

Draft Final Report: LIBI Vegetation Mapping Report

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Introduction

Little Bighorn Battlefield National Monument commemorates a battle that directed the course of American history: the Battle of the Little Bighorn, in 1876, when the 7th Cavalry forces of Lieutenant Colonel George Armstrong Custer were decimated by combined Lakota Sioux, Cheyenne, and Arapaho warriors. The park interprets this battle, as well as westward expansion and settlement of the U.S., and its effects on the Great Plains tribes.

The Monument is in southeast Montana approximately 55 linear miles southeast of Billings, the largest regional city, and approximately 13 miles southeast of Hardin the largest proximal town. The Monument has two separate units connected by four miles of a narrow two-lane tour road. The larger Custer Battlefield unit is on the northwest end and the smaller Reno-Benteen Battlefield unit is to the southeast.

The area has continental climate with relatively low precipitation (12.1 in/year), hot summers (July average high 91.7° F), and cold winters (January average low 10.9° F). Rainfall is greatest in the mid spring through early summer months, but the peak occurring in May is only 1.98 inches. The overall patterns of precipitation and temperature promote cool season grasses.

The Monument has two distinct ecological and topographic zones of the Northern Great Plains, dry uplands and the Little Bighorn River floodplain. The elevation range is from approximately 3,000 ft to 3,400 ft. The uplands are formed from the Bearpaw and Judith River formations. The higher elevation Bearpaw Formation to the northeast is a marine sedimentary rock, primarily shale, from the Cretaceous Period. The lower uplands to the southwest are part of the sedimentary Judith River Group formed in lowland areas during the late Cretaceous. The Judith River Formation can contain fossilized dinosaurs. The demarcation between the uplands and Little Bighorn River floodplain along the southwest boundary of the Custer Battlefield unit is abrupt with steep cliffs along most of the transition. Natural erosion processes are occurring along the Little Bighorn River on the Custer Battlefield unit southeast boundary. The floodplain itself is Quaternary alluvium. The Reno-Benteen Battlefield unit is entirely in the uplands. Soils range from deep to very shallow, and from clay to loamy fine sands. Silty clay loams are the predominant texture class. Across both units the lower slopes and shales have deep soils, which are prone to both wind and water erosion (National Park Service 2007). Small ravines start on the upper slopes, run to the southwest, and are deeply cut by the time they reach the floodplain.

The uplands consist of relatively intact native mixed-grass prairie. The narrow ravines dissecting the uplands form a favorable microclimate for woody vegetation and are termed woody draws. Protected since shortly after the battle in 1876, and central to its mission the native prairie has not been grazed by livestock since it was fenced in 1891. The Little Bighorn River floodplain is dominated by native riparian trees and shrubs. The Monument also has landscaped areas that encompass a National Military Cemetery and various buildings. Major factors effecting the native vegetation are wildfire and fire suppression, lack of intensive grazing on the native grass prairie, flow regulation of the Little Bighorn River, erosion, and a moderate level of exotic plant invasion (Britten et al 2007).

The standard flora references for the area are Dorn (1984) or Hitchcock and Cronquist (1973). The upland grassland dominants include varying proportions of bluebunch wheatgrass (*Agropyron spicatum*, *Pseudoroegneria spicata*) and rhizomatous western wheatgrass (*Agropyron smithii*, *Pascopyrum smithii*). Needle and thread grass (*Stipa comata*, *Hesperostipa comata*), green needlegrass (*Stipa viridula*, *Nassella viridula*), and prairie sand reedgrass (*Calamovilfa longifolia*) are common in more clumped distributions. Several short graminoids are common but occur with low cover values and even more patchy distributions; these include threadleaf sedge (*Carex filifolia*), sideoats grama (*Bouteloua curtipendula*), and blue grama (*Bouteloua gracilis*). Two exotic annual bromes, cheatgrass (*B. tectorum*) and Japanese brome (*B. japonicus*, *B. arvensis*) are not uncommon in these uplands.

Wyoming big sagebrush (*Artemisia tridentata*) is the most abundant upland shrub. However, vegetation monitoring done over two decades by Bