* $< 2\%$ cover, ATCA2/BRTE.
 - 19b) *Atriplex canescens* var. *canescens* $< 2\%$ cover, lead 21a.
 - 21a) *Eriogonum microthecum* var. *laxiflorum* $\geq 2\%$ cover, ERMI4/ACHY.
 - 21b) *Eriogonum microthecum* var. *laxiflorum* $< 2\%$ cover, lead 22a.
 - 22a) *Artemisia tridentata* ssp. *tridentata* $\geq 2\%$ cover, ARTRT/BRTE.
 - 22b) *Artemisia tridentata* ssp. *tridentata* $< 2\%$ cover, lead 23a.
 - 23a) *Sarcobatus vermiculatus* $\geq 1\%$ cover, lead 24a.
 - 24a) *Leymus cinereus* $\geq 5\%$ cover, SAVE4/LECI4.
 - 24b) *Leymus cinereus* $< 5\%$ cover, SAVE4/BRTE.
 - 23b) *Sarcobatus vermiculatus* $< 1\%$ cover, lead 25a.
 - 25a) *Purshia tridentata* $\geq 2\%$ cover, PUTR2/ACHY.
 - 25b) *Purshia tridentata* $< 2\%$ cover, lead 25a.
 - 26a) *Krascheninnikovia lanata* $\geq 2\%$ cover, KRLA2/POSE.
 - 26b) *Krascheninnikovia lanata* $> 2\%$ cover, lead 27a.
 - 27a) *Atriplex confertifolia* $\geq 1\%$ cover, lead 28a.
 - 28a) *Picrothamnus desertorum* is present, ATCO-PIDE4/(ACHY)-BRTE.
 - 28b) *Picrothamnus desertorum* is absent, lead 29a.
 - 29a) *Achnatherum hymenoides* is present, ATCO/ACHY.

- 29b) *Achnatherum hymenoides* is absent, ATCO/BRTE.
- 27b) *Atriplex confertifolia* <1% cover, lead 30a.
- 30a) *Ericameria nauseosa* ≥2% cover, ERNA10-CHVI8/(ACHY)-BRTE.
- 30b) *Ericameria nauseosa* <2% cover, CHVI8/ACHY.

Part C: Herbaceous Vegetation

- 31a) Total shrub cover ≥3% cover, lead 13a (Part B, above).
- 31a) Total shrub cover <3% cover, lead 32a.
 - 32a) Native grass composition ≥50% cover, lead 33a.
 - 33a) *Achnatherum hymenoides* ≥2% cover, EROV/ACHY.
 - 33b) *Achnatherum hymenoides* <2% cover, lead 34a.
 - 34a) *Eleocharis palustris* ≥5% cover, ELPA3.
 - 34b) *Eleocharis palustris* <5% cover, POAN3/TYLA.
 - 32b) Native grass composition <50% cover, lead 35a.
 - 35a) *Lactuca tatarica* var. *pulchella* ≥5% cover, LATAP.
 - 35b) *Lactuca tatarica* var. *pulchella* <5% cover, lead 36a.
 - 36a) *Agropyron cristatum* ≥4% cover, AGCR/SIAL2.
 - 36b) *Agropyron cristatum* <4% cover, BRTE/SIAL2.

APPENDIX D: Vegetation Association Descriptions for HAFO

U.S. NATIONAL VEGETATION CLASSIFICATION

Hagerman Fossil Beds National Historic Monument

February 19, 2009

By
Northwest Management, Inc.
PO Box 9748
Moscow, Idaho 83843

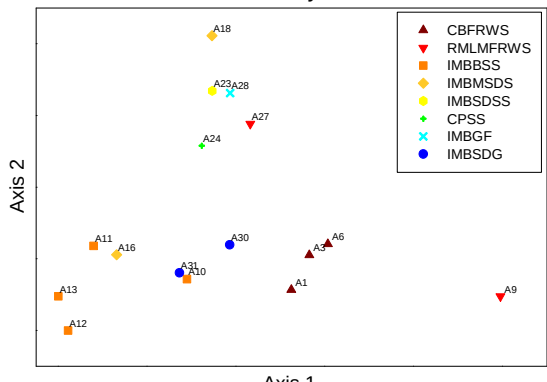
And
NPS – Upper Columbia Basin Network
University of Idaho
College of Natural Resources
Moscow, Idaho 83843



This subset of the U.S. National Classification covers vegetation associations and alliances attributed to Hagerman Fossil Beds National Monument. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications.

Russian Olive / Cheatgrass Semi-natural Woodland

Elaeagnus angustifolia / *Bromus tectorum* Semi-natural Woodland

| | |
|--|---|
|  | <p>HAFO Summary Ordination</p>  |
| <p>Description</p> <p>The vegetation of this semi-natural association is characterized by the dominance of the introduced tree species <i>Elaeagnus angustifolia</i>. The tree canopy may range from open to nearly closed. The understory is sparse to moderate in terms of cover, and is generally dominated by introduced species. The introduced annual grass, <i>Bromus tectorum</i> is the most common species in the understory and comprises the majority of the herbaceous cover. <i>Agropyron cristatum</i>, an introduced perennial grass species may also be sparse and variable in the herbaceous layer. A variety of native shrub species may also occur sporadically in the understory with relatively low cover values. Associated shrub species may include <i>Artemisia</i> spp., <i>Ribes aureum</i>, <i>Salix exigua</i>, <i>Salix melanopsis</i>, and <i>Atriplex confertifolia</i>.</p> <p><i>Elaeagnus angustifolia</i> tends to dominate more mesic habitats of semi-arid environments, often adjacent to streams and rivers. <i>Bromus tectorum</i> can occur across a wide range of environmental conditions and is not tightly constrained by slope, aspect, soil texture, or soil depth. Thus, an association characterized by the dominance of these two species is likely only restricted by the availability of enough soil moisture to sustain <i>Elaeagnus angustifolia</i>.</p> | |
| <p>CONSERVATION RANK N/A</p> | <p>DATABASE CODE N/A</p> |
| <p>CHARACTERISTIC SPECIES (n = 3, AA)</p> <p>Tree</p> <p><i>Elaeagnus angustifolia</i> (Russian olive) V.46, <i>Populus angustifolia</i> (narrowleaf cottonwood) III.2</p> <p>Shrub</p> <p>None</p> <p>Dwarf-shrub</p> <p>None</p> <p>Graminoid</p> <p><i>Bromus tectorum</i> (cheatgrass) IV.10</p> <p>Forb</p> <p>None</p> | |

RANGE

Hagerman Fossil Beds National Monument

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

The widespread Russian Olive Semi-natural Woodland Alliance is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. The Cheatgrass Semi-natural Herbaceous Alliance is also found throughout much of western North America from the western Great Plains to intermountain and southwestern U.S. Therefore, an association characterized by both of these species is likely distributed sporadically throughout the western U.S where conditions are appropriate and where both species have had the opportunity to invade native plant communities.

COMMENTS

Elaeagnus angustifolia is considered a naturalized species and has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, especially mesic areas associated with streams and rivers. Consequently, stands tend to be small and linear. *Bromus tectorum* often becomes established after disturbance of a natural shrub- or grass-dominated community resulting in the replacement of the natural vegetation by non-native, annual grass species. At Hagerman Fossil Beds National Monument, it is likely that a combination of disturbed soil and the spread of ornamental tree plantings have led to the establishment and co-dominance of these two species.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Elaeagnus angustifolia* Woodland Alliance contains *Elaeagnus angustifolia* / *Bromus tectorum* Semi-natural Woodland (A1) and also contains the following associations; *Elaeagnus angustifolia* / *Leymus cinereus* Semi-natural Woodland (A2), *Elaeagnus angustifolia* / *Poa secunda* Semi-natural Woodland (A3), *Elaeagnus angustifolia* / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland (A4), *Elaeagnus angustifolia* / *Rhus trilobata* var. *trilobata* – *Rosa woodsii* Semi-natural Woodland (A5), *Elaeagnus angustifolia* / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland (A6). This map code occupies approximately (91) polygons containing a combination of the associations listed above. These polygons average about (3.38) ha in size and comprise nearly (26.9) ha of total area within the Monument.

Russian Olive / Basin Wildrye Semi-natural Woodland

Elaeagnus angustifolia / *Leymus cinereus* Semi-natural Woodland



Description

This semi-natural association is characterized by the dominance of the introduced tree species *Elaeagnus angustifolia* with a variety of native and introduced species occurring in the understory. The tree canopy may range from open to nearly closed. *Leymus cinereus* is typically the dominant native grass species in the herbaceous understory; however, non-native grass species, primarily *Bromus tectorum*, may also occur frequently with moderate cover levels in this vegetation type.

Elaeagnus angustifolia tends to occur in more mesic habitats of semi-arid environments, such as near streams and rivers. The presence of *Leymus cinereus* also suggests an environment with seasonal flooding and more mesic soils, possibly with substantial clay content.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 1, AA)

Tree

Elaeagnus angustifolia (Russian olive)

Shrub

N/A

Dwarf-shrub

N/A

Graminoid

Leymus cinereus (basin wildrye)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

The widespread Russian Olive Semi-natural Woodland Alliance is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. The Russian Olive / Basin Wildrye Semi-natural Woodland Association likely occurs within the range of the greater alliance where environmental conditions are appropriate for the persistence of *Leymus cinereus*.

COMMENTS

Elaeagnus angustifolia is considered a naturalized species and has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, especially mesic areas associated with streams and rivers. Consequently, stands tend to be small and linear.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

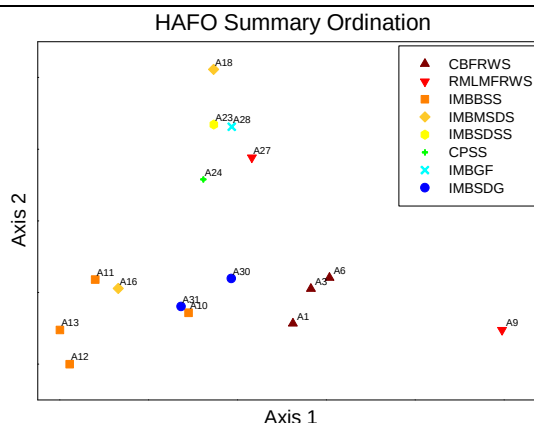
MAP UNITS

This map code *Elaeagnus angustifolia* Woodland Alliance contains *Elaeagnus angustifolia* / *Leymus cinereus* Semi-natural Woodland (A2) and also contains the following associations; *Elaeagnus angustifolia* / *Bromus tectorum* Semi-natural Woodland (A1), *Elaeagnus angustifolia* / *Poa secunda* Semi-natural Woodland (A3), *Elaeagnus angustifolia* / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland (A4), *Elaeagnus angustifolia* / *Rhus trilobata* var. *trilobata* – *Rosa woodsii* Semi-natural Woodland (A5), *Elaeagnus angustifolia* / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland (A6). This map code occupies approximately (91) polygons containing a combination of the associations listed above. These polygons average about (3.38) ha in size and comprise nearly (26.9) ha of total area within the Monument.

A3

Russian Olive / Sandberg Bluegrass Semi-natural Woodland

Elaeagnus angustifolia / *Poa secunda* Semi-natural Woodland



Description

This semi-natural association is characterized by the dominance of the introduced tree species *Elaeagnus angustifolia*. The native perennial grass *Poa secunda* generally dominates the herbaceous understory. The tree canopy may range from open to nearly closed. Herbaceous cover can approach moderate cover levels. Shrubs may occur sporadically at very low cover. The shrub species that occur with the greatest regularity in this plant community include *Artemisia* spp. and *Ericameria nauseosa*. In addition to *Poa secunda*, grass species present in the herbaceous understory often include *Hordeum jubatum* and *Bromus tectorum*. Forb cover is generally low and species composition is variable. Only one forb species, *Chenopodium fremontii*, a native annual, occurs with high constancy, albeit at low cover values, in this vegetation type.

Elaeagnus angustifolia tends to dominate more mesic habitats of semi-arid environments, often adjacent to streams and rivers. *Poa secunda* can be found across a wide range of elevations and slopes. This species occurs on all aspects, but is most common on southern exposures. Soils are typically shallow, moderately to well-drained, non-calcareous with a high percentage of rock fragments and exposed rock (lithic), and texture varies from sandy loam to clay loam.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 4, AA)

Tree

Elaeagnus angustifolia (Russian olive) V.42

Shrub

None

Dwarf-shrub

None

Graminoid

Poa secunda (Sandberg bluegrass) V.10, *Bromus tectorum* (cheatgrass) V.3, *Hordeum jubatum* (foxtail barley) IV.1

Forb

Chenopodium fremontii (Fremont's goosefoot) IV.1

RANGE

Hagerman Fossil Beds National Monument

This association is found along the river and creek corridors as well as adjacent to spring fed-drainages and seeps.

Global

The widespread Russian Olive Semi-natural Woodland Alliance is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. The *Poa secunda* Grassland Alliance is restricted to the Columbia Basin of eastern Washington, eastern Oregon, Idaho and northeastern California. Therefore, the range of the Russian Olive / Sandberg Bluegrass Semi-natural Woodland Association is likely restricted to locations where environmental conditions permit the persistence of *Elaeagnus angustifolia*, within the greater range of *Poa secunda*-dominated community types.

COMMENTS

Elaeagnus angustifolia is considered a naturalized species and has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, especially mesic areas associated with streams and rivers. Consequently, stands tend to be small and linear.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Elaeagnus angustifolia* Woodland Alliance contains *Elaeagnus angustifolia* / *Poa secunda* Semi-natural Woodland (A3) and also contains the following associations; *Elaeagnus angustifolia* / *Bromus tectorum* Semi-natural Woodland (A1), *Elaeagnus angustifolia* / *Leymus cinereus* Semi-natural Woodland (A2), *Elaeagnus angustifolia* / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland (A4), *Elaeagnus angustifolia* / *Rhus trilobata* var. *trilobata* – *Rosa woodsii* Semi-natural Woodland (A5), *Elaeagnus angustifolia* / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland (A6). This map code occupies approximately (91) polygons containing a combination of the associations listed above. These polygons average about (3.38) ha in size and comprise nearly (26.9) ha of total area within the Monument.

A4 Russian Olive / Antelope Bitterbrush / Basin Wildrye Semi-natural Woodland

Elaeagnus angustifolia / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland



Description

This woodland community type is dominated by the introduced tree species, *Elaeagnus angustifolia*. The tree canopy may range from open to crowns nearly touching. *Purshia tridentata* is typically present in the shrub layer, and *Leymus cinereus* is generally the dominant native grass in the herbaceous understory. Additional native shrub, grass, and forb species may occur, but species composition can be variable and cover of these species is generally low. Non-native grass species, primarily *Bromus* spp., are often present in the herbaceous layer and cover can range from low to moderate.

Elaeagnus angustifolia tends to occur in more mesic habitats of semi-arid environments, such as near streams and rivers. The presence of *Leymus cinereus* also suggests an environment with seasonal flooding and more mesic soils, possibly with substantial clay content.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 2, AA)

Tree

Elaeagnus angustifolia (Russian olive)

Shrub

Purshia tridentata (antelope bitterbrush)

Dwarf-shrub

N/A

Graminoid

Leymus cinereus (basin wildrye)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

The widespread Russian Olive Semi-natural Woodland Alliance is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. The Russian Olive / Antelope Bitterbrush / Basin Wildrye Semi-natural Woodland Association likely occurs as small patches within the range of the greater alliance where environmental conditions are appropriate for the persistence of *Purshia tridentata* and *Leymus cinereus*.

COMMENTS

Elaeagnus angustifolia is considered a naturalized species and has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, especially mesic areas associated with streams and rivers. Consequently, stands tend to be small and linear.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only two plots were sampled at Hagerman Fossil Beds; therefore, a thorough characteristic species list could not be compiled.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Elaeagnus angustifolia* Woodland Alliance contains *Elaeagnus angustifolia* / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland (A4) and also contains the following associations; *Elaeagnus angustifolia* / *Bromus tectorum* Semi-natural Woodland (A1), *Elaeagnus angustifolia* / *Leymus cinereus* Semi-natural Woodland (A2), *Elaeagnus angustifolia* / *Poa secunda* Semi-natural Woodland (A3), *Elaeagnus angustifolia* / *Rhus trilobata* var. *trilobata* – *Rosa woodsii* Semi-natural Woodland (A5), *Elaeagnus angustifolia* / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland (A6). This map code occupies approximately (91) polygons containing a combination of the associations listed above. These polygons average about (3.38) ha in size and comprise nearly (26.9) ha of total area within the Monument.

A5

Russian Olive / Skunkbush Sumac – Woods’ Rose Semi-natural Woodland

Elaeagnus angustifolia / *Rhus trilobata* - *Rosa woodsii* Semi-natural Woodland



Description

This woodland is dominated by the introduced tree species, *Elaeagnus angustifolia* with canopy cover ranging from open to nearly closed. The shrub layer is typically dense and is dominated by *Rhus trilobata*; however, *Rosa woodsii* is often present and may also be locally abundant. Other shrubs species that occasionally occur in this plant community include *Ribes aureum* and *Salix* spp. The herbaceous layer is typically sparse due to shading but *Bromus* spp. are often present.

Elaeagnus angustifolia tends to occur in more mesic habitats of semi-arid environments, such as near streams and rivers. *Rhus trilobata* favors intermittently flooded areas, including rocky, well-drained benches and toeslopes in rocky river reaches having little floodplain development due to bedrock confinement. The association resulting from the co-dominance of these species likely occurs as a narrow band on rocky, well-drained benches located between the high-water line and the upland slopes in moderately wide valleys and along narrow reaches of larger rivers. Soil textures are shallow sandy loams or loamy sands over coarse alluvium or bedrock.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 1, AA)

Tree

Elaeagnus angustifolia (Russian olive)

Shrub

Rhus trilobata (skunkbush sumac), *Rosa woodsii* (Woods’ rose)

Dwarf-shrub

N/A

Graminoid

N/A Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

The widespread Russian Olive Semi-natural Woodland Alliance is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. The Skunkbush Sumac Intermittently Flooded Shrubland Alliance has been described from western Colorado, southwestern New Mexico, and central Idaho. It likely also occurs throughout the southwestern U.S. and Colorado Plateau regions. Hence, the Russian Olive / Skunkbush Sumac – Woods' Rose Semi-natural Woodland Alliance is probably constrained to small patches adjacent to rivers and streams within the ranges of the greater alliances where environmental conditions are appropriate and *Elaeagnus angustifolia* has had the opportunity to invade the otherwise native plant community.

COMMENTS

Elaeagnus angustifolia is considered a naturalized species and has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, especially mesic areas associated with streams and rivers. Consequently, stands tend to be small and linear.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

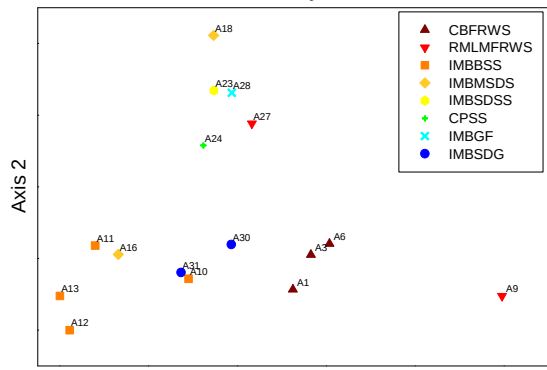
This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Elaeagnus angustifolia* Woodland Alliance contains *Elaeagnus angustifolia* / *Rhus trilobata* var. *trilobata* – *Rosa woodsii* Semi-natural Woodland (A5), and also contains the following associations; *Elaeagnus angustifolia* / *Bromus tectorum* Semi-natural Woodland (A1), *Elaeagnus angustifolia* / *Leymus cinereus* Semi-natural Woodland (A2), *Elaeagnus angustifolia* / *Poa secunda* Semi-natural Woodland (A3), *Elaeagnus angustifolia* / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland (A4), *Elaeagnus angustifolia* / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland (A6). This map code occupies approximately (91) polygons containing a combination of the associations listed above. These polygons average about (3.38) ha in size and comprise nearly (26.9) ha of total area within the Monument.

A6 Russian Olive / Greasewood / Mesic Graminoids Semi-natural Woodland

Elaeagnus angustifolia / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland

| | |
|---|---|
|  | <p>HAFO Summary Ordination</p>  |
| <p>Description</p> <p><i>Elaeagnus angustifolia</i> dominates the canopy of this semi-natural woodland association. The tree canopy can range from open to nearly closed. Shrubs cover is generally low, but <i>Sarcobatus vermiculatus</i> is always present and <i>Ribes aureum</i> and <i>Ericameria nauseosa</i> may also occur in the shrub layer on occasion. Graminoids, including <i>Poa secunda</i>, <i>Eleocharis palustris</i>, and <i>Bromus tectorum</i> and the forb <i>Dipsacus fullonum</i>, comprise the majority of the herbaceous understory.</p> <p><i>Elaeagnus angustifolia</i> tends to dominate more mesic habitats of semi-arid environments, often adjacent to streams and rivers, while <i>Sarcobatus vermiculatus</i> is typically found on saline and alkaline soils that are prone to seasonal flooding. The combination of environmental factors required for the co-dominance of these species likely occurs adjacent to streams and rivers where soil texture is fine and drainage is poor.</p> | |
| <p>CONSERVATION RANK N/A</p> | <p>DATABASE CODE N/A</p> |
| <p>CHARACTERISTIC SPECIES (n = 1, AA)</p> <p>Tree</p> <p><i>Elaeagnus angustifolia</i> (Russian olive)</p> <p>Shrub</p> <p><i>Sarcobatus vermiculatus</i> (greasewood)</p> <p>Dwarf-shrub</p> <p>N/A</p> <p>Graminoid</p> <p>N/A</p> <p>Forb</p> <p>N/A</p> | |

RANGE

Hagerman Fossil Beds National Monument

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

The widespread Russian Olive Semi-natural Woodland Alliance is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. Greasewood is native and common throughout the West on saline, alkaline flood plains. The distribution of the Russian Olive / Greasewood / Mesic Graminoids Semi-natural Woodland Association is probably limited in patch size and distribution, occurring only where environmental conditions are conducive to *Sarcobatus vermiculatus* persistence and where *Elaeagnus angustifolia* has had the opportunity to invade the local plant community.

COMMENTS

Elaeagnus angustifolia is considered a naturalized species and has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, especially mesic areas associated with streams and rivers. Consequently, stands tend to be small and linear.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Elaeagnus angustifolia* Woodland Alliance contains *Elaeagnus angustifolia* / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland (A6), and also contains the following associations; *Elaeagnus angustifolia* / *Bromus tectorum* Semi-natural Woodland (A1), *Elaeagnus angustifolia* / *Leymus cinereus* Semi-natural Woodland (A2), *Elaeagnus angustifolia* / *Poa secunda* Semi-natural Woodland (A3), *Elaeagnus angustifolia* / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland (A4), *Elaeagnus angustifolia* / *Rhus trilobata* var. *trilobata* – *Rosa woodsii* Semi-natural Woodland (A5). This map code occupies approximately (91) polygons containing a combination of the associations listed above. These polygons average about (3.38) ha in size and comprise nearly (26.9) ha of total area within the Monument.

A7 **Black Cottonwood - Russian Olive / Cheatgrass Semi-natural Woodland**

Populus balsamifera - *Elaeagnus angustifolia* / *Bromus tectorum* Semi-natural Woodland

| | |
|---|----------------------|
| | |
| <p>Description</p> <p><i>Populus balsamifera</i> and <i>Elaeagnus angustifolia</i> dominate the tree canopy of this vegetation type. The canopy can range from open to nearly closed. <i>Bromus tectorum</i>, a non-native annual grass, is characteristic of the understory of this plant community and cover of this species can reach moderate levels. Additional tree, shrub, and/or herbaceous species may occur in this plant community, but cover is generally low and species composition can be quite variable from one stand to another.</p> <p>Vegetation types in the Black Cottonwood Temporarily Flooded Woodland Alliance occur on alluvial terraces along major streams and rivers. Stands can occupy broad floodplains or form narrow stringers adjacent to streams with a much steeper slope. Soils are typically Entisols, with up to 1 m of mineral soil overlying river gravel and/or cobbles. Soil texture varies from loam to coarse sand. The water table underlying these plant communities usually drops below 1 m of the soil surface in summer, but can remain moist due to capillary action. <i>Elaeagnus angustifolia</i> also tends to dominate more mesic habitats of semi-arid environments, often adjacent to streams and rivers. <i>Bromus tectorum</i> can occur across a wide range of environmental conditions and is not tightly constrained by slope, aspect, soil texture, or soil depth. Thus, an association characterized by an abundance of these three species is likely constrained by the hydrologic regime and soils necessary for the persistence of <i>Populus balsamifera</i>.</p> | |
| CONSERVATION RANK N/A | DATABASE CODE N/A |
| <p>CHARACTERISTIC SPECIES (n = 1, AA)</p> <p>Tree</p> <p><i>Populus balsamifera</i> (black cottonwood), <i>Elaeagnus angustifolia</i> (Russian olive)</p> <p>Shrub</p> <p>N/A</p> <p>Dwarf-shrub</p> <p>N/A</p> <p>Graminoid</p> <p><i>Bromus tectorum</i> (cheatgrass)</p> <p>Forb</p> | |

| |
|---|
| N/A |
| <p>RANGE</p> <p><i>Hagerman Fossil Beds National Monument</i></p> <p>This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.</p> <p><i>Global</i></p> <p>The widespread Russian Olive Semi-natural Woodland Alliance is found in the northern Great Plains, Utah, and probably throughout much of the western United States and adjacent Canada. The Cheatgrass Semi-natural Herbaceous Alliance is also found throughout much of western North America from the western Great Plains to intermountain and southwestern U.S. The Black Cottonwood Temporarily Flooded Woodland Alliance is found in Alaska, Idaho, Oregon, and British Columbia, Canada, and possibly Washington. The range of the Black Cottonwood - Russian Olive / Cheatgrass Semi-natural Woodland Alliance is probably limited to small patches along rivers and streams in the western U.S. where environmental conditions are appropriate for <i>Populus balsamifera</i> to dominate and where <i>Elaeagnus angustifolia</i> and <i>Bromus tectorum</i> have had the opportunity to invade the plant community.</p> |
| <p>COMMENTS</p> <p><i>Elaeagnus angustifolia</i> is considered a naturalized species and has been widely planted in hedgerows for windbreaks. It has since spread to a variety of native habitats, especially mesic areas associated with streams and rivers. Consequently, stands tend to be small and linear. <i>Bromus tectorum</i> often occurs after disturbance of natural shrub- or grass-dominated communities resulting in the replacement of the natural vegetation by non-native, annual grass species.</p> <p>This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.</p> <p>This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.</p> |
| <p>MAP UNITS</p> <p>This map code <i>Populus balsamifera</i> Woodland alliance contains <i>Populus balsamifera</i> spp. <i>Trichocarpa</i>--<i>Elaeagnus angustifolia</i> / <i>Bromus tectorum</i> Semi-natural woodland (A7). This map code occupies approximately (3) polygons containing a combination of the associations listed above. These polygons average about (1.58) ha in size and comprise nearly (1.9) ha of total area within the Monument.</p> |

A8

American Elm / Cheatgrass Semi-natural Woodland

Ulmus americana / *Bromus tectorum* Semi-natural Woodland



Description

The vegetation in this semi-natural alliance is dominated by the introduced tree species *Ulmus americana*. *Bromus tectorum* comprises the majority of the herbaceous cover in this vegetation type. However, a variety of native and introduced species may also occur sporadically in the understory.

Ulmus americana is not known to occur in Idaho except as an ornamental shade tree. Appropriate habitats within its traditional range include bottomlands and flood plains but, it will often survive and thrive in well-drained soils. *Ulmus americana* likely occurs in abandoned farmsteads and as an ornamental planting outside of its historic range. *Bromus tectorum* can occur across a wide range of environmental conditions and is not tightly constrained by slope, aspect, soil texture, or soil depth. It often occurs after disturbance of a natural shrub- or grass-dominated community. The distribution of a plant community dominated by a combination of these species is probably not constrained by environmental factors; rather it results from historic land use patterns.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 0, AA)

Tree

Ulmus americana (American elm)

Shrub

N/A

Dwarf-shrub

N/A

Graminoid

Bromus tectorum (cheatgrass)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is found along drainage ditches or upland from the river's edge.

Global

This association is likely uncommon, with a few small patches across the western U.S., occurring only where *Ulmus americana* has been planted or has spread from a planting and disturbance has facilitated the dominance of *Bromus tectorum* in the understory.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. Consequently, this species tends to co-dominate primarily on sites that have been impacted by disturbance.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. No plots were sampled at Hagerman Fossil Beds and only three observations point were noted; therefore a thorough characteristic species list could not be compiled.

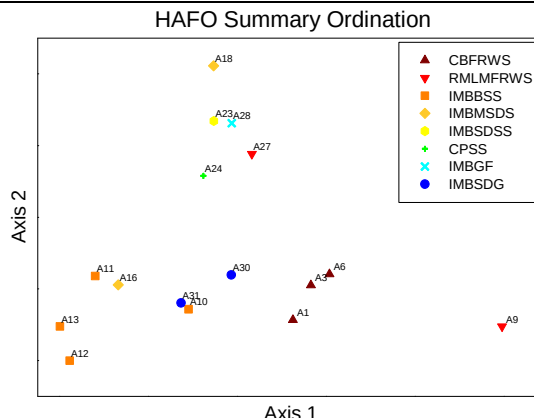
This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Ulmus americana* Woodland alliance contains *Ulmus Americana* / *Bromus tectorum* Semi-natural woodland (A8). This map code occupies approximately (4) polygons containing a combination of the associations listed above. These polygons average about (0.0125) ha in size and comprise nearly (0.5) ha of total area within the Monument.

A9 Narrowleaf Cottonwood / Broadleaf Cattail Woodland

Populus angustifolia / *Typha latifolia* Woodland



Description

This woodland community is visually dominated by *Populus angustifolia* comprising an open canopy. *Elaeagnus angustifolia* may also be found in the canopy of some stands. The wetland forb, *Typha latifolia*, is characteristic of the understory, and cover can reach moderate levels. A sparse tall-shrub layer is often present and *Salix exigua* is the most constant species in that layer. *Populus angustifolia* saplings are also often common beneath the canopy. Depending on hydrologic conditions and the degree of canopy closure, the herbaceous layer may be sparse to dense and can be quite diverse. Aside from *Typha latifolia*, *Solanum dulcamara* is the most constant herbaceous species in understory.

Communities dominated by *Populus angustifolia* are typically found in wide valleys to narrow canyons at mid to upper elevations, occurring on streamside alluvial bars that border perennial rivers and intermittent streams of low to moderate gradients. Soils tend to be young and weakly developed with wet (aquic) conditions in the top 50 cm. *Typha latifolia* requires regular inundation and slow moving water on fine, poorly drained soils. The persistence and co-dominance of both species likely results from a complex collection of environmental conditions.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 4, AA)

Tree

Populus angustifolia (narrowleaf cottonwood) V.13, *Elaeagnus angustifolia* (Russian olive) III.9

Shrub

Salix exigua (narrowleaf willow) III.4

Dwarf-shrub

None

Graminoid

None

Forb

Unknown species V.6, *Typha latifolia* (broadleaf cattail) IV.22, *Solanum dulcamara* (climbing nightshade) IV.5

RANGE*Hagerman Fossil Beds National Monument*

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

Associations in the Narrowleaf Cottonwood Temporarily Flooded Woodland Alliance are widespread in mountainous regions of the San Juan, Pecos, and Rio Grande river basins in northern and central New Mexico and are widely distributed throughout the Rocky Mountain region and Intermountain West. The distribution of the Narrowleaf Cottonwood / Broadleaf Cattail Woodland Association is probably patchy and very limited within the greater alliance

COMMENTS

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

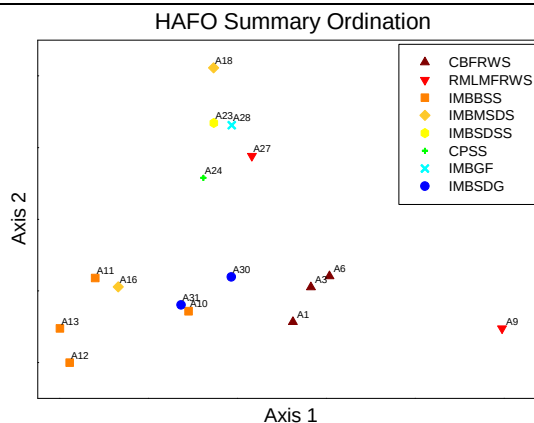
MAP UNITS

This map code *Populus angustifolia* Woodland alliance contains *Polulus angustifolia* / *Typha latifolia* Woodland (A9). This map code occupies approximately (4) polygons containing a combination of the associations listed above. These polygons average about (0.275) ha in size and comprise nearly (1.1) ha of total area within the Monument.

A10

Basin Big Sagebrush / Cheatgrass Semi-natural Shrubland

Artemisia tridentata ssp. *tridentata* / *Bromus tectorum* Semi-natural Shrubland



Description

Artemisia tridentata ssp. *tridentata* dominates the canopy of this shrubland association. The canopy structure can range from open to nearly closed. Additional species occurring in the shrub overstory include *Atriplex confertifolia* and *Atriplex canescens*, which are frequently present as scattered individuals. The herbaceous understory is generally sparse to moderate in terms of cover and is dominated by *Bromus tectorum*. Additional native and non-native grass and forb species often occur in this vegetation type, but tend to be sparse in terms of cover and variable in terms of species composition; *Sisymbrium altissimum* is the only forb species consistently present in the understory of this community, albeit at low cover values.

This shrubland association occurs in small to large patches on point bars, stream terraces, valley floors and alluvial fans with slopes that are generally gentle. Stands may be oriented to any aspect. Soils are sandy loams or loamy sands derived from alluvium. Although associated with drainages and floodplains, this community occurs in sites that rarely flood.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 3, AA)

Tree

None

Shrub

Artemisia tridentata ssp. *tridentata* (basin big sagebrush) V.28, *Atriplex confertifolia* (shadscale) IV.2

Dwarf-shrub

None

Graminoid

Bromus tectorum (cheatgrass) V.23

Forb

Sisymbrium altissimum (tall tumbled mustard) V.<1

RANGE

Hagerman Fossil Beds National Monument

This association is found along the terrace above the river, and other alluvial fans below draws. This plant community may also occur on mid slopes where favorable soil and moisture conditions exist.

Global

This shrubland association has the potential to occur throughout the interior western U.S. from Washington to Montana south to Utah and Nevada. It may also occur in Oregon, California, and British Columbia, Canada.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. Consequently, this species tends to co-dominate primarily on sites that have been impacted by disturbance.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

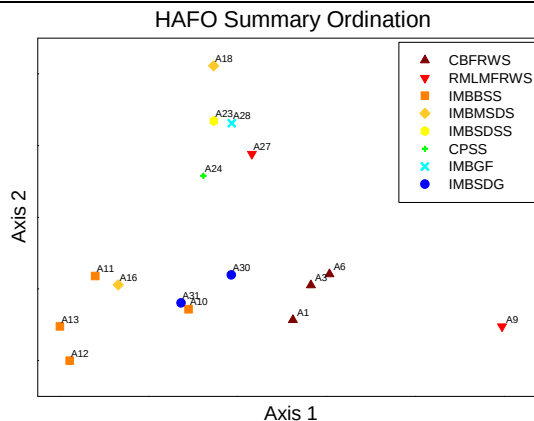
MAP UNITS

This map code *Artemisia tridentata* spp. *tridentata* Woodland alliance contains *Artemisia tridentata* spp. *Tridentate* / *Bromus tectorum* Semi-natural Shrubland alliance (A10). This map code occupies approximately (31) polygons containing a combination of the associations listed above. These polygons average about (2.93) ha in size and comprise nearly (91.1) ha of total area within the Monument.

A11

Wyoming Big Sagebrush / Indian Ricegrass Shrubland

Artemisia tridentata ssp. *wyomingensis* / *Achnatherum hymenoides* Shrubland



Description

This association is characterized by an open to dense shrub canopy dominated by *Artemisia tridentata* ssp. *wyomingensis*, with the bunchgrass *Achnatherum hymenoides* conspicuous in a patchy open herbaceous layer. Other shrub species may include *Artemisia tripartita*, *Chrysothamnus viscidiflorus*, *Purshia tridentata* and *Ericameria nauseosa*. The herbaceous layer is diverse and variable, providing low to moderate cover. Associated graminoids generally include but are not limited to *Elymus elymoides*, *Poa secunda*, and the introduced grass *Bromus tectorum*. *Bromus tectorum* typically occurs at relatively low cover. Forbs are variable, provide sparse cover, and may include *Lactuca serriola*, *Balsamorhiza sagittata*, *Crepis acuminata*, *Leptodactylon pungens*, *Erigeron* spp., and *Phlox* spp. Mosses and lichens may also provide sparse to low cover.

This shrubland association occurs on slopes and terraces above drainages and ridges. Sites are gentle to steep colluvial slopes and alluvial benches often on warmer southeast to southwest aspects. Substrates are variable but are typically moderately deep, well-drained soils with sandy clay loam, sandy loam and loam textures. The ground surface has high cover of large and small rocks, low to moderate cover of litter, and occasionally high cover of bare ground.

CONSERVATION RANK G5

DATABASE CODE Cegl001046

CHARACTERISTIC SPECIES (n = 5, AA)

Tree

None

Shrub

Artemisia tridentata ssp. *wyomingensis* (Wyoming big sagebrush) V.8, *Chrysothamnus viscidiflorus* (green rabbitbrush) V.3, *Ericameria nauseosa* (rubber rabbitbrush) V.1

Dwarf-shrub

None

Graminoid

Achnatherum hymenoides (Indian ricegrass), *Poa secunda* (Sandberg bluegrass) V.4, *Bromus tectorum* (cheatgrass) V.2, *Elymus elymoides* (bottlebrush squirreltail) V.1

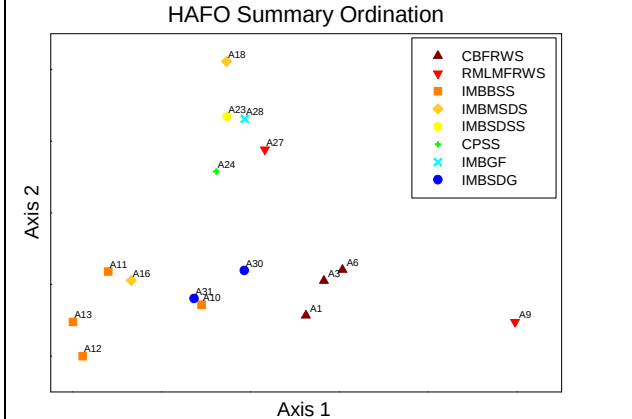
Forb

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|---|
| <i>Lactuca serriola</i> (prickly lettuce) V.<1 |
| <p>RANGE</p> <p><i>Hagerman Fossil Beds National Monument</i></p> <p>This association is scattered throughout the park in open, exposed sites and is more common in sandy soils.</p> <p><i>Global</i></p> <p>This sagebrush shrubland association is known from the Gunnison River Valley and the Piceance Basin in western Colorado and the Columbia Basin in Oregon and Idaho, and it likely occurs in California. It is also recognized as occurring in the Upper Snake River Plain and Great Rift regions of southeast and south-central Idaho.</p> |
| <p>COMMENTS</p> <p>Although <i>Achnatherum hymenoides</i> is a characteristic species of this association, other grass species, such as <i>Poa secunda</i>, may occasionally be more locally abundant in communities at Hagerman Fossil Beds.</p> |
| <p>MAP UNITS</p> <p>This map code <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> Shrubland alliance contains <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> / <i>Achnatherum hymenoides</i> Shrubland alliance (A11) and also contains the following associations; <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> / <i>Hesperostipa comata</i> Shrubland (A13) and <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> / <i>Poa secunda</i> Shrubland (A14). This map code occupies approximately (60) polygons containing a combination of the associations listed above. These polygons average about (4.50) ha in size and comprise nearly (270.1) ha of total area within the Monument.</p> |



Wyoming Big Sagebrush / Cheatgrass Semi-natural Shrubland

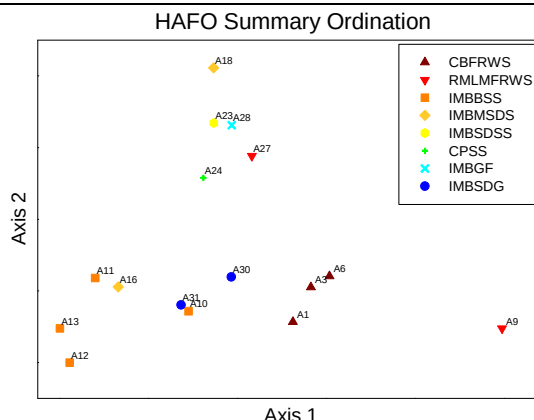
Artemisia tridentata ssp. *wyomingensis* / *Bromus tectorum* Semi-natural Shrubland

| | |
|--|---|
|  | <p>HAFO Summary Ordination</p>  |
| <p>Description</p> <p><i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> forms a moderate to dense, shrub canopy that generally does not exceed 1 m in height. <i>Atriplex confertifolia</i>, <i>Chrysothamnus viscidiflorus</i>, <i>Ericameria nauseosa</i>, and <i>Sarcobatus vermiculatus</i> are also occasionally present in the shrub layer. The herbaceous layer is dominated by graminoids, primarily the introduced annual grass, <i>Bromus tectorum</i>. <i>Agropyron cristatum</i> and <i>Poa secunda</i> may also occur frequently in the understory of this plant community. Cover of the herbaceous layer is generally much lower than that of the shrub layer. Forb cover and species composition can be quite variable from one site to another. Forbs are likely more characteristic of the plant community that was present prior to the invasion of <i>Bromus tectorum</i> than they are of the current vegetation type.</p> <p>This shrubland association often occupies the most disturbed sites within the shrub-steppe mosaic in which it occurs. Slopes range from level to moderate, and many stands are on derived substrates such as loess deposits or alluvial fans and terraces, often modified by a veneer of alluvial cobble or gravel. Soils are generally calcareous, excessively well-drained, fine-textured silts, clays or fine sands; often deep to bedrock but sometimes with a shallow duripan that limits water infiltration.</p> | |
| <p>CONSERVATION RANK N/A</p> | <p>DATABASE CODE N/A</p> |
| <p>CHARACTERISTIC SPECIES (n = 14, AA)</p> <p>Tree</p> <p>None</p> <p>Shrub</p> <p><i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> (Wyoming big sagebrush) V.28, <i>Atriplex confertifolia</i> (shadscale) IV.1</p> <p>Dwarf-shrub</p> <p>None</p> <p>Graminoid</p> <p><i>Bromus tectorum</i> (cheatgrass) V.12, <i>Agropyron cristatum</i> (crested wheatgrass) IV.3</p> <p>Forb</p> | |

| |
|---|
| None |
| <p>RANGE</p> <p><i>Hagerman Fossil Beds National Monument</i></p> <p>This association is fairly common throughout the park in open, exposed sites especially on slopes and terraces adjacent to agricultural fields.</p> <p><i>Global</i></p> <p>This association occurs within the greater range of <i>Artemisia tridentata</i> spp. <i>wyomingensis</i>-dominated shrublands where <i>Bromus tectorum</i> has had the opportunity to invade the understory, including northeastern California, eastern Oregon and southeastern Washington, across the northern Great Basin and dry habitats of the Rocky Mountains to the northern Great Plains of Montana, Wyoming and North and South Dakota. Stands are also reported from the intermountain parks of Colorado, and from Alberta, Canada.</p> |
| <p>COMMENTS</p> <p>The unique life history characteristics of <i>Bromus tectorum</i> and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. Consequently, it may often be a characteristic species on or around sites that have been impacted by disturbance.</p> <p>This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on data from Craters of the Moon and on related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.</p> |
| <p>MAP UNITS</p> <p>This map code <i>Artemisia tridentata</i> spp. <i>wyomingensis</i> Shrubland alliance contains <i>Artemisia tridentata</i> spp. <i>wyomingensis</i> / <i>Bromus tectorum</i> Semi-natural Shrubland (A12). This map code occupies approximately (111) polygons containing the association listed above. These polygons average about (4.08) ha in size and comprise nearly (453.4) ha of total area within the Monument</p> |

A13 Wyoming Big Sagebrush / Needle and Thread Shrubland

Artemisia tridentata ssp. *wyomingensis* / *Hesperostipa comata* Shrubland



Description

This association is dominated by *Artemisia tridentata* ssp. *wyomingensis*, with *Chrysothamnus viscidiflorus* commonly present in the shrub stratum. Shrub cover typically exceeds herbaceous cover, and *Hesperostipa comata* is the most characteristic understory species. Additional shrubs occasionally occur in this vegetation type and species may include *Purshia tridentata* and *Ericameria nauseosa*. The herbaceous layer is diverse and variable, providing low to moderate cover. Other component graminoids include *Bromus tectorum*, *Poa secunda*, and *Elymus elymoides*. Forbs are variable, provide low to moderate cover, and may include a variety of different species with *Sisymbrium altissimum* and *Lactuca serriola* being some of the most constant. A cryptogamic crust may be present on undisturbed stands of this association.

This association is restricted to sandy loam or uniformly, highly calcareous silt loam soils. B horizons are weakly to moderately developed, and probably overlie C horizons with carbonate hardpans. Sites where this association occurs are susceptible to wind erosion when plant cover is reduced, due to the low precipitation, warm temperatures and sandy soils.

CONSERVATION RANK G2

DATABASE CODE Cegl001051

CHARACTERISTIC SPECIES (n = 2, AA)

Tree

None

Shrub

Artemisia tridentata ssp. *wyomingensis* (Wyoming big sagebrush) V.14, *Chrysothamnus viscidiflorus* (green rabbitbrush) IV.3

Dwarf-shrub

None

Graminoid

Hesperostipa comata (needle and thread), *Bromus tectorum* (cheatgrass) V.2, *Elymus elymoides* (bottlebrush squirreltail) V.2, *Poa secunda* (Sandberg bluegrass) V.1

Forb

| |
|---|
| <i>Sisymbrium altissimum</i> (tall tumbled mustard) V.<1 |
| <p>RANGE</p> <p><i>Hagerman Fossil Beds National Monument</i></p> <p>This association is uncommon within the park. However it may be found in open, exposed sites and tends to favor sandy soil.</p> <p><i>Global</i></p> <p>The plant association occurs within the Columbia River Basin of Oregon and Washington (Columbia Basin and western portion of the Okanogan Highlands ecoregional sections) and the Snake River Plain (Owyhee Uplands and Snake River Basalts ecoregional sections) in Idaho.</p> |
| <p>COMMENTS</p> <p>This association is considered to be imperiled. The number, condition, and size of stands of this relatively wide-ranging plant association have declined significantly due to land conversion to cultivation, intensive range management, introduction of exotic species, and alteration of fire disturbance regimes. Few high-quality occurrences are known. Protected occurrences are typically not in good condition and/or are small in size.</p> |
| <p>MAP UNITS</p> <p>This map code <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> Shrubland alliance contains <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> / <i>Hesperostipa comata</i> Shrubland (A13) and also contains the following associations; <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> / <i>Achnatherum hymenoides</i> Shrubland (A11) and <i>Artemisia tridentate</i> spp. <i>wyomingensis</i> / <i>Poa secunda</i> Shrubland (A14). This map code occupies approximately (111) polygons containing a combination of the associations listed above. These polygons average about (4.08) ha in size and comprise nearly (453.4) ha of total area within the Monument.</p> |

A14 Wyoming Big Sagebrush / Sandberg Bluegrass Shrubland

Artemisia tridentata ssp. *wyomingensis* / *Poa secunda* Shrubland



Description

Species richness may be very low in stands of this plant community type. *Artemisia tridentata* ssp. *wyomingensis* dominates the open shrub canopy and generally does not exceed 1 m in height and 25% cover. *Ericameria nauseosa*, *Chrysothamnus viscidiflorus*, and *Purshia tridentata* may also occur sporadically in the shrub canopy. In addition to *Poa secunda*, *Bromus tectorum* and *Elymus elymoides* are typically common in the graminoid functional group. Other grass species often occur in the herbaceous layer, but are variable in terms of cover and composition. Forbs provide sparse to moderate cover and species composition tends to vary greatly from one stand to another.

This sparse shrubland association occurs as patches within a matrix of other shrubland or shrub-steppe types. Slopes range from level to moderate, and many stands are on derived substrates such as loess deposits or alluvial fans and terraces, often modified by a veneer of alluvial cobble or gravel. Soils are generally calcareous, excessively well-drained, fine-textured silts, clays or fine sands, often deep to bedrock but sometimes with a shallow duripan that limits water infiltration.

CONSERVATION RANK G4

DATABASE CODE CEG001049

CHARACTERISTIC SPECIES (n = 1, AA)

Tree

N/A

Shrub

Artemisia tridentata ssp. *wyomingensis* (Wyoming big sagebrush)

Dwarf-shrub

N/A

Graminoid

Poa secunda (Sandberg bluegrass)

Forb

N/A

RANGE

Craters of the Moon National Monument

This association is scattered throughout the park in open, exposed sites with low vegetative cover.

Global

This association has been documented from northwestern Colorado, northeastern Nevada, southern Idaho, and the Columbia Basin of eastern Washington, and Oregon. It is likely to occur in Wyoming and possibly also in northeastern California and southern Montana.

COMMENTS

Dominance of shallow-rooted grasses such as *Poa secunda* indicates that sites are too dry for deeper-rooted perennials to persist. The distribution of patches of this association may also be controlled by microhabitat factors, such as snow depth, that are difficult to predict or model.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

MAP UNITS

This map code *Artemisia tridentate* spp. *wyomingensis* Shrubland alliance contains *Artemisia tridentate* spp. *wyomingensis* / *Poa secunda* Shrubland (A14) and also contains the following associations; *Artemisia tridentate* spp. *wyomingensis* / *Achnatherum hymenoides* Shrubland (A11) and *Artemisia tridentate* spp. *wyomingensis* / *Hesperostipa comata* Shrubland (A13). This map code occupies approximately (111) polygons containing a combination of the associations listed above. These polygons average about (4.08) ha in size and comprise nearly (453.4) ha of total area within the Monument

A15 Fourwing Saltbush / Indian Ricegrass Shrubland

Atriplex canescens / *Achnatherum hymenoides* Shrubland



Description

This semi-desert to desert vegetation type is characterized by an open (10 to 25% cover) short-shrub layer that is dominated by *Atriplex canescens*, with a sparse herbaceous layer dominated by the bunchgrass *Achnatherum hymenoides*. Additional shrub species may occur in this plant community, but typically contribute sparse cover; they may include *Grayia spinosa*, *Chrysothamnus viscidiflorus*, and *Krascheninnikovia lanata*. The herbaceous layer is generally low in species diversity and sparse to low in terms of cover. The introduced annual *Bromus tectorum* may be locally abundant in disturbed stands.

Stands occur on level desert plains, toeslopes, alluvial terraces and steep slopes at the base of foothills. Soils are well-drained, somewhat alkaline and include sandy clay loam.

CONSERVATION RANK G4

DATABASE CODE CEG001289

CHARACTERISTIC SPECIES (n = 0, AA)

Tree

N/A

Shrub

Atriplex canescens (fourwing saltbush)

Dwarf-shrub

N/A

Graminoid

Achnatherum hymenoides (Indian ricegrass)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is scattered throughout the park in open, exposed sites, often in deeper soils such as those at the mouth of draws or within the floodplain of the river.

Global

This shrubland is found on the western slope of the Colorado Rocky Mountains, adjacent northeastern Utah and the Great Salt Lake Desert; it has been observed in the Snake River Plain of eastern Idaho as well. This association may have a wider distribution than is reported here as both diagnostic species are common in the semi-arid western U.S.

COMMENTS

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. No plots were sampled and only one observation point was recorded at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15) and also contains the following associations; *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16), *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland (A17), *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18), *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19), *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22), *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24), and *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument.

A16 Fourwing Saltbush / Cheatgrass Semi-natural Woodland

Atriplex canescens / *Bromus tectorum* Semi-natural Woodland

| | |
|--|--------------------------------|
| | <p>HAFO Summary Ordination</p> |
| <p>Description</p> <p>This semi-desert to desert vegetation type is characterized by an open shrub layer that is dominated by <i>Atriplex canescens</i>. The sparse herbaceous understory is dominated by the introduced annual, <i>Bromus tectorum</i>. Associated shrub species provide sparse cover and may include several species of <i>Artemisia</i> and <i>Atriplex</i> as well as <i>Chrysothamnus viscidiflorus</i>. The herbaceous layer is low in species diversity and <i>Poa secunda</i> is the only native grass to occur with high constancy, albeit at low cover values.</p> <p>This association likely occurs on or around disturbed sites. Stands generally occupy level desert plains, toeslopes, alluvial terraces and steep slopes at the base of foothills. Soils are well-drained, somewhat alkaline and have a sandy clay loam texture.</p> | |
| <p>CONSERVATION RANK N/A</p> | <p>DATABASE CODE N/A</p> |
| <p>CHARACTERISTIC SPECIES (n = 4, AA)</p> <p>Tree</p> <p>None</p> <p>Shrub</p> <p><i>Atriplex canescens</i> (fourwing saltbush) V.10, <i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> (Wyoming big sagebrush) III.5, <i>Chrysothamnus viscidiflorus</i> (green rabbitbrush) III.5</p> <p>Dwarf-shrub</p> <p>None</p> <p>Graminoid</p> <p><i>Bromus tectorum</i> (cheatgrass) V.4, <i>Poa secunda</i> (Sandberg bluegrass) V.1</p> <p>Forb</p> <p>None</p> | |

RANGE

Hagerman Fossil Beds National Monument

This association is scattered throughout the park in open, exposed sites, often in deeper soils such as those at the mouth of draws or within the floodplain of the river.

Global

Although fourwing saltbush shrubland associations have only been described on the western slope of the Colorado Rocky Mountains, adjacent northeastern Utah, the Great Salt Lake Desert, and the Snake River Plain of Idaho, their range is likely much greater due to the widespread range of occurrence of the diagnostic species.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. Consequently, this species tends to co-dominate primarily on sites that have been impacted by disturbance.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16) and also contains the following associations; *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15), *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland (A17), *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18), *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19), *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22), *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24), and *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument.



Shadscale - Bud Sagebrush / (Indian Ricegrass) - Cheatgrass Semi-natural Shrubland

Atriplex confertifolia - *Picrothamnus desertorum* / (*Achnatherum hymenoides*) - *Bromus tectorum* Semi-natural Shrubland



Description

Sparse and patchy vegetative cover is characteristic of this shrub-dominated association. Shrubs are low-statured and the canopy is generally open. Dominant shrubs are *Atriplex confertifolia* and *Picrothamnus desertorum*. Other shrub species, such as *Artemisia tridentata* may also occur occasionally in the canopy of this plant community. Herbaceous cover is generally very sparse. The most constant native graminoids include *Achnatherum hymenoides* and *Poa secunda*, although the distribution of *Achnatherum hymenoides* tends to be patchy and variable, which may result in its absence from the understory of some stands at a local scale. The non-native annual grass *Bromus tectorum* can be abundant in some stands, particularly those in close proximity to areas that have been disturbed.

This alkaline desert association occurs on barren toeslopes and playas on sandy or heavy clay soils, and foothill areas where saline hardpans occur at depths of 1-2 feet. Soil moisture tends to be limited through much of the growing season as a result exposure and soil texture.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 3, AA)

Tree

N/A

Shrub

Atriplex confertifolia (shadscale)

Dwarf-shrub

Picrothamnus desertorum (bud sagebrush)

Graminoid

Achnatherum hymenoides (Indian ricegrass), *Bromus tectorum* (cheatgrass)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This uncommon association is scattered throughout the park in open, exposed, very dry sites mostly with a southwest to southeast aspect.

Global

This association likely occurs occasionally throughout the range of the Shadscale Shrubland Alliance, primarily across the Great Basin, Columbia Basin and Colorado Plateau.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. Consequently, this species tends to co-dominate primarily on sites that have been impacted by disturbance.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Although three plots were sampled at Hagerman Fossil Beds; a thorough characteristic species list could not be compiled for this association as a result of insufficient data.

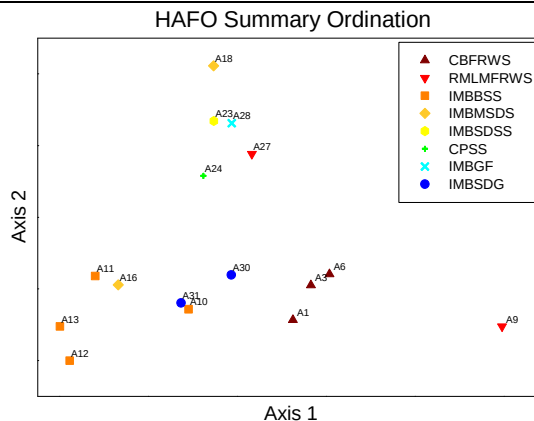
This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland (A17) and also contains the following associations; *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15), *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16), *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18), *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19), *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22), *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24), and *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument.

A18 Shadscale / Indian Ricegrass Shrubland

Atriplex confertifolia / *Achnatherum hymenoides* Shrubland



Description

Low-growing *Atriplex confertifolia* is the dominant shrub in this shrubland association, which is characterized by low total vegetative cover. The shrub layer tends to have open canopy and other shrub species, including *Artemisia tridentata*, *Chrysothamnus viscidiflorus*, *Atriplex canescens*, and *Ericameria nauseosa* may also occur as scattered individuals in the canopy. In high-quality stands of this vegetation type, *Achnatherum hymenoides* dominates the otherwise sparse herbaceous understory. Forbs vary greatly across the range of this association and rarely contribute significant cover. Some locally common forb species include *Eriogonum* spp., *Stanleya pinnata*, *Chaenactis douglasii*, and *Astragalus* spp. Degraded stands tend to have an abundance of *Bromus tectorum* in the understory and higher total herbaceous cover.

This plant association is widely scattered on benches, plateaus, gullies and slopes vary from gentle to steep. The association is typically found on well-drained, alkaline soils derived from volcanic tuff or shale that often have been modified by alluvial deposits. Soil textures include rocky and gravelly sandy loams and may have an argillic horizon. Many sites show evidence of sheet and gully erosion.

CONSERVATION RANK G3

DATABASE CODE Cegl001311

CHARACTERISTIC SPECIES (n = 2, AA)

Tree

None

Shrub

Atriplex confertifolia (shadscale) V.3, *Ericameria nauseosa* (rubber rabbitbrush) V.2, *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) V.<1

Dwarf-shrub

None

Graminoid

Achnatherum hymenoides (Indian ricegrass), *Bromus tectorum* (cheatgrass) V.4

Forb

Stanleya pinnata (desert princesplume) V.1, *Astragalus purshii* (woollypod milkvetch) V.<1, *Chaenactis*

douglasii (Douglas' dustymaiden) V.<1, *Eriogonum watsonii* (Watson's buckwheat) V.<1

RANGE

Hagerman Fossil Beds National Monument

This association is uncommon within the park but does occur sporadically in open, exposed, very dry sites and favors sandy soils.

Global

This plant association ranges from southeastern Oregon, southern Idaho, and Nevada to Utah and western Colorado. It is also purported to occur in California and Wyoming. In Idaho, it is known from the South Fork Owyhee River canyon, the Owyhee Mountains lowland front near the Snake River, and the Salmon River canyon near Challis.

COMMENTS

This plant association is widespread throughout its range, but not abundant. This vegetation type tends to be discontinuously distributed, and large stands are uncommon. Its long-term security throughout its range is questionable. Stands undisturbed by livestock grazing, off-highway vehicles, or other activities have healthy understories of *Achnatherum hymenoides* and minimal *Bromus tectorum*. However, such high-quality stands are probably uncommon. The historic range of this type is unknown; however, widespread *Bromus tectorum* invasion has likely decreased the total number of occurrences.

MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18) and also contains the following associations; *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15), *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16), *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland (A17), *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19), *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22), *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24), and *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument.

A19 Shadscale / Cheatgrass Semi-natural Shrubland

Atriplex confertifolia / *Bromus tectorum* Semi-natural Shrubland



Description

Low-growing *Atriplex confertifolia* is the dominant shrub in this sparsely-vegetated association. Scattered individuals of other shrub species may also occur in the canopy, but constancy and cover are generally low. The introduced annual grass, *Bromus tectorum* dominates the understory of this plant community with low to moderate cover. Additional native and non-native grasses and forbs often occur in the herbaceous understory, but cover is generally sparse and constancy of a given species from one stand to another is low.

This plant association is widely scattered on benches, plateaus, and gullies and slopes vary from gentle to steep. The association is typically found on well-drained, alkaline soils derived from volcanic tuff or shale that often have been modified by alluvial deposits. Soil textures include rocky and gravelly sandy loams and may have an argillic horizon. Many sites show evidence of sheet and gully erosion.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 0, AA)

Tree

N/A

Shrub

Atriplex confertifolia (shadscale)

Dwarf-shrub

N/A

Graminoid

Bromus tectorum (cheatgrass)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is scattered throughout the park in open, exposed, very dry sites.

Global

This plant association occurs sporadically within the range of the greater Shadscale Shrubland Alliance where cheatgrass has had the opportunity to invade the understory. The Shadscale Shrubland Alliance ranges from southeastern Oregon, southern Idaho, and Nevada to Utah and western Colorado. It is purported to occur in California and Wyoming. In Idaho, it is known from the South Fork Owyhee River canyon, the Owyhee Mountains lowland front near the Snake River, and the Salmon River canyon near Challis.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. Consequently, this species tends to co-dominate primarily on sites that have been impacted by disturbance.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. No plots were sampled at Hagerman Fossil Beds and only three observation points were recorded; therefore a thorough characteristic species list could not be compiled.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19) and also contains the following associations; *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15), *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16), *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland (A17), *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18), *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22), *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24), and *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument.

A20 **Green Rabbitbrush / Indian Ricegrass Shrubland**

Chrysothamnus viscidiflorus / *Achnatherum hymenoides* Shrubland



Description

Stands in the *Chrysothamnus viscidiflorus* Shrubland Alliance, are characterized by an open to moderately dense shrub layer. *Chrysothamnus viscidiflorus* dominates the canopy, and other shrub species may be present but sparse in the shrub stratum of this plant community. *Achnatherum hymenoides* is characteristic of the understory of this association; however, the herbaceous layer can be quite variable ranging from moderately dense and diverse to sparse and depauperate. Total vegetation cover is low to moderate and rarely exceeds 60%. Forbs may be diverse and variable in terms of species composition, but typically contribute very little cover. Disturbance-related species, such as the introduced annual grass *Bromus tectorum*, have become important in some stands.

This association generally occurs in areas that have experienced disturbance. *Chrysothamnus viscidiflorus*-dominated communities often result from wildland fires in sagebrush steppe ecosystems. Slopes range from gentle to moderately steep. Soils have textures ranging from silt loam to sandy loam to loamy sand, and bare soil covers most of the unvegetated ground surface.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 4, AA)

Tree

N/A

Shrub

Chrysothamnus viscidiflorus (green rabbitbrush)

Dwarf-shrub

N/A

Graminoid

Achnatherum hymenoides (Indian ricegrass)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This uncommon association in the park favors open, exposed, dry sites and sandy soils.

Global

The Green Rabbitbrush Shrubland Alliance is currently known from Colorado and Utah in the Colorado Plateau extending east into the southern Rocky Mountains. Stands are likely more widespread in the intermountain western U.S since both diagnostic species in the Green Rabbitbrush / Indian Ricegrass Shrubland Association are common and widely distributed throughout the region.

COMMENTS

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Although four plots were sampled at Hagerman Fossil Beds; a thorough characteristic species list could not be compiled as a result of insufficient data.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Ericameria* (*Chrysothamnus*) spp. Shrubland Complex contains *Ericameria nauseosa* – *Chrysothamnus viscidiflorus* / (*Achnatherum humanoids*) – *Bromus tectorum* Semi-natural Shrubland (A21) and also contains *Chrysothamnus viscidiflorus* / *Hesperostipa comata* Shrubland (A20). This map code occupies approximately (67) polygons containing a combination of the associations listed above. These polygons average about (1.52) ha in size and comprise nearly (102.7) ha of total area within the monument.

A21 Rubber Rabbitbrush - Green Rabbitbrush / (Indian Ricegrass) - Cheatgrass Semi-natural Shrubland

Ericameria nauseosa - *Chrysothamnus viscidiflorus* / (*Achnatherum hymenoides*) - *Bromus tectorum*
Semi-natural Shrubland



Description

Total vegetation cover of this association is generally low to moderate and the plant community is characterized by an open shrub canopy dominated by either *Ericameria nauseosa*, *Chrysothamnus viscidiflorus* or a combination of both. Other shrubs may occur sporadically in the overstory, although species composition is variable and cover is sparse. Cover of the herbaceous layer is low to moderate and occasionally approaches cover levels equal to those of the shrub stratum. *Achnatherum hymenoides* generally dominates the patchy understory and *Bromus tectorum* is always present and occasionally co-dominates the herbaceous layer at low to moderate cover values. Forbs tend to be sparse and variable and often include both introduced and native species.

This association generally occurs in areas that have experienced disturbance. *Chrysothamnus viscidiflorus*-dominated communities often result from wildland fires in sagebrush steppe ecosystems. Slopes range from gentle to moderately steep. Soils have textures ranging from silt loam to sandy loam to loamy sand, and bare soil covers most of the unvegetated ground surface.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 2, AA)

Tree

N/A

Shrub

Ericameria nauseosa (rubber rabbitbrush), *Chrysothamnus viscidiflorus* (green rabbitbrush)

Dwarf-shrub

N/A

Graminoid

Achnatherum hymenoides (Indian ricegrass), *Bromus tectorum* (cheatgrass)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is uncommon within the park. It is located in open, exposed sites and tends to favor sandy soils.

Global

This association likely occurs as isolated patches throughout the western U.S. as all of the diagnostic species are common and widespread. The range of this association is probably restricted to areas that have been impacted by disturbance as indicated by the abundance of cheatgrass and the absence of non-resprouting shrubs.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. Consequently, this species tends to co-dominate primarily on sites that have been impacted by disturbance.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Because only two plots were sampled at Hagerman Fossil Beds; a thorough characteristic species list could not be compiled.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Ericameria (*Chrysothamnus*) spp. Shrubland Complex contains *Chrysothamnus viscidiflorus* / *Hesperostipa comata* Shrubland (A20) and also contains *Ericameria nauseosa* – *Chrysothamnus viscidiflorus* / (*Achnatherum humanoids*) – *Bromus tectorum* Semi-natural Shrubland (A21). This map code occupies approximately (67) polygons containing a combination of the associations listed above. These polygons average about (1.52) ha in size and comprise nearly (102.7) ha of total area within the monument.

A22 Winterfat / Sandberg Bluegrass Dwarf-shrubland

Krascheninnikovia lanata / *Poa secunda* Dwarf-shrubland



Description

This association has sparse to moderate vegetative cover with most of the total cover resulting from only two lifeforms: dwarf-shrubs and short-grasses. *Krascheninnikovia lanata* dominates the open dwarf-shrub canopy of these communities, contributing 10-50% to the total plant cover. Associated dwarf-shrubs may be present but sporadic at low cover values. *Poa secunda* is often the only conspicuous perennial grass, although *Achnatherum hymenoides* may be a common associate. Forb species tend to be diverse, weedy, low in cover, and inconsistent among sites. Annuals are typically present in all communities; the exotic grass *Bromus tectorum* is the most abundant. Mosses and lichens cover the soil surface in many sites.

This association is a patchily-distributed community type occurring on steep colluvial canyon slopes. It is also found locally adjacent to various *Artemisia* spp. association types on more clayey soil types.

CONSERVATION RANK G3

DATABASE CODE C EGL001326

CHARACTERISTIC SPECIES (n = 1, AA)

Tree

N/A

Shrub

Krascheninnikovia lanata (winterfat)

Dwarf-shrub

N/A

Graminoid

Poa secunda (Sandberg bluegrass)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This uncommon association occurs in open, exposed, sparsely vegetated sites within the park.

Global

This association is a minor community type reported in Idaho and is likely to be found in northern Nevada as well as Washington and Oregon.

COMMENTS

Although this community is widespread, locally it never is very common. It occurs in very hot, dry habitats and is susceptible to overgrazing. Many of the remnants in Oregon are included in Research Natural Areas, which provide limited protection from livestock. This association is also threatened by introduced plants, such as *Bromus tectorum*, and agriculture conversion.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

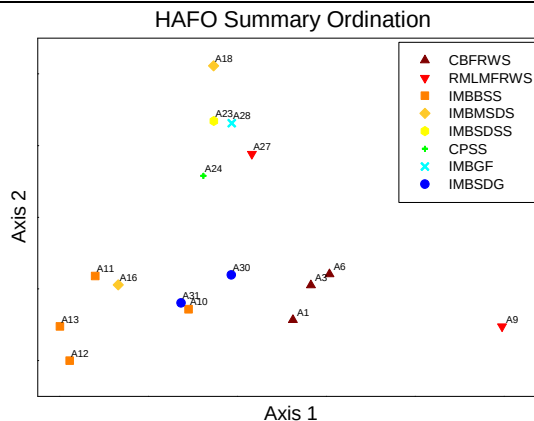
MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22) and also contains the following associations; *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15), *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16), *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland.(A17), *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18), *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19), *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24), and *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument.

A23

Antelope Bitterbrush / Indian Ricegrass Shrubland

Purshia tridentata / *Achnatherum hymenoides* Shrubland



Description

This plant community is unique in its patchy vegetation pattern. Total vegetative cover can range from sparse to dense, and two lifeforms predominate; medium-tall shrubs and herbaceous understory species. *Purshia tridentata*, typically 2-3 feet tall, forms a discernable canopy in some stands and is nearly absent others. *Artemisia tridentata*, *Chrysothamnus viscidiflorus*, are *Ericameria nauseosa* are usually present, but contribute little total canopy cover. *Achnatherum hymenoides*, a bunchgrass, and *Elymus lanceolatus*, a rhizomatous grass, are the most conspicuous perennial grasses in the understory of this plant community. *Hesperostipa comata*, *Koeleria macrantha*, and *Poa secunda* are often locally abundant in patches throughout the understory. Exotic annuals, such as *Bromus tectorum* and *Salsola kali*, can also be common in the herbaceous layer of this association.

This community type is confined to dry, hot, sand dunes with high exposure and low water holding capacity.

CONSERVATION RANK G1

DATABASE CODE Cegl001058

CHARACTERISTIC SPECIES (n = 3, AA)

Tree

None

Shrub

Purshia tridentata (antelope bitterbrush) V.10, *Ericameria nauseosa* (rubber rabbitbrush) V.3, *Chrysothamnus viscidiflorus* (green rabbitbrush) V.2, *Atriplex confertifolia* (shadscale) V.1, *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) V.1

Dwarf-shrub

None

Graminoid

Achnatherum hymenoides (Indian ricegrass), *Bromus tectorum* (cheatgrass) V.5

Forb

Stanleya pinnata (desert princesplume) V.3, *Balsamorhiza sagittata* (arrowleaf balsamroot) V.1

RANGE

Hagerman Fossil Beds National Monument

This uncommon park association occurs in open, sandy sites.

Global

This association is a narrowly restricted community found in isolated sand dunes in Franklin, Grant, Yakima, Klickitat, and Benton counties, Washington. It is also found as isolated communities in Idaho, Oregon, and Wyoming.

COMMENTS

The conservation rank of this association indicates that it is considered to be critically imperiled due to its narrowly restricted geographic range and its susceptibility to disturbance. The condition of occurrences is rapidly declining because of the presence of *Bromus tectorum*. Recreational vehicles and use of large land-moving equipment combined with irrigation have denuded or created non-functional dune systems at an accelerated rate.

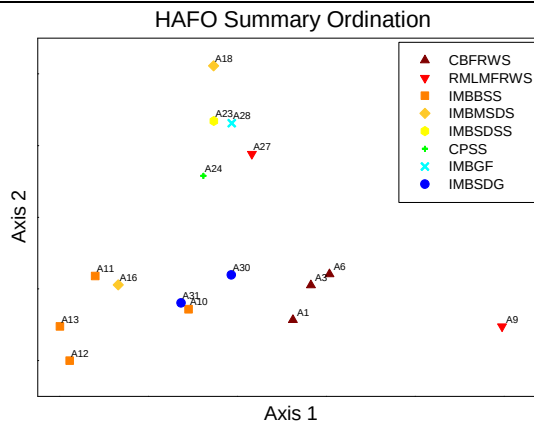
MAP UNITS

This map code *Purshia tridentata* Shrubland Alliance contains *Purshia tridentata* / *Achnatherum hymenoides* Shrubland (A23). This map code occupies approximately (27) polygons containing a combination of the associations listed above. These polygons average about (.88) ha in size and comprise nearly (24) ha of total area within the monument.

A24

Slender Buckwheat / Indian Ricegrass Dwarf-shrubland

Eriogonum microthecum / *Achnatherum hymenoides* Dwarf-shrubland



Description

This dwarf-shrub association is characterized by a sparse, short woody layer that is dominated by *Eriogonum microthecum*. Individuals of other shrub species may occur sporadically throughout a stand, the most constant of which are *Chrysothamnus viscidiflorus*, *Artemisia tridentata* ssp. *wyomingensis* and *Ericameria nauseosa*. The herbaceous layer also tends to have low cover in this plant community, typically <10%. It is comprised of a relatively even mixture of forbs and grasses, the most characteristic of which is *Achnatherum hymenoides*. Other common grass species include *Poa secunda*, *Elymus elymoides*, and the non-native annual, *Bromus tectorum*. Herbaceous forb species with high constancy in this plant community include *Balsamorhiza sagittata*, *Lactuca serriola*, *Stanleya pinnata*, and *Astragalus whitneyi*.

Stands of this vegetation type are often found on highly weathered basalt outcrops in canyons. Sites are very hot and dry, occurring on moderate to steep slopes with southern or western aspects. Soils are very shallow and well-drained, with a high percentage of rock fragments. Soil texture ranges from gravelly sand to gravelly sandy loam. The soil surface has a high cover of pea-sized gravel and sand with cobbles.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 6, AA)

Tree

None

Shrub

Chrysothamnus viscidiflorus (green rabbitbrush) V.3, *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) V.1, *Ericameria nauseosa* (rubber rabbitbrush) V.1

Dwarf-shrub

Eriogonum microthecum (slender buckwheat) V.6

Graminoid

Achnatherum hymenoides (Indian ricegrass), *Poa secunda* (Sandberg bluegrass) V.5, *Bromus tectorum* (cheatgrass) V.2, *Elymus elymoides* (bottlebrush squirreltail) V.<1

Forb

Balsamorhiza sagittata (arrowleaf balsamroot) V.1, *Lactuca serriola* (prickly lettuce) V.<1

RANGE

Hagerman Fossil Beds National Monument and Preserve

This association is uncommon within the park, but favors north-facing slopes where it is found.

Global

The *Eriogonum microthecum* Dwarf-shrub Alliance is found in limited distribution on unique substrate in the vicinity of the Snake River Canyon at the boundaries of Idaho, Oregon, and Washington states. The range of the Slender Buckwheat / Indian Ricegrass Dwarf-shrubland Association is likely further constrained within the range of the greater alliance.

COMMENTS

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24) and also contains the following associations; *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15), *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16), *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland (A17), *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18), *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19), *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22), and *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument.

A25 Cushion Buckwheat / Indian Ricegrass Dwarf-shrubland

Eriogonum ovalifolium / *Achnatherum hymenoides* Dwarf-shrubland



Description

The vegetation of this plant community is characterized by a mix of herbaceous grasses and forbs. Total cover of all strata is low to moderate, though cover may be higher in the spring due to the presence of annuals. The most conspicuous perennial forb species in this plant community is *Eriogonum ovalifolium*. *Achnatherum hymenoides* is the most common graminoid species in this vegetation type, but it tends to occur in a patchy distribution at low cover values. Short-statured shrubs may occur sporadically in this association and several additional perennial grass and forb species may be common into mid-summer.

This association often occurs on shallow, relatively coarse textured soils. Slopes may range from shallow to steep and appropriate sites are often exposed and dry.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 0, AA)

Tree

N/A

Shrub

N/A

Dwarf-shrub

N/A

Graminoid

Achnatherum hymenoides (Indian ricegrass)

Forb

Eriogonum ovalifolium (cushion buckwheat)

RANGE

Hagerman Fossil Beds National Monument and Preserve

This association is uncommon within the park but occurs occasionally in open, exposed, dry sites.

Global

The *Eriogonum ovalifolium* Dwarf-shrubland alliance has been described primarily from the Craters of the Moon National Monument on the northern edge of the Snake River Plain of southern Idaho. It may also occur in the same region of southern Idaho on cinder cones on the Idaho National Engineering Laboratory. Occurrences at Hagerman Fossil Beds National Monument are likely found on different parent materials than occurrences elsewhere in southeast Idaho.

COMMENTS

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. No plots were sampled at Hagerman Fossil Beds and only one observation point was recorded; therefore a thorough characteristic species list could not be compiled.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Sparsely Vegetated Badlands Complex contains *Eriogonum ovalifolium* / *Achnatherum hymenoides* Dwarf-shrubland (A25) and also contains the following associations; *Atriplex canescens* / *Achnatherum hymenoides* Shrubland (A15), *Atriplex canescens* / *Bromus tectorum* Semi-natural Shrubland (A16), *Atriplex confertifolia*-*Picrothamnus desertorum* / (*Achnatherum hymenoides*) – *Bromus tectorum* Semi-natural Shrubland (A17), *Atriplex confertifolia* - *Achnatherum hymenoides* Shrubland (A18), *Atriplex confertifolia* – *Bromus tectorum* Semi-natural Shrubland (A19), *Krascheninnikovia lanata* / *Poa secunda* Dwarf-shrubland (A22), and *Eriogonum microthecum* / *Achnatherum hymenoides* Dwarf-shrubland (A24). This map code occupies approximately (116) polygons containing a combination of the associations listed above. These polygons average about (2.11) ha in size and comprise nearly (245.8) ha of total area within the monument

A26 Coyote Willow / Mesic Forbs Shrubland

Salix exigua / Mesic Forbs Shrubland



Description

The vegetation of this association is visually dominated by a tall-shrub overstory of *Salix exigua*, with a canopy ranging from open to dense. *Salix lutea*, *Ribes* spp., and *Rosa woodsii* are also commonly present in the shrub stratum. The herbaceous understory of this plant community is populated by a lush layer of mixed tall forbs. The composition and cover of forb species are highly variable from one location to another and no single forb species has high constancy and cover across the association's range. Total mesic graminoid cover tends to be low, especially when compared to forb cover. Non-native herbaceous species are not uncommon in this plant community.

This association typically occurs on streambanks, terraces, and meadows along a wide variety of low- to moderate-gradient stream types. It has also been documented to occupy annually flooded banks, islands, and terraces of reservoirs and large rivers. This vegetation type usually occurs on well-developed sandy to silty alluvial loam soils, on the wettest (often flooded) but stable sites supporting *Salix exigua*.

CONSERVATION RANK G2

DATABASE CODE C EGL001202

CHARACTERISTIC SPECIES (n = 2, AA)

Tree

N/A

Shrub

Salix exigua (coyote willow)

Dwarf-shrub

N/A

Graminoid

N/A

Forb

N/A

RANGE*Hagerman Fossil Beds National Monument*

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

This association has been documented to occur at mid elevations in central Nevada, Utah and western Colorado, north through eastern Idaho. It is expected to occur in similar habitats in Wyoming.

COMMENTS

This association is considered to be imperiled. It is thought to be moderately wide-ranging but infrequently sampled throughout the core of its range. Stands are often found in poor ecological condition and are threatened by livestock overgrazing leading to invasion by exotic graminoid species

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only two plots were sampled at Hagerman Fossil Beds; therefore, a thorough characteristic species list could not be compiled.

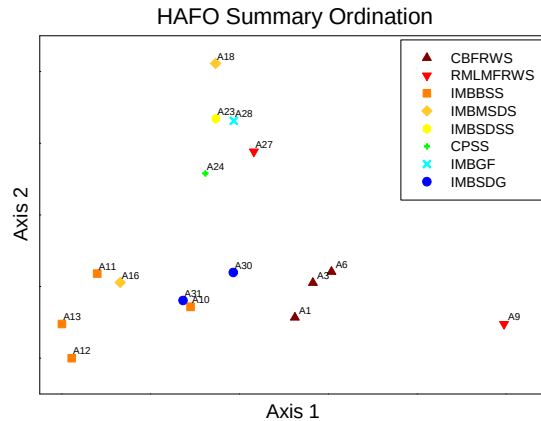
MAP UNITS

This map code *Salix exigua* – *Salix lucida* spp. *caudate* Shrubland Complex contains *Salix exigua* / Mesic Forbs Shrubland (A26) and also contains *Salix lucida* spp. *caudate* / *Thinopyrum intermedium* Semi-natural Shrubland (26A). This map code occupies approximately (9) polygons containing a combination of the associations listed above. These polygons average about (.33) ha in size and comprise nearly (3.0) ha of total area within the monument



Shining Willow / Intermediate Wheatgrass Semi-natural Shrubland

Salix lucida / *Thinopyrum intermedium* Semi-natural Shrubland



Description

The dominant species in the overstory of this tall-shrub association is *Salix lucida*. The canopy is generally dense and other *Salix* spp. may co-dominate some stands. Lower-statured shrubs, including *Ericameria nauseosa* and *Artemisia* spp. are also occasionally present at a local scale. The understory of stands in this association has been invaded by the popular agriculture grass, *Thinopyrum intermedium*. *Thinopyrum intermedium* often contributes 90% or more of the herbaceous cover in this community; however, other exotic grasses such as *Bromus inermis* may also be present. Forb cover is generally sparse, and component forbs may be a mix of native and non-native species. Native grass and forb species rarely reestablish once they have been lost from areas dominated by *Thinopyrum intermedium*. Stands can occur in a wide variety of human-disturbed habitats.

Vegetation communities dominated by *Salix lucida* are located adjacent to small streams and rivers and are occasionally associated with abandoned beaver ponds and sloughs. Landforms diagnostic of these types include overflow channels of large rivers and alluvial deposits (point bars) of sands and gravels. Soils are typically Entisols; less frequently Mollisols. They are typically coarse-textured but remain moist with water tables above 1 m throughout the growing season. *Thinopyrum intermedium* typically occurs on drier, medium-textured soils, but has adapted to a broad range of soil textures and moisture conditions which has likely facilitated its spread into some *Salix* dominated communities.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 1, AA)

Tree

None

Shrub

Salix lucida (shining willow), *Ericameria nauseosa* (rubber rabbitbrush) V.1, *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) V.<1

Dwarf-shrub

None

Graminoid

Thinopyrum intermedium (intermediate wheatgrass), *Bromus tectorum* (cheatgrass) V.1

Forb

Cirsium arvense (Canada thistle) V.2, *Descurainia sophia* (herb sophia) V.<1, *Dipsacus fullonum* (Fuller's teasel) V.<1, *Lactuca serriola* (prickly lettuce) V.<1, *Tragopogon dubius* (yellow salsify) V.<1

RANGE

Hagerman Fossil Beds National Monument and Preserve

This association is found along the river and creek corridors as well as adjacent to spring-fed drainages and seeps.

Global

The Shining Willow Temporarily Flooded Shrubland Alliance is moderately widespread at lower to mid-elevations in the western United States. It has been reported from Oregon, Idaho, Washington, Montana and Colorado, and is likely to occur in California. The *Thinopyrum intermedium* type occurs widely throughout the northern Great Plains of the United States and at montane elevations in the Intermountain West. The Shining Willow / Intermediate Wheatgrass Semi-natural Shrubland Association likely occurs within the range of the greater alliances where intermediate wheatgrass has had the opportunity to invade the understory.

COMMENTS

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; despite the small sample size, a characteristic species list for this association was compiled as it was present in the classification relevee table, which included all species present one plot.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

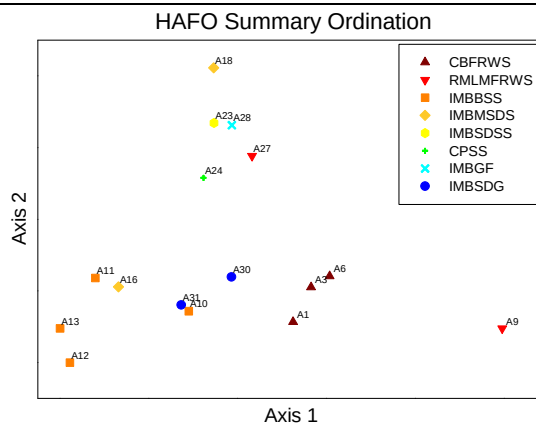
MAP UNITS

This map code *Salix lucida* / *Thinopyrum intermedium* Semi-natural Shrubland contains *Salix exigua* / Mesic Forbs Shrubland (A26) and also contains *Salix exigua* / Barren Shrubland. This map code occupies approximately (9) polygons containing a combination of the associations listed above. These polygons average about (.33) ha in size and comprise nearly (3.0) ha of total area within the monument

A28

Greasewood / Cheatgrass Semi-natural Shrubland

Sarcobatus vermiculatus / *Bromus tectorum* Semi-natural Shrubland



Description

Sarcobatus vermiculatus dominates the sparse to moderately dense shrub layer of this vegetation association. Other shrubs species commonly include *Atriplex canescens*, *Atriplex confertifolia*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, *Grayia spinosa*, and *Tetradymia canescens*. If *Artemisia tridentata* is present, it is with very low cover. *Bromus tectorum* is the dominant herbaceous species in this vegetation type. The understory can range from sparse to dense in terms of cover, but native species typically have very low cover. Herbaceous species tend to be weedy and/or exotic; In addition to *Bromus tectorum*, *Descurainia pinnata*, *Sisymbrium altissimum*, *Alyssum desertorum*, and *Halogeton glomeratus* are the most prevalent.

Stands are found on terraces, swales, coppice dunes, playas, alluvial fans and flats, valley floors, toeslopes and ridges. Slopes tend to be gentle. Soils are typically derived from mixed alluvium or from eolian deposits. Soil textures range from sand to silty clay and tend to be alkaline and saline, often with a white salt crust on the soil surface.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 5, AA)

Tree

None

Shrub

Sarcobatus vermiculatus (greasewood) V.6, *Artemisia tridentata* ssp. *wyomingensis* (Wyoming big sagebrush) III.2, *Atriplex canescens* (fourwing saltbush) III.2

Dwarf-shrub

None

Graminoid

Bromus tectorum (cheatgrass) V.18

Forb

Sisymbrium altissimum (tall tumbled mustard) V.2, *Descurainia sophia* (herb sophia) V.<1

RANGE

Hagerman Fossil Beds National Monument

This association is most often found close to waterways or in drainage channels where greater soil moisture is available.

Global

This widespread but patchy shrubland likely occurs throughout the Colorado Plateau and Great Basin and extends to mountain valleys in the southern Rocky Mountains where *Bromus tectorum* has had the opportunity to invade the understory.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of shrublands in large parts of the western U.S. Consequently, this species tends to co-dominate primarily on sites that have been impacted by disturbance.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Sarcobatus vermiculatus* Intermittently Flooded Shrubland Alliance contains *Sarcobatus vermiculatus* / *Bromus tectorum* Semi-natural Shrubland (A28) and *Sarcobatus vermiculatus* / *Leymus cinereus* Shrubland (A29). This map code occupies approximately (20) polygons containing a combination of the associations listed above. These polygons average about (2.01) ha in size and comprise nearly (40.2) ha of total area within the monument.

A29

Greasewood / Basin Wildrye Shrubland

Sarcobatus vermiculatus / *Leymus cinereus* Shrubland



Description

This association has a moderately dense shrub canopy that is dominated by *Sarcobatus vermiculatus*. *Chrysothamnus viscidiflorus* is also often present in the shrub stratum. The moderately dense herbaceous layer is dominated by perennial graminoids, the most conspicuous of which is *Leymus cinereus*. *Pascopyrum smithii* regularly co-dominates the herbaceous stratum of this plant community. Forb cover tends to be low and component species may include *Comandra umbellata*, *Iva axillaris*, *Tragopogon dubius*, and *Sphaeralcea* spp. The cactus *Opuntia polyacantha* is typically present in this vegetation type as well.

This shrubland is restricted to a relatively narrow band on floodplains and toeslopes above drainages in semiarid environments. Substrates are poorly drained. Soil textures range from sand to silty clay and tend to be alkaline and saline, often with a white salt crust on the soil surface.

CONSERVATION RANK G3

DATABASE CODE CEGL001366

CHARACTERISTIC SPECIES (n = 0, AA)

Tree

N/A

Shrub

Sarcobatus vermiculatus (greasewood)

Dwarf-shrub

N/A

Graminoid

Leymus cinereus (basin wildrye)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This association is most often found close to waterways or in drainage channels where greater soil moisture is available.

Global

This association has been documented in western Montana and Oregon, and may occur in Washington, California, Nevada and Idaho.

COMMENTS

Much of the historic range of this association has been converted to cropland. Improper grazing by livestock can eliminate *Leymus cinereus* from the understory. Alteration of natural hydrologic processes may change the flood regimes that support this vegetation type and result in changes to the plant community as well.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. No plots were sampled at Hagerman Fossil Beds and only one observation point was recorded; therefore a thorough characteristic species list could not be compiled.

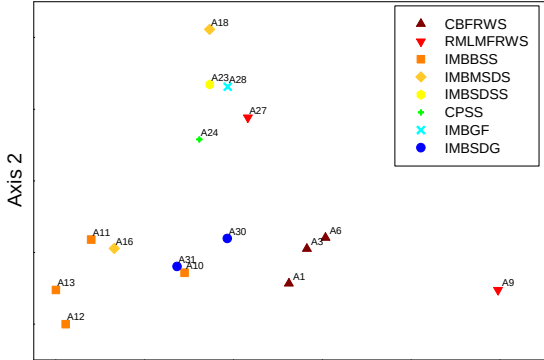
MAP UNITS

This map code *Sarcobatus vermiculatus* Intermittently Flooded Shrubland Alliance contains *Sarcobatus vermiculatus* / *Leymus cinereus* Shrubland (A29) and *Sarcobatus vermiculatus* / *Bromus tectorum* Semi-natural Shrubland (A28). This map code occupies approximately (20) polygons containing a combination of the associations listed above. These polygons average about (2.01) ha in size and comprise nearly (40.2) ha of total area within the monument



Crested Wheatgrass / Tall Tumblemustard Semi-natural Herbaceous Vegetation

Agropyron cristatum / *Sisymbrium altissimum* Semi-natural Herbaceous Vegetation

| | |
|--|--|
|  | <p>HAFO Summary Ordination</p>  <p>Axis 2</p> <p>Axis 1</p> <p>Legend:</p> <ul style="list-style-type: none"> ▲ CBFRRWS ▼ RMLMFRWS ■ IMBBS ◆ IMBMSDS ● IMBDS ◆ CPSS × IMBGF ● IMBSDG |
| <p>Description</p> <p>This herbaceous plant community is characterized by an abundance of introduced species with low to moderate total cover. The dominant species in this vegetation type is <i>Agropyron cristatum</i>, a perennial bunchgrass. <i>Sisymbrium altissimum</i>, an annual forb, is also characteristic of this plant community, but it typically occurs at low cover values. Other non-native grass species, such as <i>Bromus tectorum</i>, are often present with sparse cover. Native species persist in some stands, however cover and diversity are typically low, and component native species can be quite variable depending on the plant community that was present prior to the conversion to introduced grasses. <i>Poa secunda</i> is the most frequently occurring and abundant native grass in this community type. Other non-native forb species are common and typically include <i>Lactuca serriola</i>, <i>Descurainia sophia</i>, and <i>Chorispora tenella</i>.</p> <p>This association can occur across a wide range of environmental conditions in semi-arid ecosystems and is not tightly constrained by slope, aspect, soil texture, or soil depth. Stands can occur in and adjacent to a wide variety of human-disturbed habitats, including highway rights-of-way, revegetation projects, etc.</p> | |
| <p>CONSERVATION RANK N/A</p> | <p>DATABASE CODE N/A</p> |
| <p>CHARACTERISTIC SPECIES (n = 4, AA)</p> <p>Tree</p> <p>None</p> <p>Shrub</p> <p>None</p> <p>Dwarf-shrub</p> <p>None</p> <p>Graminoid</p> <p><i>Agropyron cristatum</i> (crested wheatgrass) V.23, <i>Bromus tectorum</i> (cheatgrass) IV.1, <i>Poa secunda</i> (Sandberg bluegrass) IV.1</p> <p>Forb</p> <p><i>Sisymbrium altissimum</i> (tall tumble mustard) V.1, <i>Lactuca serriola</i> (prickly lettuce) V.<1</p> | |

RANGE

Hagerman Fossil Beds National Monument

This association is most often found adjacent to agricultural fields that were seeded to pasture or areas that were reseeded after a fire.

Global

The Crested Wheatgrass Semi-natural Herbaceous Alliance is found in Utah, Montana, Wyoming, Idaho, and North and South Dakota, and in Canada in Manitoba and Saskatchewan.

COMMENTS

Agropyron cristatum has been planted into pastures and rangelands to improve forage production and is well suited to the cold, semi-arid conditions of the Great Basin, northwestern Great Plains and higher elevation rangeland in more southern latitudes, facilitating its persistence and occasional spread.

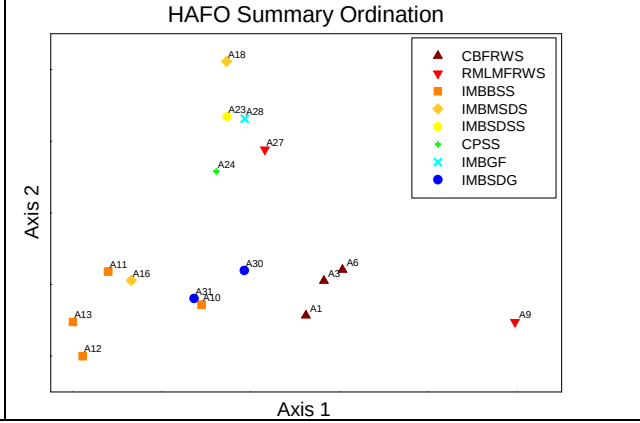
This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code *Agropyron cristatum* / *Sisymbrium altissimum* Herbaceous Vegetation contains *Agropyron cristatum* / *Sisymbrium altissimum* Herbaceous Vegetation (A30). This map code occupies approximately (10) polygons containing the association listed above. These polygons average about (1.85) ha in size and comprise nearly (18.5) ha of total area within the monument

A31 Cheatgrass / Tall Tumblemustard Semi-natural Herbaceous Vegetation

Bromus tectorum / *Sisymbrium altissimum* Semi-natural Herbaceous Vegetation

| | |
|---|---|
|  | <p>HAFO Summary Ordination</p>  |
| <p>Description</p> <p>This herbaceous plant community is characterized by an abundance of introduced species. The vegetation in this association is dominated by <i>Bromus tectorum</i>, an annual grass, <i>Sisymbrium altissimum</i>, an annual forb, or a combination of both species. This association often occurs on or near sites that have been disturbed. Total vegetation cover ranges from 10 to 70%, generally with less than half from native species. Native species persist in some stands, however cover and diversity are typically low, and component native species can be quite variable depending on the plant community that was present prior to the conversion to introduced species. Native shrubs may occur sporadically with low densities. Several native and non-native forb species may also be sparse and variable across stands of this vegetation type and typically include <i>Descurainia sophia</i>, <i>Lactuca serriola</i>, <i>Salsola kali</i>, and <i>Chorispora tenella</i>.</p> <p>This association can occur across a wide range of environmental conditions in semi-arid ecosystems but is likely to be found in low-lying areas that have fine soil-textures and experience occasional seasonal flooding.</p> | |
| <p>CONSERVATION RANK N/A</p> | <p>DATABASE CODE N/A</p> |
| <p>CHARACTERISTIC SPECIES (n = 5, AA)</p> <p>Tree</p> <p> None</p> <p>Shrub</p> <p> None</p> <p>Dwarf-shrub</p> <p> None</p> <p>Graminoid</p> <p> <i>Bromus tectorum</i> (cheatgrass) V.27</p> <p>Forb</p> <p> <i>Sisymbrium altissimum</i> (tall tumblemustard) V.7, <i>Descurainia sophia</i> (herb sophia) IV.3</p> | |

RANGE

Hagerman Fossil Beds National Monument

This association is fairly widespread throughout the park. It is most common adjacent to roads, agricultural fields, and other disturbed areas.

Global

This global distribution of this association likely coincides with the range the *Bromus tectorum* Semi-natural Herbaceous Alliance, which occurs throughout much of western North America from the western Great Plains to the intermountain and southwestern U.S.

COMMENTS

The unique life history characteristics of *Bromus tectorum* and the altered ecological process associated with this species have promoted the spread of it and other exotic annual bromes at the expense of sagebrush shrublands in large parts of the western U.S. *Sisymbrium altissimum* is also introduced and is characteristic of disturbed areas. Consequently, these species tend to co-dominate on or around sites that have been impacted.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Bromus tectorum / Sisymbrium altissimum Herbaceous Vegetation contains *Bromus tectorum* / *Sisymbrium altissimum* Herbaceous Vegetation (A31). This map code occupies approximately (170) polygons containing the association listed above. These polygons average about (1.37) ha in size and comprise nearly (234.1) ha of total area within the monument

A32 **Blue Lettuce Semi-natural Herbaceous Vegetation**

Lactuca tatarica Semi-natural Herbaceous Vegetation

Description

The dominant species in this herbaceous association, *Lactuca tatarica*, is perennial and native to North America; however, it tends to be considered weedy in many parts of the West as it creates a monoculture in disturbed areas. Other native species tend to be sparse and occur with very low cover and/or frequency. Non-native species may also occur sporadically throughout stands of this vegetation type.

Typical habitat for this plant community includes foothills, marshes, canal and stream banks, roadsides, meadows, pastures, and cultivated fields. It is more common in moist soil types but is highly adapted to survive a range of environmental conditions.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 0, AA)

Tree

N/A

Shrub

N/A

Dwarf-shrub

N/A

Graminoid

N/A

Forb

Lactuca tatarica (blue lettuce)

RANGE

Hagerman Fossil Beds National Monument

This association is most often found in moist meadows or drainage channels with sub-surface moisture.

Global

This widespread association may be found in disturbed patches across much of North America and Canada.

COMMENTS

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. No plots were sampled and only one observation point was recorded at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.

MAP UNITS

This map code Annual Weedy Herbaceous Vegetation Complex contains *Lactuca tatarica* var. *pulchella* Herbaceous Vegetation (A32). This map code occupies approximately (15) polygons containing the association listed above. These polygons average about (.23) ha in size and comprise nearly (3.4) ha of total area within the monument



Western Wheatgrass – Indian Ricegrass Herbaceous Vegetation

Pascopyrum smithii - *Achnatherum hymenoides* Herbaceous Vegetation



Description

This association is characterized by an open to moderated herbaceous layer that grows 0.5-1 m tall and is strongly dominated by *Pascopyrum smithii*. Herbaceous cover may be significantly less on drier sites or after scarce cool-season precipitation. *Achnatherum hymenoides* is also characteristic of this community type, but may occur in a sparse and/or patchy distribution. Additional graminoid species vary from one stand to another. Shrubs and dwarf-shrubs are rare in this vegetation type, but occasional woody species that are common to sagebrush steppe plant communities may be present. Forbs are common but are variable in terms of species composition and sparse in terms of vegetation cover. Additional non-native, weedy species may also be locally abundant, especially in stands that have been disturbed.

Stands occur on level to gently sloping terrain. They may be found on alluvial fans, swales, floodplains, valley bottoms and basins. The soils are typically deep (40-100 cm), slightly alkaline and well-developed with clay, clay loam, and silt loam textures, but also coarser textures such as sand and loamy sand. Some stands occur on perched water tables. Parent materials include landslide deposits, volcanic rocks, sandstones and shale that have eroded and deposited as secondary stream alluvium.

CONSERVATION RANK N/A

DATABASE CODE N/A

CHARACTERISTIC SPECIES (n = 1, AA)

Tree

N/A

Shrub

N/A

Dwarf-shrub

N/A

Graminoid

Pascopyrum smithii (western wheatgrass), *Achnatherum hymenoides* (Indian ricegrass)

Forb

| |
|--|
| N/A |
| <p>RANGE</p> <p><i>Hagerman Fossil Beds National Monument</i></p> <p>This uncommon association may be found in open sites where sandy soils overlay a soil layer containing more clay.</p> <p><i>Global</i></p> <p>This grassland vegetation type is likely found as small, somewhat isolated patches throughout the northern and western Great Plains, Rocky Mountains, intermountain western United States and Canada, ranging from North Dakota and Saskatchewan, south to Nebraska and Colorado, and west to northern Arizona, Utah and Idaho.</p> |
| <p>COMMENTS</p> <p>This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.</p> <p>This association was not recognized in the National Vegetation Classification (NVC) and had not been documented or described by NatureServe (2009) at the time this document was produced. Therefore, the plant community description is based on limited data from Hagerman Fossil Beds and related plant communities that have been previously described. The descriptions provided herein may vary slightly from similar plant communities found elsewhere due to the local scale at which data were collected and the lack of a published standard in the NVC.</p> |
| <p>MAP UNITS</p> <p>This map code <i>Pascopyrum smithii</i> – <i>Achnatherum hymenoides</i> Herbaceous Vegetation contains <i>Achnatherum hymenoides</i> Herbaceous Vegetation (A33). This map code occupies approximately (0) polygons containing the association listed above. These polygons average about (0) ha in size and comprise nearly (0) ha of total area within the monument</p> |

A34

Common Spikerush Herbaceous Vegetation

Eleocharis palustris Herbaceous Vegetation



Description

This wetland association is dominated by submersed and emergent rooted vegetation under 1 m tall. This community is easily recognized by bright green stands of *Eleocharis palustris*. Vegetation cover can be sparse to dense (10-90%), but *Eleocharis palustris* is the dominant species, and the only species with 100% constancy. Other species, when present, can contribute as much as 40% cover, but never exceed that of the *Eleocharis palustris*. Co-occurring species in low-elevation stands can include native species such as, *Juncus balticus*, *Hordeum jubatum*, *Equisetum* spp., *Pascopyrum smithii*, as well as the introduced species *Melilotus officinalis* and *Bromus inermis*. Forb cover is typically low but may occasionally approach moderate levels in some stands.

This herbaceous wetland occurs across a range of elevations in valleys and canyon bottoms on the banks and in the overflow channels of low-gradient streams, as well as along the margins of ponds and lakes. It can also occur in the bottom of ephemeral ponds or playas on floodplain terraces of large rivers. In wet years, stands may remain ponded throughout the growing season. Soils range from organic to silty clay to fine loam formed from weathered siltstone and shale or eolian loess. Soils are reported as slightly alkaline.

CONSERVATION RANK G5

DATABASE CODE Cegl001833

CHARACTERISTIC SPECIES (n = 1, AA)

Tree

N/A

Shrub

N/A

Dwarf-shrub

N/A

Graminoid

Eleocharis palustris (common spikerush)

Forb

N/A

RANGE

Hagerman Fossil Beds National Monument

This uncommon association may be found in slow-moving waterways or where water is ponded for much or all of the year.

Global

This spikerush wet meadow community is found in the central Great Plains of the United States and Canada and throughout the western United States including the desert Southwest.

COMMENTS

The hydrological regime is critically important to this association. Most stands are seasonally to permanently flooded.

This association is uncommon at Hagerman Fossil Beds National Monument. Due to the limited spatial extent of occurrence and associated low sample size, the classification of this plant community is considered provisional. Only one plot was sampled at Hagerman Fossil Beds; therefore a thorough characteristic species list could not be compiled.

MAP UNITS

This map code *Eleocharis palustris* – *Typha latifolia* Wetland Vegetation Complex contains *Eleocharis palustris* Herbaceous Vegetation (A34). This map code occupies approximately (30) polygons containing the association listed above. These polygons average about (.32) ha in size and comprise nearly (9.7) ha of total area within the monument

APPENDIX E: HAFO Species List

This is not a complete list for HAFO.

| Hagerman Fossil Beds NM Vascular Plants | | | |
|---|----------------|---|---|
| TSN | Family | Standard Scientific Name | Standard Common Name |
| 28749 | Aceraceae | <i>Acer negundo</i> | ashleaf maple, box elder, boxelder, boxelder maple, california boxelder, manitoba maple, western boxelder |
| 38917 | Alismataceae | <i>Sagittaria cuneata</i> | arum-leaf arrowhead, arumleaf arrowhead, northern arrowhead, wapato |
| 20719 | Amaranthaceae | <i>Amaranthus albus</i> | pigweed, pigweed amaranth, prostrate pigweed, tumble pigweed, tumbleweed, white pigweed |
| 20745 | Amaranthaceae | <i>Amaranthus retroflexus</i> | Pigweed, careless weed, red-root amaranth, redroot amaranth, redroot pigweed, rough pigweed |
| 539586 | Anacardiaceae | <i>Rhus aromatica</i> var. <i>trilobata</i> | No data |
| 28822 | Anacardiaceae | <i>Toxicodendron rydbergii</i> | W. Poison ivy, poison ivy, western poison ivy, western poison-ivy |
| 192931 | Apiaceae | <i>Berula erecta</i> var. <i>incisa</i> | No data |
| 182152 | Apiaceae | <i>Cicuta maculata</i> var. <i>angustifolia</i> | common water hemlock, poison parsnip, spotted cowbane, spotted parsley, spotted water hemlock, spotted water-hemlock, water hemlock |
| 29628 | Apiaceae | <i>Cymopterus acaulis</i> | plains spring parsley, plains springparsley, stemless springparsley, wild parsley |
| 527615 | Apiaceae | <i>Cymopterus acaulis</i> var. <i>greeleyorum</i> | Greeley springparsley |
| 536919 | Apiaceae | <i>Lomatium dissectum</i> var. <i>eatonii</i> | No data |
| 29704 | Apiaceae | <i>Lomatium foeniculaceum</i> ssp. <i>macdougalii</i> | Macdougal's biscuitroot, carrot-leaf desert-parsley |
| 526072 | Apiaceae | <i>Lomatium triternatum</i> ssp. <i>platycarpum</i> | No data |
| -1E+07 | Apiaceae | <i>Lomatium triternatum</i> ssp. <i>triternatum</i> var. <i>triternatum</i> | No data |
| 184783 | Apocynaceae | <i>Apocynum cannabinum</i> var. <i>glaberrimum</i> | No data |
| 532381 | Asclepiadaceae | <i>Asclepias cryptoceras</i> var. <i>davisii</i> | No data |
| 30241 | Asclepiadaceae | <i>Asclepias incarnata</i> | rose milkweed, swamp milkweed |
| 30304 | Asclepiadaceae | <i>Asclepias speciosa</i> | showy milkweed |
| -501892 | Asteraceae | <i>Achillea millefolium</i> ssp. <i>lanulosa</i> var. <i>lanulosa</i> | white yarrow |
| 36497 | Asteraceae | <i>Ambrosia acanthicarpa</i> | annual bursage, bursage, bursage ragweed, flat-spine burr-ragweed, flat-spine burr ragweed, sand bursage |
| 36508 | Asteraceae | <i>Ambrosia grayi</i> | bur ragweed, lagoonweed, woollyleaf burr ragweed, woollyleaf bursage, woollyleaf franseria, woollyleaf povertyweed |
| 36727 | Asteraceae | <i>Antennaria dimorpha</i> | low everlasting, low pussytoes |
| 36546 | Asteraceae | <i>Arctium minus</i> | bardane, beggar's button, burdock, common burdock, lesser burdock, lesser burdock, small burdock, smaller burdock, wild burdock, wild rhubarb |

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| Hagerman Fossil Beds NM Vascular Plants | | | |
|--|---------------|---|---|
| TSN | Family | Standard Scientific Name | Standard Common Name |
| 35449 | Asteraceae | <i>Artemisia arbuscula</i> | little sagebrush, low sagebrush |
| 500971 | Asteraceae | <i>Artemisia nova</i> | black sagebrush |
| 35496 | Asteraceae | <i>Artemisia spinescens</i> | bud sagebrush |
| -1E+07 | Asteraceae | <i>Artemisia tridentata</i> var. <i>tridentata</i> | No data |
| -1E+07 | Asteraceae | <i>Artemisia tridentata</i> var. <i>tridentata</i> X var. <i>vaseyana</i> | No data |
| 532368 | Asteraceae | <i>Artemisia tridentata</i> var. <i>vaseyana</i> | No data |
| 532369 | Asteraceae | <i>Artemisia tridentata</i> var. <i>wyomingensis</i> | No data |
| 35502 | Asteraceae | <i>Artemisia tripartita</i> | threetip sagebrush |
| 35560 | Asteraceae | <i>Aster eatonii</i> | Eaton's aster |
| 36811 | Asteraceae | <i>Balsamorhiza hookeri</i> | Hooker balsamroot, Hooker's balsamroot, hairy balsamroot |
| 36818 | Asteraceae | <i>Balsamorhiza sagittata</i> | arrowleaf balsamroot |
| 35710 | Asteraceae | <i>Bidens cernua</i> | bur marigold, nodding beggartick, nodding beggarticks, nodding bur marigold, nodding burmarigold, nodding burr-marigold, sticktight |
| 35707 | Asteraceae | <i>Bidens frondosa</i> | bur marigold, devil's beggartick, devil's beggarticks, devil's bootjack, devil's-pitchfork, devils beggartick, pitchfork weed, sticktight, sticktight, tickseed sunflower |
| 526983 | Asteraceae | <i>Brickellia microphylla</i> var. <i>microphylla</i> | littleleaf brickellbush |
| 36958 | Asteraceae | <i>Centaurea diffusa</i> | diffuse knapweed, diffuse knaweed, white knapweed |
| 36964 | Asteraceae | <i>Centaurea maculosa</i> | spotted knapweed |
| 36987 | Asteraceae | <i>Chaenactis douglasii</i> | Douglas dustymaiden, Douglas' dustymaiden, Douglas' pincushion, dusty maiden, dusty-maiden |
| 533335 | Asteraceae | <i>Chaenactis douglasii</i> var. <i>achilleifolia</i> | No data |
| 37029 | Asteraceae | <i>Chondrilla juncea</i> | hogbite, rush skeletonweed, skeletonweed |
| 37055 | Asteraceae | <i>Chrysothamnus nauseosus</i> | gray rabbitbrush |
| 533554 | Asteraceae | <i>Chrysothamnus nauseosus</i> var. <i>graveolens</i> | No data |
| 533555 | Asteraceae | <i>Chrysothamnus nauseosus</i> var. <i>hololeucus</i> | No data |
| 533563 | Asteraceae | <i>Chrysothamnus nauseosus</i> var. <i>oreophilus</i> | No data |
| 533586 | Asteraceae | <i>Chrysothamnus viscidiflorus</i> var. <i>puberulus</i> | No data |
| 566625 | Asteraceae | <i>Chrysothamnus viscidiflorus</i> var. <i>viscidiflorus</i> | yellow rabbitbrush |
| 36335 | Asteraceae | <i>Cirsium arvense</i> | Californian thistle, Canada thistle, Canadian thistle, creeping thistle, field thistle |
| 36351 | Asteraceae | <i>Cirsium canovirens</i> | graygreen thistle |
| 36416 | Asteraceae | <i>Cirsium subniveum</i> | Jackson Hole thistle, gray thistle |
| 36428 | Asteraceae | <i>Cirsium vulgare</i> | bull thistle, common thistle, spear thistle |
| 527477 | Asteraceae | <i>Conyza canadensis</i> var. <i>glabrata</i> | Canadian horseweed |
| 37169 | Asteraceae | <i>Crepis acuminata</i> | long-leaf hawksbeard, longleaf hawksbeard, tapertip hawksbeard |
| 37186 | Asteraceae | <i>Crepis modocensis</i> | Modoc hawksbeard, Siskiyou hawksbeard, common hawksbeard |
| 37198 | Asteraceae | <i>Crepis occidentalis</i> ssp. <i>conjuncta</i> | largeflower hawksbeard |
| 527921 | Asteraceae | <i>Erigeron bloomeri</i> var. <i>bloomeri</i> | scabland daisy, scabland fleabane |

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| Hagerman Fossil Beds NM Vascular Plants | | | |
|--|---------------|---|--|
| TSN | Family | Standard Scientific Name | Standard Common Name |
| 531624 | Asteraceae | <i>Erigeron pumilus</i> ssp. <i>intermedius</i> var. <i>gracilior</i> | shaggy daisy, shaggy fleabane |
| 35951 | Asteraceae | <i>Erigeron strigosus</i> | Daisy Fleabane, prairie fleabane, rough fleabane |
| 528052 | Asteraceae | <i>Eriophyllum lanatum</i> var. <i>integrifolium</i> | common woolly sunflower, wholeleaf eriophyllum |
| 37356 | Asteraceae | <i>Euthamia occidentalis</i> | western goldenrod, western goldentop |
| 528278 | Asteraceae | <i>Grindelia integrifolia</i> var. <i>integrifolia</i> | Puget Sound gumweed |
| 37472 | Asteraceae | <i>Grindelia squarrosa</i> | Curleycup gumweed, curlycup gumweed, curlytop gumweed, gumweed, rosinweed, tarweed |
| 528288 | Asteraceae | <i>Grindelia squarrosa</i> var. <i>serrulata</i> | curly-cup gumweed, curlycup gumweed, curlytop gumweed, gumweed, rosinweed, tarweed |
| 37483 | Asteraceae | <i>Gutierrezia sarothrae</i> | Broomsnakeweed, broom snakeweed, broomweed, perennial snakeweed, stinkweed, turpentine weed, yellow top |
| 37499 | Asteraceae | <i>Haplopappus acaulis</i> | No data |
| 528350 | Asteraceae | <i>Helenium autumnale</i> var. <i>montanum</i> | mountain sneezeweed |
| 36616 | Asteraceae | <i>Helianthus annuus</i> | annual sunflower, common sunflower, sunflower, wild sunflower |
| 36033 | Asteraceae | <i>Iva axillaris</i> | Iva poverty weed, deer-root, lesser marshelder, mouseear pvertyweed, poverty sumpweed, poverty weed, povertyweed, smallflowered marshelder |
| 515577 | Asteraceae | <i>Lactuca pulchella</i> | blue lettuce |
| 36608 | Asteraceae | <i>Lactuca serriola</i> | China lettuce, prickly lettuce, wild lettuce |
| 37863 | Asteraceae | <i>Layia glandulosa</i> | white tidytips, whitedaisy tidytips |
| 537311 | Asteraceae | <i>Lygodesmia grandiflora</i> var. <i>dianthopsis</i> | No data |
| 37984 | Asteraceae | <i>Machaeranthera canescens</i> | hoary aster, hoary goldenweed, hoary machaeranthera, hoary tansy-aster, hoary tansyaster, purple aster |
| 566724 | Asteraceae | <i>Machaeranthera canescens</i> var. <i>sessiliflora</i> | hoary tansyaster |
| 38058 | Asteraceae | <i>Malacothrix torreyi</i> | Mohave aster, Torrey's desert dandelion, Torrey's desertdandelion |
| 38140 | Asteraceae | <i>Onopordum acanthium</i> | Scotch cotton thistle, Scotch cottonthistle, Scotch thistle, cotton thistle, heraldic thistle |
| 36224 | Asteraceae | <i>Solidago canadensis</i> | Canada goldenrod, Canadian goldenrod, common goldenrod |
| 540753 | Asteraceae | <i>Solidago gigantea</i> var. <i>serotina</i> | No data |
| 38421 | Asteraceae | <i>Sonchus arvensis</i> | creeping sowthistle, field sow-thistle, field sowthistle, perennial sowthistle, sowthistle |
| 38424 | Asteraceae | <i>Sonchus asper</i> | perennial sowthistle, prickly sowthistle, spiny sowthistle, spiny-leaf sow-thistle |
| 38427 | Asteraceae | <i>Sonchus oleraceus</i> | annual sowthistle, common sow-thistle, common sowthistle, pualele, sow thistle, sow-thistle |
| 36213 | Asteraceae | <i>Taraxacum officinale</i> | blowball, common dandelion, dandelion, faceclock |
| 38497 | Asteraceae | <i>Tetradymia glabrata</i> | littleleaf horsebrush |
| 38499 | Asteraceae | <i>Tetradymia spinosa</i> | shortspine horsebrush, spiny horsebrush |

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| TSN | Family | Standard Scientific Name | Standard Common Name |
| 38544 | Asteraceae | <i>Townsendia florifera</i> | showy Townsend daisy, showy townsendia |
| 38564 | Asteraceae | <i>Tragopogon dubius</i> | Western goat's beard, common salsify, goat's beard, goatsbeard, meadow goat's-beard, salsifis majeur, salsify, western salsify, wild oysterplant, yellow goat's beard, yellow salsify |
| 530872 | Asteraceae | <i>Xanthium strumarium</i> var. <i>canadense</i> | Canada cocklebur, Canada cocklebur, cocklebur, common cocklebur, rough cocklebur, rough cocklebur |
| 31706 | Boraginaceae | <i>Amsinckia tessellata</i> | bristly fiddleneck, western fiddleneck |
| 31723 | Boraginaceae | <i>Asperugo procumbens</i> | German mugwort, German-madwort, madwort |
| 31793 | Boraginaceae | <i>Cryptantha circumscissa</i> | cushion catseye, cushion cryptantha, matted cryptantha |
| 31813 | Boraginaceae | <i>Cryptantha gracilis</i> | narrowstem catseye, narrowstem cryptantha, narrowstem pick-me-not |
| 31825 | Boraginaceae | <i>Cryptantha interrupta</i> | Elko cryptantha |
| 527573 | Boraginaceae | <i>Cryptantha pterocarya</i> var. <i>pterocarya</i> | wingnut catseye, wingnut cryptantha |
| 31875 | Boraginaceae | <i>Cryptantha spiculifera</i> | Snake River cryptantha |
| 527576 | Boraginaceae | <i>Cryptantha torreyana</i> var. <i>torreyana</i> | Torrey's catseye |
| 31890 | Boraginaceae | <i>Cynoglossum officinale</i> | common houndstongue, gypsy-flower, gypsyflower, hound's tongue, houndstongue |
| 31931 | Boraginaceae | <i>Hackelia micrantha</i> | Jessica sticktight, meadow stickseed |
| 528677 | Boraginaceae | <i>Lappula occidentalis</i> var. <i>cupulata</i> | flat-spine sheepburr, flatspine stickseed |
| 505521 | Boraginaceae | <i>Tiquilia nuttallii</i> | Nuttall's crinklemat, Nuttall's tiquilia, rosette crinklemat |
| 23032 | Brassicaceae | <i>Alyssum desertorum</i> | desert alyssum, desert madwort |
| 22702 | Brassicaceae | <i>Arabis holboellii</i> | Holboell rockcress, Holboell's rockcress |
| 184362 | Brassicaceae | <i>Arabis holboellii</i> var. <i>retrofracta</i> | a holboell rock-cress, second rockcress |
| 184443 | Brassicaceae | <i>Arabis sparsiflora</i> var. <i>sparsiflora</i> | sicklepod rockcress |
| 22599 | Brassicaceae | <i>Camelina microcarpa</i> | false flax, little-pod false flax, littlepod false flax, littlepod falseflax, littleseed falseflax, small fruited falseflax, smallseed falseflax |
| 22766 | Brassicaceae | <i>Capsella bursa-pastoris</i> | shepardspurse, shepherd's purse, shepherd's-purse, shepherdspurse |
| 23099 | Brassicaceae | <i>Chorispora tenella</i> | beanpodd mustard, blue mustard, bluemustard, chorispora, common blue mustard, common bluemustard, crossflower, purple mustard, tenella mustard |
| 534402 | Brassicaceae | <i>Descurainia richardsonii</i> var. <i>sonnei</i> | No data |
| 534403 | Brassicaceae | <i>Descurainia richardsonii</i> var. <i>viscosa</i> | No data |
| 22843 | Brassicaceae | <i>Descurainia sophia</i> | flaxweed tansymustard, flixweed, flixweed tansymustard, herb sophia, herb-sophia, pinnate tansymustard, tansymustard |
| 22923 | Brassicaceae | <i>Draba verna</i> | spring Whitlowgrass, spring draba |
| 22931 | Brassicaceae | <i>Erysimum asperum</i> | No data |
| 22945 | Brassicaceae | <i>Erysimum occidentale</i> | pale wallflower, western wallflower |
| 22974 | Brassicaceae | <i>Lepidium perfoliatum</i> | clasping pepperweed, clasping pepperwort, claspingleaf pepperweed |

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| 23243 | Brassicaceae | <i>Malcolmia africana</i> | African addersmouth, African malcomia, African mustard |
| 22993 | Brassicaceae | <i>Rorippa nasturtium-aquaticum</i> | watercress |
| 539694 | Brassicaceae | <i>Rorippa palustris</i> var. <i>hispida</i> | No data |
| 23014 | Brassicaceae | <i>Rorippa sinuata</i> | spreading yellowcress |
| 23015 | Brassicaceae | <i>Rorippa sphaerocarpa</i> | round-fruit yellowcress, roundfruit yellowcress |
| 23312 | Brassicaceae | <i>Sisymbrium altissimum</i> | Jim Hill mustard, tall hedge-mustard, tall mustard, tall tumbledustard, tumble mustard, tumbledustard, tumbleweed mustard |
| 23329 | Brassicaceae | <i>Stanleya pinnata</i> | desert prince'splume, desert princesplume, golden prince's-plume |
| 23333 | Brassicaceae | <i>Streptanthella longirostris</i> | longbeak fiddle mustard, longbeak streptanthella |
| 23422 | Brassicaceae | <i>Thlaspi arvense</i> | Frenchweed, fanweed, field pennycress, pennycress, stinkweed |
| 19726 | Cactaceae | <i>Opuntia polyacantha</i> | plains pricklypear |
| 19109 | Cannabaceae | <i>Cannabis sativa</i> | Mary Jane, grass, hashish, hemp, marijuana, pot |
| 22620 | Capparaceae | <i>Cleome lutea</i> | yellow beeplant, yellow spiderflower |
| 184233 | Caryophyllaceae | <i>Arenaria franklinii</i> var. <i>franklinii</i> | Franklin's sandwort |
| 503057 | Caryophyllaceae | <i>Holosteum umbellatum</i> | jagged chickweed |
| 530371 | Caryophyllaceae | <i>Silene scaposa</i> var. <i>lobata</i> | Lost River silene, lostriver champion |
| 18403 | Ceratophyllaceae | <i>Ceratophyllum demersum</i> | common hornwort, coon's tail, coon's-tail, coontail, hornwort |
| 192226 | Chenopodiaceae | <i>Atriplex canescens</i> var. <i>canescens</i> | fourwing saltbush |
| 20519 | Chenopodiaceae | <i>Atriplex confertifolia</i> | shadscale, shadscale saltbush, spiny saltbush |
| 20536 | Chenopodiaceae | <i>Atriplex heterosperma</i> | No data |
| 532462 | Chenopodiaceae | <i>Atriplex patula</i> var. <i>hastata</i> | No data |
| 509370 | Chenopodiaceae | <i>Atriplex spinosa</i> | No data |
| 20588 | Chenopodiaceae | <i>Bassia hyssopifolia</i> | fivehook bassia, fivehorn smotherweed, smother weed, smotherweed |
| 20592 | Chenopodiaceae | <i>Chenopodium album</i> | common lambsquarters, lambsquarters, lambsquarters goosefoot, white goosefoot |
| 20687 | Chenopodiaceae | <i>Eurotia lanata</i> | No data |
| 20692 | Chenopodiaceae | <i>Halogeton glomeratus</i> | barilla, halogeton, saltlover |
| 20696 | Chenopodiaceae | <i>Kochia scoparia</i> | Mexican burningbush, Mexican fireweed, Mexican-fireweed, common kochia, fireweed, kochia, mock cypress, summer cypress |
| 20655 | Chenopodiaceae | <i>Salsola kali</i> | Russian thistle, prickly Russian thistle, tumbleweed |
| 20707 | Chenopodiaceae | <i>Sarcobatus vermiculatus</i> | black greasewood, greasewood |
| 30705 | Convolvulaceae | <i>Convolvulus arvensis</i> | European bindweed, creeping jenny, field bindweed, morningglory, perennial morningglory, smallflowered morning glory |
| 194872 | Cupressaceae | <i>Juniperus scopulorum</i> | Rocky Mountain juniper |
| 534120 | Cuscutaceae | <i>Cuscuta pentagona</i> var. <i>calycina</i> | No data |
| 39456 | Cyperaceae | <i>Carex hystericina</i> | bottlebrush sedge, porcupine sedge |
| 39458 | Cyperaceae | <i>Carex lanuginosa</i> | woolly sedge |
| 39711 | Cyperaceae | <i>Carex nebrascensis</i> | Nebraska sedge |

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| 39767 | Cyperaceae | <i>Carex praegracilis</i> | clustered field sedge, slim sedge |
| 40030 | Cyperaceae | <i>Eleocharis bella</i> | beautiful spikerush |
| 40019 | Cyperaceae | <i>Eleocharis palustris</i> | common spikerush, creeping spikerush, spikesedge |
| 40240 | Cyperaceae | <i>Scirpus acutus</i> | hardstem bulrush |
| 40226 | Cyperaceae | <i>Scirpus americanus</i> | No data |
| 40275 | Cyperaceae | <i>Scirpus pungens</i> | No data |
| 35406 | Dipsacaceae | <i>Dipsacus sylvestris</i> | Fuller's teasel, common teasel |
| 27770 | Elaeagnaceae | <i>Elaeagnus angustifolia</i> | Russian olive, Russian-olive, oleaster |
| 17152 | Equisetaceae | <i>Equisetum arvense</i> | field horsetail, scouring rush, western horsetail |
| 17154 | Equisetaceae | <i>Equisetum hyemale</i> | horsetail, scouring horsetail, scouringrush, scouringrush horsetail, tall scouring-rush, western scouringrush |
| 17156 | Equisetaceae | <i>Equisetum laevigatum</i> | horsetail, smooth horsetail, smooth scouring-rush, smooth scouringrush |
| 17159 | Equisetaceae | <i>Equisetum pratense</i> | meadow horsetail |
| 501422 | Euphorbiaceae | <i>Chamaesyce glyptosperma</i> | rib-seed sandmat, ribseed sandmat, ridgeseed spurge |
| 565061 | Euphorbiaceae | <i>Chamaesyce maculata</i> | large spurge, spotted sandmat, spotted spurge |
| 501458 | Euphorbiaceae | <i>Chamaesyce serpyllifolia</i> | thyme-leaf sandmat, thymeleaf sandmat |
| 502543 | Euphorbiaceae | <i>Euphorbia myrsinites</i> | myrtle spurge |
| 192359 | Fabaceae | <i>Astragalus atratus</i> var. <i>inseptus</i> | Fairfield milkvetch |
| 192362 | Fabaceae | <i>Astragalus atratus</i> var. <i>owyheensis</i> | Owyhee milkvetch |
| 192389 | Fabaceae | <i>Astragalus calycosus</i> var. <i>calycosus</i> | Torrey milkvetch, Torrey's milkvetch |
| 25453 | Fabaceae | <i>Astragalus caricinus</i> | buckwheat milkvetch |
| 25515 | Fabaceae | <i>Astragalus filipes</i> | basalt milkvetch, threadstalk milkvetch |
| 192508 | Fabaceae | <i>Astragalus geyeri</i> var. <i>geyeri</i> | Geyer's milkvetch |
| 25574 | Fabaceae | <i>Astragalus malacus</i> | shaggy milkvetch |
| 25605 | Fabaceae | <i>Astragalus nudisiliquus</i> | cobblestone milkvetch |
| 192713 | Fabaceae | <i>Astragalus purshii</i> var. <i>glareosus</i> | gravel milkvetch, woollypod milkvetch |
| 192721 | Fabaceae | <i>Astragalus purshii</i> var. <i>ophiogenes</i> | Snake River milkvetch |
| 192724 | Fabaceae | <i>Astragalus purshii</i> var. <i>purshii</i> | Pursh's milk-vetch, Pursh's milkvetch, woollypod milkvetch |
| 25705 | Fabaceae | <i>Astragalus toanus</i> | Toano milkvetch |
| 26635 | Fabaceae | <i>Dalea ornata</i> | Blue Mountain prairie clover, showy prairieclover |
| 192912 | Fabaceae | <i>Dalea purpurea</i> var. <i>purpurea</i> | Purple prairieclover, violet dalea, violet prairie clover, violet prairie-clover, violet prairieclover |
| 502401 | Fabaceae | <i>Glycyrrhiza lepidota</i> var. <i>lepidota</i> | No data |
| 566682 | Fabaceae | <i>Lupinus argenteus</i> var. <i>argenteus</i> | silvery lupine |
| 537009 | Fabaceae | <i>Lupinus argenteus</i> var. <i>holosericeus</i> | No data |
| -1E+07 | Fabaceae | <i>Lupinus pusillus</i> var. <i>pusillus</i> | No data |
| 183623 | Fabaceae | <i>Medicago sativa</i> | alfalfa |
| 26149 | Fabaceae | <i>Melilotus alba</i> | white sweetclover |
| 26150 | Fabaceae | <i>Melilotus officinalis</i> | yellow sweet-clover, yellow sweetclover |
| 504645 | Fabaceae | <i>Psoraleidium lanceolatum</i> | dune scurfpea, lemmon scurfpea, lemon scurfpea, wild lemonweed |

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| 26185 | Fabaceae | <i>Robinia pseudo-acacia</i> | black locust |
| 26251 | Fabaceae | <i>Trifolium fragiferum</i> | strawberry clover |
| 29147 | Geraniaceae | <i>Erodium cicutarium</i> | California filaree, alfilaree, alfilaria, cutleaf filaree, filaree, red-stem stork's-bill, redstem, redstem filaree, redstem stork's bill, stork's bill, storksbill |
| 24452 | Grossulariaceae | <i>Ribes aureum</i> | golden currant |
| 38937 | Hydrocharitaceae | <i>Elodea canadensis</i> | Canada waterweed, Canadian waterweed, broad waterweed |
| 529255 | Hydrophyllaceae | <i>Nama densum</i> var. <i>parviflorum</i> | leafy fiddleleaf |
| 31521 | Hydrophyllaceae | <i>Phacelia glandulifera</i> | sticky phacelia |
| 504271 | Hydrophyllaceae | <i>Phacelia heterophylla</i> | variable-leaf scorpion-weed, varileaf phacelia, virgate phacelia, wand phacelia |
| 504273 | Hydrophyllaceae | <i>Phacelia ivesiana</i> | Ives phacelia, Ives scorpion-weed, Ives' phacelia |
| 43194 | Iridaceae | <i>Iris pseudacorus</i> | paleyellow iris, yellow flag |
| 39249 | Juncaceae | <i>Juncus articulatus</i> | jointed rush, jointleaf rush |
| 39223 | Juncaceae | <i>Juncus balticus</i> | Baltic rush |
| 39320 | Juncaceae | <i>Juncus torreyi</i> | Torrey's rush, torrey rush |
| 32254 | Lamiaceae | <i>Lycopus americanus</i> | American bugleweed, American water horehound, American waterhorehound, cut-leaf water-horehound, water horehound, waterhorehound |
| 32256 | Lamiaceae | <i>Lycopus asper</i> | rough bugleweed, rough water-horehound |
| 537473 | Lamiaceae | <i>Mentha arvensis</i> var. <i>glabrata</i> | No data |
| 32272 | Lamiaceae | <i>Mentha spicata</i> | bush mint (spearmint), spearmint |
| 32275 | Lamiaceae | <i>Mentha X piperita</i> | peppermint |
| 32623 | Lamiaceae | <i>Nepeta cataria</i> | catmint, catnip, catwort, field balm |
| 32798 | Lamiaceae | <i>Scutellaria galericulata</i> | hooded skullcap, marsh scullcap, marsh skullcap |
| 42590 | Lemnaceae | <i>Lemna minor</i> | common duckweed, least duckweed, lesser duckweed |
| 503361 | Lemnaceae | <i>Lemna minuta</i> | least duckweed |
| 42707 | Liliaceae | <i>Allium acuminatum</i> | taper-tip onion, tapertip onion |
| 182634 | Liliaceae | <i>Allium bisceptrum</i> var. <i>bisceptrum</i> | twincrest onion |
| 182610 | Liliaceae | <i>Allium geyeri</i> var. <i>geyeri</i> | Geyer onion, Geyer's onion |
| 182626 | Liliaceae | <i>Allium nevadense</i> var. <i>nevadense</i> | Nevada onion |
| 42670 | Liliaceae | <i>Allium textile</i> | prairie onion, textile onion, wild onion |
| 42784 | Liliaceae | <i>Asparagus officinalis</i> | asparagus, garden asparagus, garden-asparagus |
| 42837 | Liliaceae | <i>Calochortus bruneauensis</i> | Bruneau mariposa lily |
| 42936 | Liliaceae | <i>Fritillaria pudica</i> | yellow bells, yellow fritillary, yellow missionbells, yellowbells |
| 514632 | Liliaceae | <i>Hemerocallis flava</i> | No data |
| 43038 | Liliaceae | <i>Smilacina stellata</i> | No data |
| 43167 | Liliaceae | <i>Zigadenus paniculatus</i> | foothill deathcamas, sand-corn |
| 503757 | Loasaceae | <i>Mentzelia albicaulis</i> | white blazingstar, whitestem blazingstar, whitestem stickleaf |
| 503769 | Loasaceae | <i>Mentzelia dispersa</i> | Nevada blazingstar, bushy blazingstar, scattered blazingstar |

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| 503779 | Loasaceae | <i>Mentzelia laevicaulis</i> | blazingstar mentzelia, smoothstem blazingstar |
| 529156 | Loasaceae | <i>Mentzelia torreyi</i> var. <i>acerosa</i> | Torrey's blazingstar |
| 27079 | Lythraceae | <i>Lythrum salicaria</i> | purple loosestrife, purple loosestrife or lythrum, purple lythrum, rainbow weed, salicaire, spiked loosestrife |
| 21836 | Malvaceae | <i>Malva neglecta</i> | buttonweed, cheeseplant, cheeseweed, common mallow, dwarf mallow, roundleaf mallow |
| 19066 | Moraceae | <i>Morus alba</i> | mulberry, white mulberry |
| 32929 | Oleaceae | <i>Fraxinus pennsylvanica</i> | green ash |
| 32996 | Oleaceae | <i>Syringa vulgaris</i> | common lilac |
| 532883 | Onagraceae | <i>Camissonia claviformis</i> var. <i>cruciformis</i> | No data |
| -1E+07 | Onagraceae | <i>Camissonia scapoidea</i> var. <i>scapoidea</i> | No data |
| 27293 | Onagraceae | <i>Epilobium ciliatum</i> | fringed willowherb, hairy willowherb, hairy willowweed |
| -
502303 | Onagraceae | <i>Epilobium ciliatum</i> var. <i>ciliatum</i> | No data |
| 27320 | Onagraceae | <i>Epilobium palustre</i> | marsh willowherb, marsh willowweed |
| -
502619 | Onagraceae | <i>Oenothera caespitosa</i> var. <i>caespitosa</i> | No data |
| 566494 | Onagraceae | <i>Oenothera caespitosa</i> var. <i>marginata</i> | No data |
| 566496 | Onagraceae | <i>Oenothera elata</i> var. <i>hirsutissima</i> | No data |
| -1E+07 | Onagraceae | <i>Oenothera pallida</i> ssp. <i>pallida</i> var. <i>pallida</i> | No data |
| 537972 | Onagraceae | <i>Oenothera villosa</i> var. <i>strigosa</i> | No data |
| 43481 | Orchidaceae | <i>Epipactis gigantea</i> | giant hellebore, giant helleborine, stream orchid |
| 34287 | Orobanchaceae | <i>Orobanche corymbosa</i> | Rydberg's broomrape, flat-top broomrape |
| 34290 | Orobanchaceae | <i>Orobanche fasciculata</i> | clustered broom-rape, clustered broomrape, purple broomrape, tufted broomrape |
| 183389 | Pinaceae | <i>Pinus sylvestris</i> | Scotch pine, Scots pine |
| 504434 | Plantaginaceae | <i>Plantago eriopoda</i> | alkali plantain, red-woolly plantain, redwood plantain, redwool plantain, saline plantain |
| 32874 | Plantaginaceae | <i>Plantago lanceolata</i> | English plantain, buckhorn plantain, lanceleaf Indianwheat, lanceleaf plantain, narrowleaf plantain, ribgrass, ribwort |
| 32907 | Plantaginaceae | <i>Plantago patagonica</i> | woolly Indianwheat, woolly plantain, woolly plantain, woolly Indianwheat, woolly plantain |
| -1E+07 | Poaceae | <i>Agropyron cristatum</i> , <i>sensu amplo</i> | No data |
| 185249 | Poaceae | <i>Agrostis capillaris</i> | colonial bent, colonial bentgrass |
| 40400 | Poaceae | <i>Agrostis stolonifera</i> | carpet bentgrass, creeping bent, creeping bentgrass, redtop, redtop bent, seaside bentgrass, spreading bent |
| 41458 | Poaceae | <i>Avena fatua</i> | flaxgrass, oatgrass, wheat oats, wild oat, wild oats |
| 41459 | Poaceae | <i>Avena sativa</i> | Common oats, common oat, oat, oatgrass (common), oats, wild oats |
| 40502 | Poaceae | <i>Bromus inermis</i> | awnless brome, smooth brome |
| 40479 | Poaceae | <i>Bromus japonicus</i> | Japanese brome, Japanese brome grass, Japanese chess |

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| 40524 | Poaceae | <i>Bromus tectorum</i> | cheat grass, cheatgrass, downy brome, early chess, military grass, wild oats |
| 193446 | Poaceae | <i>Dactylis glomerata</i> | cocksfoot, orchard grass, orchardgrass |
| 40662 | Poaceae | <i>Distichlis spicata</i> | desert saltgrass, inland saltgrass, marsh spikegrass, saltgrass, seashore saltgrass |
| 40689 | Poaceae | <i>Elymus cinereus</i> | No data |
| -1E+07 | Poaceae | <i>Elymus elongatus</i> ssp. <i>ponticus</i> | No data |
| 502264 | Poaceae | <i>Elymus elymoides</i> | bottlebrush squirreltail, squirreltail, western bottle-brush grass |
| 40692 | Poaceae | <i>Elymus flavescens</i> | No data |
| 512825 | Poaceae | <i>Elymus hispidus</i> | No data |
| 502267 | Poaceae | <i>Elymus lanceolatus</i> | streambank wheatgrass, streamside wild rye |
| 512839 | Poaceae | <i>Elymus repens</i> | quackgrass |
| 512844 | Poaceae | <i>Elymus smithii</i> | No data |
| 512845 | Poaceae | <i>Elymus spicatus</i> | No data |
| 40719 | Poaceae | <i>Eragrostis cilianensis</i> | candy grass, lovegrass, stink grass, stinkgrass, strongscented lovegrass |
| 41717 | Poaceae | <i>Eremopyrum triticeum</i> | annual false wheatgrass, annual wheatgrass |
| 40800 | Poaceae | <i>Festuca arida</i> | No data |
| 40810 | Poaceae | <i>Festuca arundinacea</i> | Alta fescue, coarse fescue, reed fescue, tall fescue |
| 513551 | Poaceae | <i>Festuca octoflora</i> | No data |
| 565873 | Poaceae | <i>Festuca ovina</i> | No data |
| 40822 | Poaceae | <i>Festuca pratensis</i> | No data |
| 502613 | Poaceae | <i>Festuca trachyphylla</i> | hard fescue |
| 40871 | Poaceae | <i>Hordeum jubatum</i> | foxtail barley |
| -1E+07 | Poaceae | <i>Hordeum marinum</i> , sensu <i>amplo</i> | No data |
| 40874 | Poaceae | <i>Hordeum vulgare</i> | Barley, cereal barley, common barley |
| 503284 | Poaceae | <i>Koeleria macrantha</i> | junegrass, prairie Junegrass |
| 40886 | Poaceae | <i>Leersia oryzoides</i> | rice cut grass, rice cutgrass |
| 40893 | Poaceae | <i>Lolium perenne</i> | italian ryegrass, perennial rye grass, perennial ryegrass |
| 41899 | Poaceae | <i>Muhlenbergia asperifolia</i> | alkali muhly, scratchgrass |
| 41335 | Poaceae | <i>Phalaris arundinacea</i> | reed canary grass, reed canarygrass |
| 41072 | Poaceae | <i>Phragmites australis</i> | common reed |
| 41116 | Poaceae | <i>Poa bulbosa</i> | bulbous blue grass, bulbous bluegrass |
| 41082 | Poaceae | <i>Poa compressa</i> | Canada bluegrass, flat-stem blue grass |
| -1E+07 | Poaceae | <i>Poa pratensis</i> , sensu <i>amplo</i> | No data |
| -1E+07 | Poaceae | <i>Poa secunda</i> , sensu <i>amplo</i> | No data |
| -1E+07 | Poaceae | <i>Poa secunda</i> , sensu <i>stricto</i> | No data |
| 41171 | Poaceae | <i>Polypogon monspeliensis</i> | annual rabbit's-foot grass, annual rabbitsfoot grass, rabbit'sfootgrass, rabbitfoot beardgrass, rabbitfoot grass, rabbitfoot polypogon, rabbitfootgrass |
| 41197 | Poaceae | <i>Puccinellia distans</i> | European alkaligrass, spreading alkali grass, weeping alkaligrass |
| 42081 | Poaceae | <i>Sclerochloa dura</i> | common hardgrass, hardgrass, tufted hardgrass |

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| Hagerman Fossil Beds NM Vascular Plants | | | |
|--|---------------|--|--|
| TSN | Family | Standard Scientific Name | Standard Common Name |
| 42090 | Poaceae | <i>Secale cereale</i> | Cultivated annual rye, cereal rye, common rye, cultivated rye, rye |
| 41231 | Poaceae | <i>Setaria viridis</i> | bottle grass, green bristle grass, green bristlegrass, green foxtail, pigeongrass, wild millet |
| 42132 | Poaceae | <i>Sporobolus cryptandrus</i> | sand dropseed |
| 42172 | Poaceae | <i>Stipa comata</i> | No data |
| 522063 | Poaceae | <i>Stipa hymenoides</i> | No data |
| 522071 | Poaceae | <i>Stipa thurberiana</i> | No data |
| 42237 | Poaceae | <i>Triticum aestivum</i> | common wheat, wheat |
| 535005 | Polemoniaceae | <i>Eriastrum sparsiflorum</i> var. <i>wilcoxii</i> | No data |
| -1E+07 | Polemoniaceae | <i>Gilia congesta</i> var. <i>congesta</i> | No data |
| -1E+07 | Polemoniaceae | <i>Gilia inconspicua</i> var. <i>inconspicua</i> | No data |
| 535797 | Polemoniaceae | <i>Gilia inconspicua</i> var. <i>sinuata</i> | No data |
| -1E+07 | Polemoniaceae | <i>Gilia leptomeria</i> var. <i>leptomeria</i> | No data |
| 31189 | Polemoniaceae | <i>Gymnosteris nudicaulis</i> | nakedstem gymnosteris |
| 31225 | Polemoniaceae | <i>Langloisia punctata</i> | No data |
| 31233 | Polemoniaceae | <i>Leptodactylon pungens</i> | common pricklygilia, granite gilia, granite prickly gilia, granite prickly phlox, granite pricklygilia |
| 31254 | Polemoniaceae | <i>Linanthus harknessii</i> | Harkness' flaxflower, threeseed linanthus |
| 537538 | Polemoniaceae | <i>Microsteris gracilis</i> var. <i>humilior</i> | No data |
| 30904 | Polemoniaceae | <i>Phlox aculeata</i> | sagebrush phlox |
| 538685 | Polemoniaceae | <i>Phlox hoodii</i> var. <i>canescens</i> | No data |
| 502696 | Polemoniaceae | <i>Phlox longifolia</i> var. <i>longifolia</i> | No data |
| 31017 | Polemoniaceae | <i>Polemonium micranthum</i> | annual jacob's-ladder, annual polemonium, littlebell Jacob's-ladder |
| 21090 | Polygonaceae | <i>Eriogonum cernuum</i> | nodding buckwheat, nodding eriogonum, nodding wild buckwheat |
| 528009 | Polygonaceae | <i>Eriogonum microthecum</i> var. <i>laxiflorum</i> | slender buckwheat |
| 195552 | Polygonaceae | <i>Eriogonum ochrocephalum</i> var. <i>sceptrum</i> | whitewoolly buckwheat |
| 21212 | Polygonaceae | <i>Eriogonum ovalifolium</i> | cushion buckwheat, cushion wild buckwheat, ovalleaf eriogonum |
| 528013 | Polygonaceae | <i>Eriogonum ovalifolium</i> var. <i>ochroleucum</i> | cushion buckwheat |
| 195553 | Polygonaceae | <i>Eriogonum ovalifolium</i> var. <i>ovalifolium</i> | cushion buckwheat, cushion wild buckwheat |
| 195575 | Polygonaceae | <i>Eriogonum shockleyi</i> var. <i>shockleyi</i> | Shockley buckwheat, Shockley's buckwheat |
| 21276 | Polygonaceae | <i>Eriogonum watsonii</i> | Watson's buckwheat |
| -1E+07 | Polygonaceae | <i>Eriogonum watsonii</i> form <i>deflexum</i> | No data |
| 20865 | Polygonaceae | <i>Polygonum amphibium</i> | water knotweed, water smartweed |
| 20876 | Polygonaceae | <i>Polygonum aviculare</i> | prostrate knotweed, yard knotweed |
| 20915 | Polygonaceae | <i>Polygonum persicaria</i> | lady's-thumb, ladysthumb, ladysthumb smartweed, smartweed, spotted knotweed, spotted ladysthumb, spotted smartweed |
| 20937 | Polygonaceae | <i>Rumex crispus</i> | Curley dock, curly dock, narrowleaf dock, sour dock, yellow dock |
| 20980 | Polygonaceae | <i>Rumex venosus</i> | veiny dock |

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| Hagerman Fossil Beds NM Vascular Plants | | | |
|--|------------------|--|---|
| TSN | Family | Standard Scientific Name | Standard Common Name |
| 20422 | Portulacaceae | <i>Portulaca oleracea</i> | akulikuli-kula, common purslane, duckweed, garden purslane, little hogweed, little-hogweed, purslane, pursley, pusley, wild portulaca |
| 39007 | Potamogetonaceae | <i>Potamogeton crispus</i> | curly pondweed, curly-leaved pondweed |
| -1E+07 | Potamogetonaceae | <i>Potamogeton foliosus</i> var. <i>foliosus</i> | No data |
| 39010 | Potamogetonaceae | <i>Potamogeton pectinatus</i> | sago pondweed |
| 39017 | Potamogetonaceae | <i>Potamogeton pusillus</i> | baby pondweed, small pondweed |
| 527664 | Ranunculaceae | <i>Delphinium nuttallianum</i> var. <i>nuttallianum</i> | Nuttal's larkspur |
| 18783 | Ranunculaceae | <i>Myosurus aristatus</i> | bristle mousetail |
| 18786 | Ranunculaceae | <i>Myosurus minimus</i> | No data |
| 194946 | Ranunculaceae | <i>Ranunculus cymbalaria</i> var. <i>cymbalaria</i> | alkali buttercup |
| 529968 | Ranunculaceae | <i>Ranunculus glaberrimus</i> var. <i>glaberrimus</i> | sagebrush buttercup |
| 18649 | Ranunculaceae | <i>Ranunculus testiculatus</i> | bur buttercup, curvseed butterwort, little bur, testiculate buttercup |
| 182033 | Rosaceae | <i>Amelanchier alnifolia</i> var. <i>alnifolia</i> | Saskatoon service-berry, Saskatoon serviceberry |
| 539216 | Rosaceae | <i>Potentilla gracilis</i> var. <i>pulcherrima</i> | No data |
| 24769 | Rosaceae | <i>Prunus armeniaca</i> | apricot |
| 24765 | Rosaceae | <i>Prunus persica</i> | peach |
| 24806 | Rosaceae | <i>Prunus virginiana</i> | Virginia chokecherry, chokecherry, chokecherry (common), common chokecherry |
| 25290 | Rosaceae | <i>Purshia tridentata</i> | antelope bitterbrush |
| 530129 | Rosaceae | <i>Rosa woodsii</i> var. <i>ultramontana</i> | Woods' rose |
| 24852 | Rosaceae | <i>Rubus discolor</i> | Himalaya blackberry, Himalayan blackberry |
| 34806 | Rubiaceae | <i>Galium trifidum</i> | small bedstraw, three-petal bedstraw, threepetal bedstraw |
| 22449 | Salicaceae | <i>Populus deltoides</i> var. <i>occidentalis</i> | No data |
| 195735 | Salicaceae | <i>Populus trichocarpa</i> | No data |
| 22499 | Salicaceae | <i>Salix amygdaloides</i> | peach-leaf willow, peachleaf willow |
| -
502874 | Salicaceae | <i>Salix exigua</i> ssp. <i>exigua</i> var. <i>exigua</i> | No data |
| -
502875 | Salicaceae | <i>Salix exigua</i> ssp. <i>exigua</i> var. <i>stenophylla</i> | No data |
| 22550 | Salicaceae | <i>Salix lasiandra</i> | pacific willow |
| 540235 | Salicaceae | <i>Salix rigida</i> var. <i>watsonii</i> | No data |
| 24395 | Saxifragaceae | <i>Lithophragma glabrum</i> | bulbous woodland-star, bulbous woodlandstar, smooth woodlandstar |
| 527192 | Scrophulariaceae | <i>Castilleja angustifolia</i> var. <i>angustifolia</i> | northwestern Indian paintbrush |
| 33113 | Scrophulariaceae | <i>Castilleja exilis</i> | No data |
| 33534 | Scrophulariaceae | <i>Collinsia parviflora</i> | blue-eyed Mary, littleflower collinsia, maiden blue eyed Mary, small-flower blue-eyed mary, smallflower blue eyed Mary |
| 33574 | Scrophulariaceae | <i>Cordylanthus ramosus</i> | Busby bird's-beak, bushy bird's beak, bushy birdbeak, muchbranched bird'sbeak |
| 33236 | Scrophulariaceae | <i>Mimulus guttatus</i> | common monkeyflower, seep monkeyflower |
| 529457 | Scrophulariaceae | <i>Penstemon acuminatus</i> var. <i>latebracteatus</i> | sharp-leaf penstemon |
| 33684 | Scrophulariaceae | <i>Penstemon cyaneus</i> | blue penstemon |
| 33977 | Scrophulariaceae | <i>Penstemon perpulcher</i> | Minidoka beardtongue |

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| Hagerman Fossil Beds NM Vascular Plants | | | |
|--|------------------|---|---|
| TSN | Family | Standard Scientific Name | Standard Common Name |
| 33394 | Scrophulariaceae | <i>Verbascum thapsus</i> | big taper, common mullein, flannel mullein, flannel plant, great mullein, mullein, velvet dock, velvet plant, woolly mullein |
| 565594 | Scrophulariaceae | <i>Veronica anagallis-aquatica</i> | blue water speedwell, water speedwell |
| 30414 | Solanaceae | <i>Solanum dulcamara</i> | European bittersweet, bitter nightshade, bittersweet nightshade, blue nightshade, climbing nightshade, fellenwort, woody nightshade |
| 30461 | Solanaceae | <i>Solanum triflorum</i> | cut-leaf nightshade, cutleaf nightshade |
| 505272 | Solanaceae | <i>Solanum tuberosum</i> | Irish potato |
| 22309 | Tamaricaceae | <i>Tamarix parviflora</i> | saltcedar, small-flower tamarisk, smallflower tamarisk, tamarisk, tamarix |
| 22310 | Tamaricaceae | <i>Tamarix ramosissima</i> | salt cedar, salt-cedar, saltcedar, tamarisk, tamarix |
| 42326 | Typhaceae | <i>Typha latifolia</i> | broadleaf cattail, cattail, cattail (common), common cattail |
| 19049 | Ulmaceae | <i>Ulmus americana</i> | American elm |
| 19055 | Ulmaceae | <i>Ulmus parvifolia</i> | Chinese elm, lacebark elm |
| 19056 | Ulmaceae | <i>Ulmus procera</i> | English elm |
| 19057 | Ulmaceae | <i>Ulmus pumila</i> | Chinese elm, Siberian elm |
| -1E+07 | Urticaceae | <i>Urtica dioica</i> ssp. <i>gracilis</i> var. <i>gracilis</i> | No data |
| -1E+07 | Urticaceae | <i>Urtica dioica</i> ssp. <i>gracilis</i> var. <i>holosericea</i> | No data |
| 35383 | Valerianaceae | <i>Plectritis macrocera</i> | longhorn plectritis, white cornsalad |
| 32085 | Verbenaceae | <i>Verbena bracteata</i> | bigbract verbena, bracted vervain, carpet vervain, prostrate verbena, prostrate vervain |
| 22042 | Violaceae | <i>Viola beckwithii</i> | Beckwith's violet |
| 39068 | Zannichelliaceae | <i>Zannichellia palustris</i> | horned pondweed, horned poolmat, horned-pondweed |
| 29057 | Zygophyllaceae | <i>Tribulus terrestris</i> | Mexican sandbur, Texas sandbur, bullhead, caltrop, goathead, puncture vine, puncturevine |

APPENDIX F: Photo Interpretation Mapping Conventions and Visual Key

This appendix describes the map units for the MIIN Vegetation Classification and Mapping Project. Its purpose is to:

- Describe the vegetation of each map unit;
- Provide a ground photo image for each map unit as available;
- Describe the link between each map unit and the NVC;
- Provide visual examples of each map unit with aerial imagery and delineated overlays.

The 20 map units used for MIIN were based on a combination of NVCS plant associations/alliances, local conditions (i.e. Park Specials), the limitations of the digital imagery, and land use / land cover classes. The vegetation described in this section reflects the classification designed specifically for this project and based on a reconnaissance survey and field work conducted at nearby HAFO between 2006 and 2009. Lookup tables that include the names of each code are included on the accompanying DVD. This guide does not attempt to show all variations within each vegetation map class; only the most common representation is included. They should be sufficient to provide users an understanding of the imagery and the relationships between vegetation classification and mapping.

Forests and Woodlands

Map Code *Ulmus americana* / *Bromus tectorum* Woodland
1 American Elm / Cheatgrass Woodland

Common Species

Ulmus americana,
Bromus tectorum,
Elaeagnus angustifolia,
Elymus cinereus,
Ericameria nauseosa,
Sarcobatus vermiculatus,
Salix lucida,
Salix exigua,
Artemisia tridentata var. *wyomingensis*

NVCS Association

Ulmus americana / *Bromus tectorum* Woodland

Representative Ground Photo



Description

This map unit occurred in MIIN as a few small stands located in disturbed mesic draws, low spots and along the various streams and canals. Stands of this class usually occurred adjacent to and intermixed with other trees, especially Russian olive. Introduced and exotic species were common. The elm trees were generally small, often less than 15 meters tall. On the 2006 imagery the elm trees had a very dark green signature compared to the lighter pale green of the Russian-olive. Mapping of this type was based partly on its signature and partially on its landscape location and where it was known to occur.

Range and Distribution

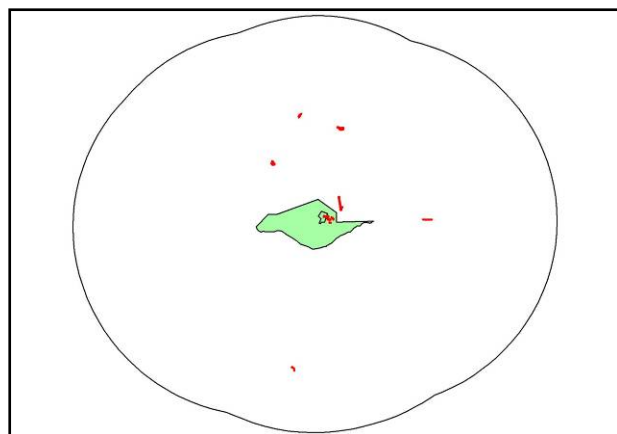


Photo Signature Example



Map Code *Elaeagnus angustifolia* Semi-natural Woodland Alliance
2 Russian-olive Semi-natural Woodland Alliance

Common Species

Elaeagnus angustifolia,
Bromus tectorum,
Chrysothamnus nauseosus,
Sarcobatus vermiculatus,
Artemisia tridentata var. *wyomingensis*

NVCS Associations

Elaeagnus angustifolia / *Bromus tectorum* Semi-natural Woodland
Elaeagnus angustifolia / *Equisetum laevigatum* Semi-natural Woodland
Elaeagnus angustifolia / *Leymus cinereus* Semi-natural Woodland
Elaeagnus angustifolia / *Poa secunda* Semi-natural Woodland
Elaeagnus angustifolia / *Purshia tridentata* / *Leymus cinereus* Semi-natural Woodland
Elaeagnus angustifolia / *Rhus trilobata* var. *trilobata* - *Rosa woodsii* Semi-natural Woodland
Elaeagnus angustifolia / *Sarcobatus vermiculatus* / Mesic Graminoids Semi-natural Woodland

Representative Ground Photo



Description

Russian olive trees were common throughout the study area and were found in much of the riparian zone along the streams, canals and in mesic upland pockets. Polygons of this map unit contained high levels of introduced and exotic species although some natives were also present. Adjacent polygons often contained other tree species such as elms. This map unit had a very distinct pale, blue-green signature and individual trees could be discerned on the 2006 imagery allowing for straight-forward mapping.

Range and Distribution

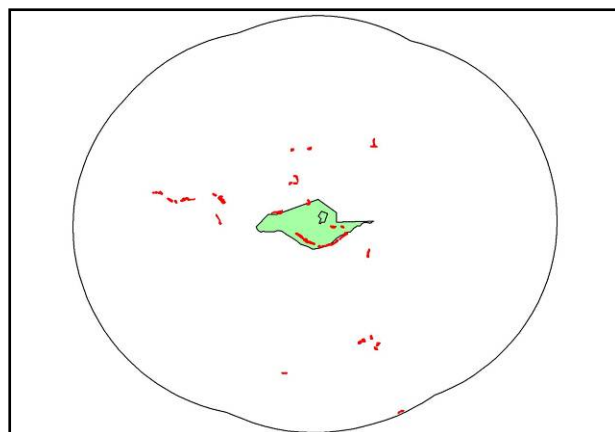


Photo Signature Example



Shrublands

| | |
|-----------------|--|
| Map Unit | <i>Artemisia tridentata</i> ssp. / (<i>Bromus tectorum</i>) Shrubland Complex |
| 3 | Wyoming Big Sagebrush / (Cheatgrass) Shrubland Complex |

Common Species

Artemisia tridentata ssp. *wyomingensis*,
Poa secunda, *Atriplex canescens*,
Achnatherum hymenoides,
Chrysothamnus viscidiflorus,
Atriplex confertifolia, *Bromus tectorum*,
Hesperostipa comata

NVCS Associations

Artemisia tridentata ssp. *wyomingensis* /
Achnatherum hymenoides Shrubland
Artemisia tridentata ssp. *wyomingensis* /
Hesperostipa comata Shrubland
Artemisia tridentata ssp. *wyomingensis* / *Poa secunda* Shrubland
Artemisia tridentata ssp. *wyomingensis* - *Atriplex confertifolia*
Shrubland
Artemisia tridentata ssp. *wyomingensis* - *Chrysothamnus viscidiflorus* / *Achnatherum hymenoides* Shrubland
Artemisia tridentata ssp. *wyomingensis* / *Bromus tectorum* Semi-natural Shrubland
Artemisia tridentata ssp. *wyomingensis* / *Bromus tectorum* Semi-natural Shrub Herbaceous Vegetation
Artemisia tridentata ssp. *tridentata* / *Bromus tectorum* Semi-natural Shrubland

Representative Ground Photo



Description

This was a common map unit occurring on upland slopes, benches and terraces. Cheatgrass or other non-native grasses were usually present in the understory. On the 2006 imagery this type varied in appearance from dispersed small gray dots against a tan background (sparse situations) to a more homogenous gray-brown mottled texture (dense stands).

Range and Distribution

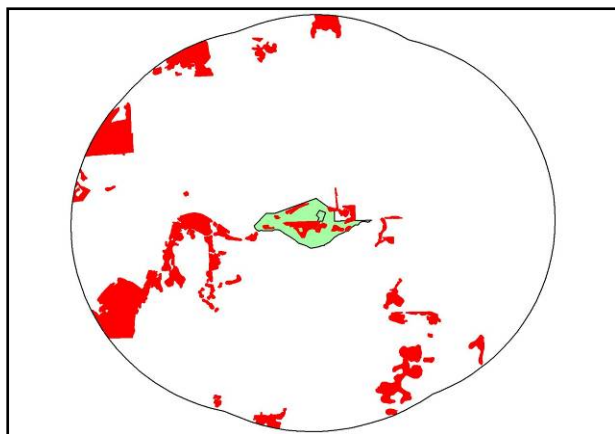


Photo Signature Example



| | |
|-----------------------------|--|
| Map Unit
4 | <i>Sarcobatus vermiculatus</i> Intermittently Flooded Shrubland Alliance
Black Greasewood Intermittently Flooded Shrubland Alliance |
|-----------------------------|--|

Common Species

Sarcobatus vermiculatus,
Bromus tectorum,
Leymus cinereus,
Artemisia tridentata ssp. *wyomingensis*,
Artemisia tridentata ssp. *tridentata*

NVCS Association

Sarcobatus vermiculatus / *Bromus tectorum* Semi-natural Shrubland
Sarcobatus vermiculatus / *Leymus cinereus* Shrubland

Representative Ground Photo (HAFO Photo)



Description

Greasewood was a rare map unit found along the streams and canals in the study area. Polygons of this type often contained cheatgrass in the understory along with similar species found in the sagebrush map unit. On the 2006 imagery this type appeared as dark dots against a tan or brown background. When greasewood occurred in higher densities it often had a rougher signature and was less brown and greyer in appearance.

Range and Distribution

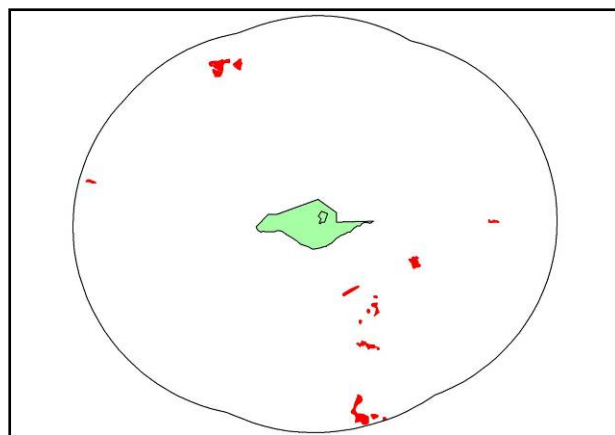


Photo Signature Example



| | |
|-----------------------------|--|
| Map Unit
5 | <i>Salix exigua</i> - <i>Salix lucida</i> ssp. <i>caudata</i> Shrubland Complex
Coyote Willow – Whiplash Willow Shrubland Complex |
|-----------------------------|--|

Common Species

Salix exigua,
Salix lucida,
Artemisia tridentata var. *wyomingensis*,
Bromus tectorum,
Elymus cinereus,
Typha latifolia

NVCS Associations

Salix exigua / Barren Shrubland
Salix exigua / Mesic Forbs Shrubland
Salix lucida ssp. *caudata* / *Thinopyrum intermedium*
Semi-natural Shrubland

Representative Ground Photo



Description

Small stands of willow were observed in riparian and mesic sites throughout the project area, often intermixed or occurring adjacent to Russian olive map units. This type is characterized by having small to medium-sized willow shrubs often with associated trees. When the willows were small (mostly *Salix exigua*) they appeared as a slightly mottled to smooth light green signature changing to a more dark green when they became larger (likely *Salix lucida*). Due to the close similarity of their signatures and their intermixing, the two species of willow could not be accurately separated in the mapping.

Range and Distribution

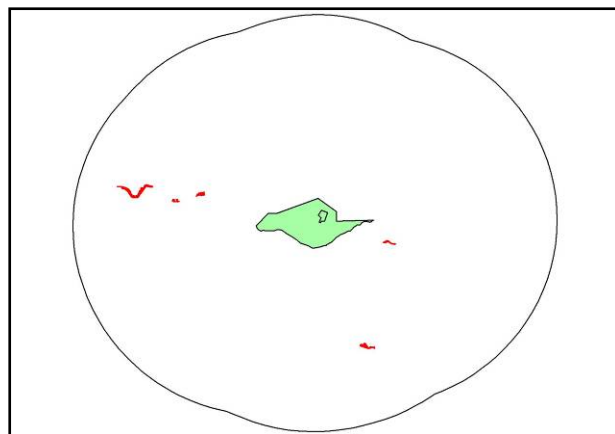


Photo Signature Example



Map Unit ***Ericameria (Chrysothamnus) spp. Shrubland Complex***
6 **Rabbitbrush Shrubland Complex**

Common Species

Ericameria nauseosa,
Chrysothamnus viscidiflorus,
Achnatherum hymenoides,
Bromus tectorum,
Chrysothamnus viscidiflorus,
Hesperostipa comata,
Artemisia tridentata ssp. wyomingensis

NVCS Associations

Ericameria nauseosa - *Chrysothamnus viscidiflorus* /
(*Achnatherum hymenoides*) - *Bromus tectorum*
Semi-natural Shrubland
Chrysothamnus viscidiflorus / *Hesperostipa comata*
Shrubland

Representative Ground Photo



Description

Stands of this type were very rare in the project area, only found next to the park boundary in small pockets on disturbed slopes. This map unit often intermixed with the sagebrush map unit and often contained similar associated species such as cheatgrass. On the 2006 imagery, this type had a very light green tint and was mapped based on where it was known to occur. Other small pockets likely occur in the project area but were not large or homogeneous enough to accurately delineate.

Range and Distribution

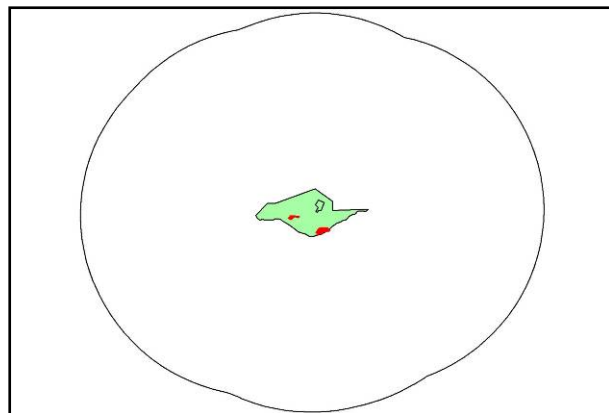


Photo Signature Example



Herbaceous Vegetation

| | |
|-----------------|--|
| Map Unit | <i>Distichlis spicata</i> Herbaceous Vegetation |
| 7 | Inland Saltgrass Herbaceous Vegetation |

Common Species

Distichlis spicata

NVCS Association

Distichlis spicata Herbaceous Vegetation

Representative Ground Photo



Description

This type was mapped based on field observations made on site. Since no data was collected, understory and associated species are unknown, although it is likely that this type contained some cheatgrass and other non-native grasses. On the 2006 imagery, this type appeared to occur on white to lightly tan soils likely a result of salts and other mineral deposits along irrigation canals and streams.

Range and Distribution

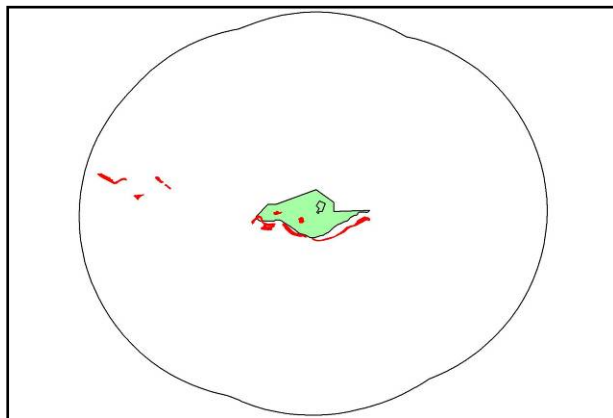


Photo Signature Example



| | |
|-----------------------------|---|
| Map Unit
8 | <i>Eleocharis palustris</i> - <i>Typha latifolia</i> Wetland Vegetation Complex
Marsh Spikerush – Broadleaf Cattail Wetland Vegetation Complex |
|-----------------------------|---|

Common Species

Typha latifolia,
Eleocharis palustris,
Schoenoplectus spp.,
Elymus elymoides

NVCS Association

Eleocharis palustris Herbaceous Vegetation
Typha (*angustifolia*, *latifolia*) - (*Schoenoplectus*
spp.) Semipermanently Flooded Herbaceous
Alliance

Representative Ground Photos (HAFO Photo)



Description

This wetland type was found along a few mesic drainage bottoms. Polygons of this type typically contained mixed stands of wetland species likely including cattails, spikerush, sedges, and various graminoids. It was impossible to tell from the imagery which wetlands species occurred in these sites so the map unit was inferred from the HAFO data. On the 2006 imagery this type was mapped partially by its landscape position in drainage bottoms and partially by its characteristic solid, smooth green color. Polygons of this type may have been confused with small willow stands or open water.

Range and Distribution

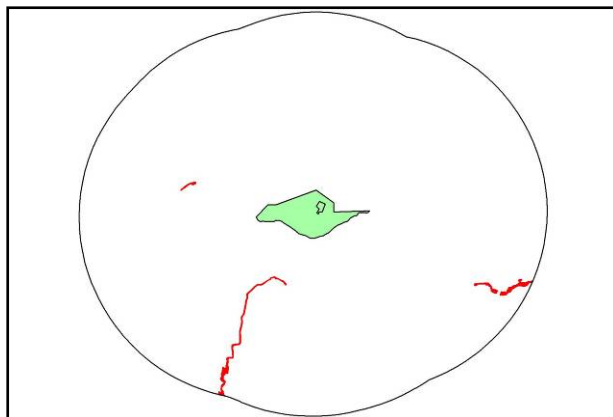


Photo Signature Example



| | |
|-----------------------------|--|
| Map Unit
9 | <i>Bromus tectorum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation
Cheatgrass / Tumble Mustard Herbaceous Vegetation |
|-----------------------------|--|

Common Species

Bromus tectorum,
Sisymbrium altissimum

NVCS Association

Bromus tectorum / *Sisymbrium altissimum*
Herbaceous Vegetation

Representative Ground Photo



Description

Cheatgrass was very common at MIIN and this map unit was used to map large areas containing very little shrub cover. Stands of cheatgrass ranged from thick, lush stands on flat uplands to sparser areas along agricultural field edges. This map unit was also used to map areas that were recently disturbed or where the sagebrush was dead. On the 2006 imagery stands of cheatgrass with sufficient cover (>20%) had a characteristic smooth, orange brown color.

Range and Distribution

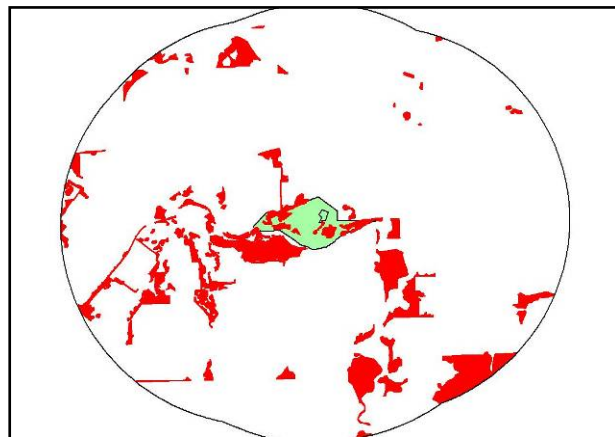


Photo Signature Example



| | |
|------------------------------|--|
| Map Unit
10 | <i>Agropyron cristatum</i> / <i>Sisymbrium altissimum</i> Herbaceous Vegetation
Crested Wheatgrass / Tumble Mustard Herbaceous Vegetation |
|------------------------------|--|

Common Species

Agropyron cristatum
Sisymbrium altissimum
Bromus tectorum

NVCS Association

Agropyron cristatum / *Sisymbrium altissimum*
Herbaceous Vegetation

Representative Ground Photo (HAFO Photo)



Description

This type was used to map primarily pasture and previously cultivated lands that were planted with non-native grasses. These areas occurred in and among cultivated and irrigated fields. It is likely that other non-native grasses like *Broumus* spp. and *Poa* spp. occur in these sites. On the 2006 imagery this type usually had a very mottled, dark brown-grey color and old field lines were sometimes apparent. Mapping of this type likely includes areas with high cheatgrass cover and possibly some pockets of native grasses.

Range and Distribution

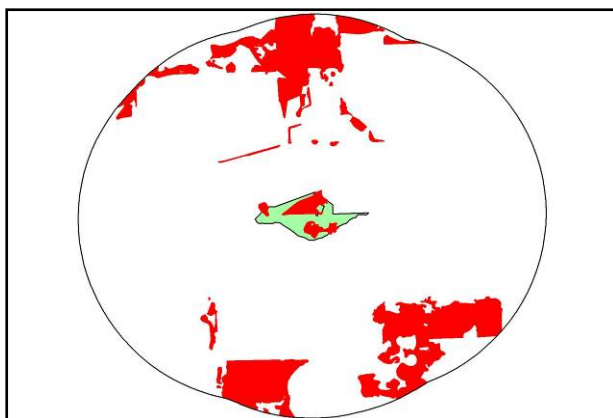
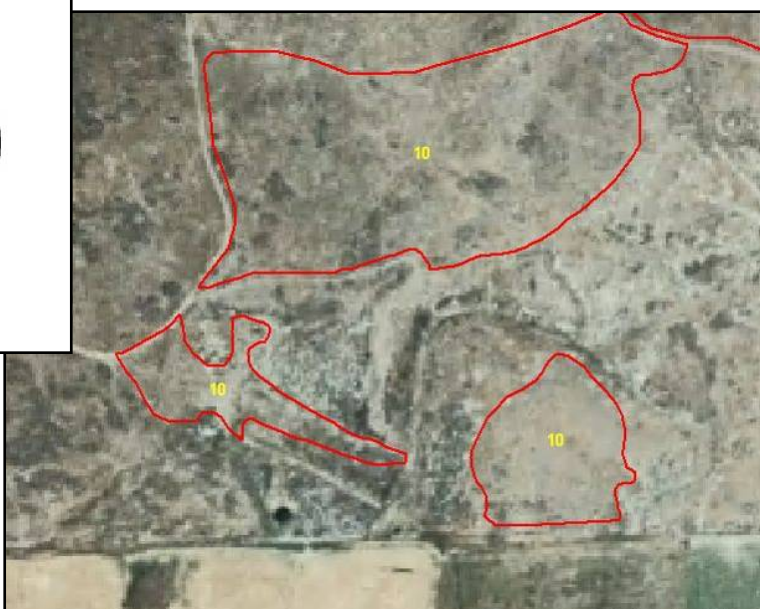


Photo Signature Example



Map Unit Annual Weedy Herbaceous Vegetation Complex
11

Common Species

Lactuca tatarica,
Lactuca serriola,
Cirsium arvense,
Bromus inermis,
Bromus japonicus,
Cryptantha spp.,
Helianthus annuus,
Kochia scoparia,
Lepidium perfoliatum,
Sisymbrium altissimum

NVCS Association

Lactuca tatarica var. *pulchella* Herbaceous
Vegetation

Representative Ground Photo



Description

This type represents disturbed sites, including fallow fields, field boundaries, road edges and old pastures. Although cheatgrass and crested wheatgrass were usually present in these stands they were not the clear dominant. Other common species in this map unit were mainly weedy annuals varying greatly in composition and density from site to site. This successional type has likely replaced native grasslands or big sagebrush shrublands. At MIIN this type had various signatures on the 2006 imagery ranging from mottled tans, to blotchy greens all characteristic of disturbed sites.

Range and Distribution

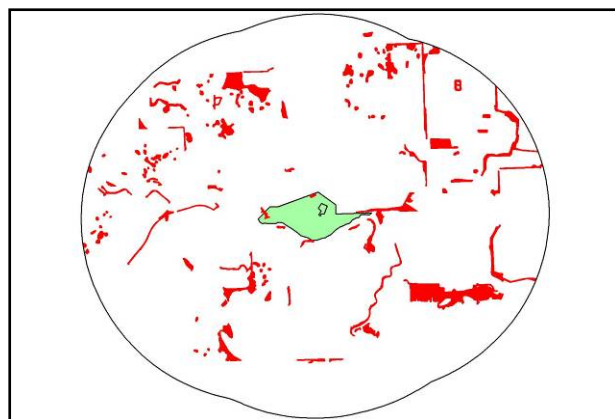
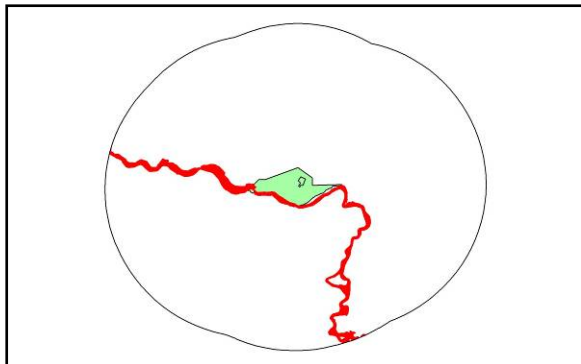


Photo Signature Example

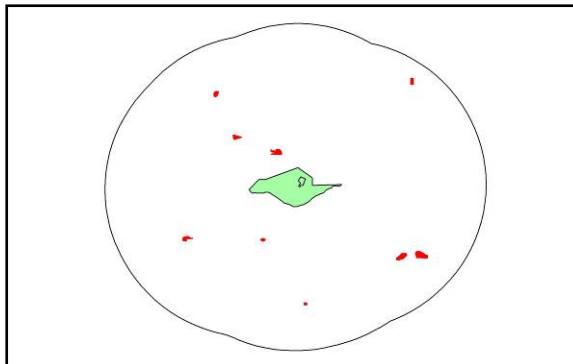


LAND COVER – LAND USE

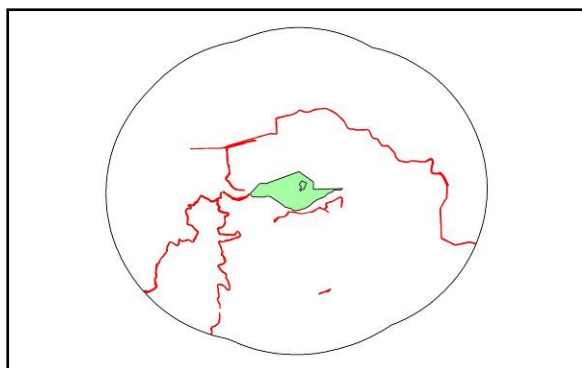
MAP CODE **Stream / River**
12



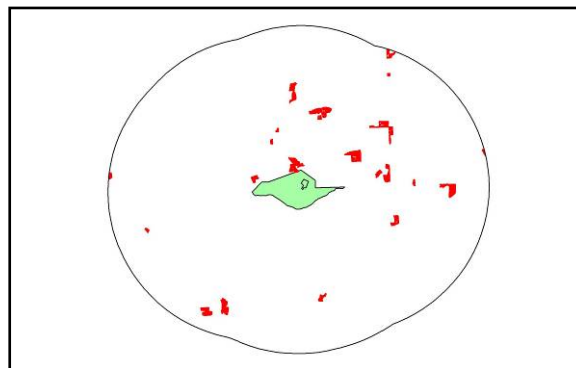
MAP CODE **Lake / Pond**
14



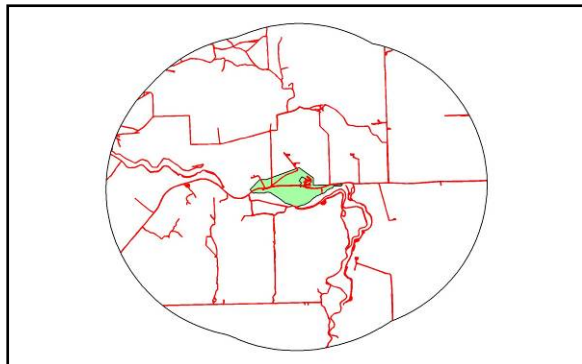
MAP CODE **Canal / Ditch**
13



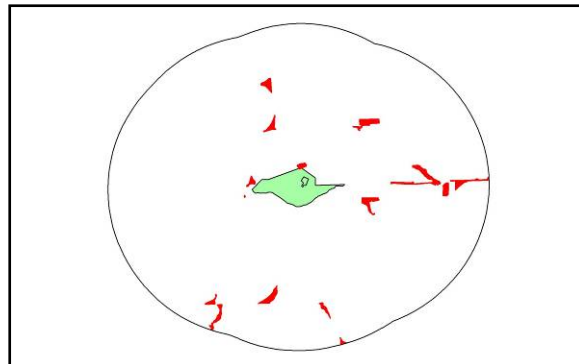
MAP CODE **Agricultural Business**
15



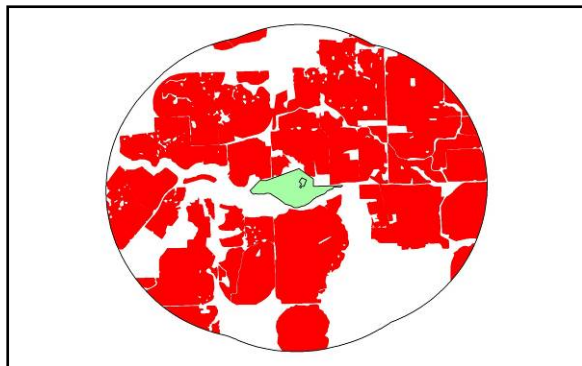
MAP CODE
16 **Transportation**



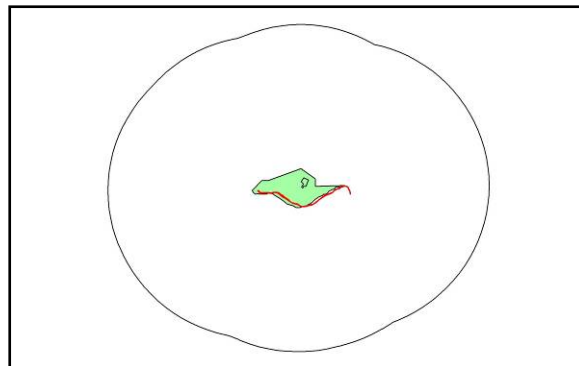
MAP CODE
18 **Transistional**



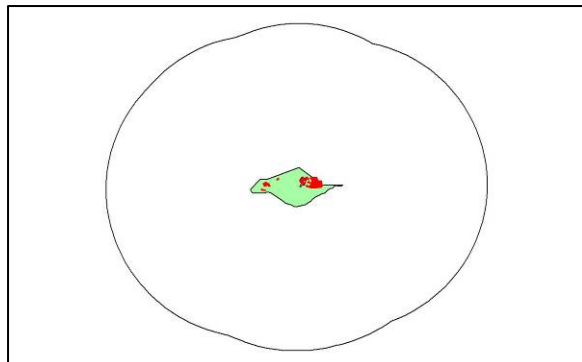
MAP CODE
17 **Planted / Cultivated**



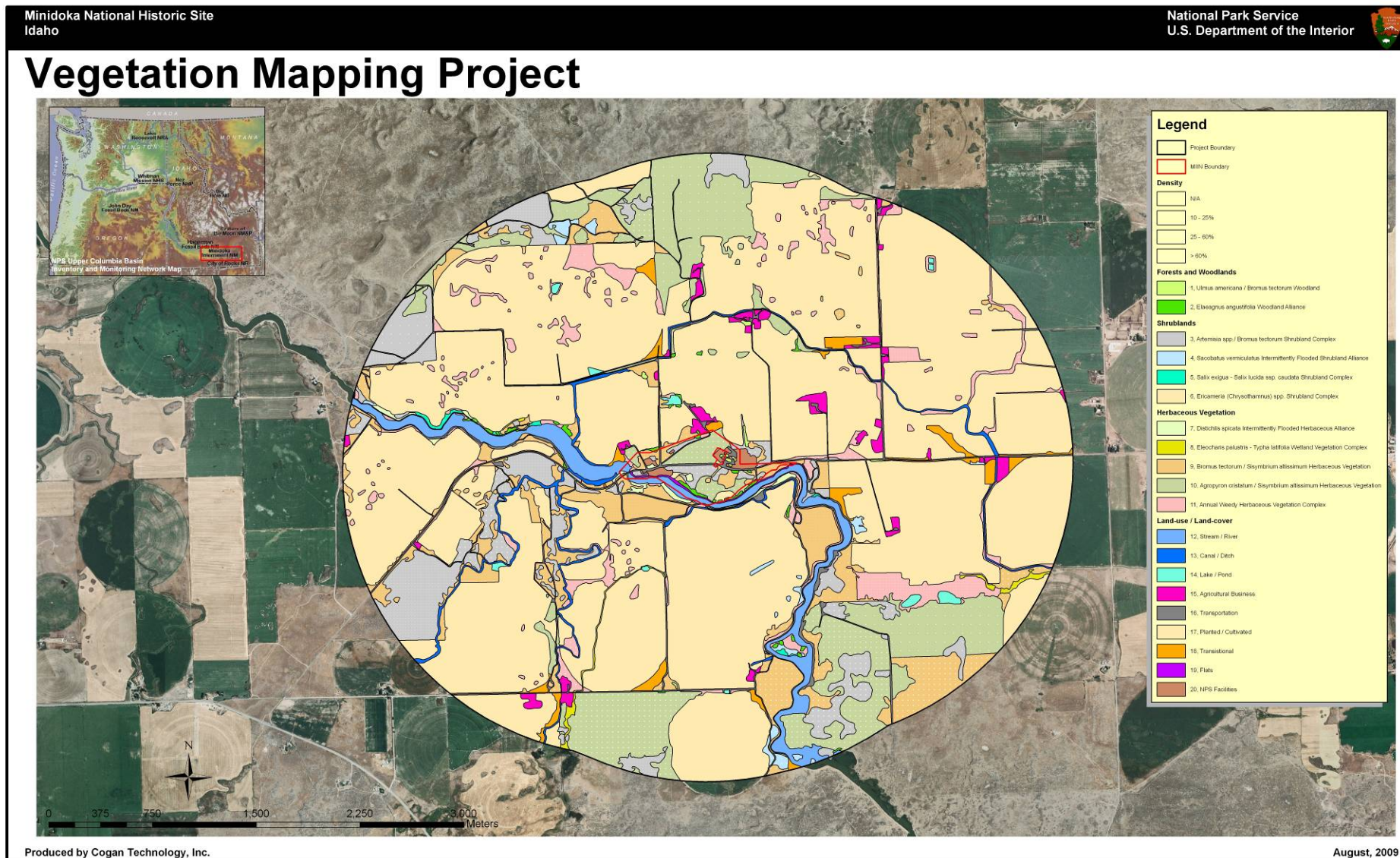
MAP CODE
19 **Flats**



MAP CODE NPS Facilities
20



APPENDIX G: Final MIIN Vegetation Map



The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities

NPS D-XXX, August 2009

USGS-NPS Vegetation Mapping Program
Minidoka National Historical Site

National Park Service
U.S. Department of the Interior



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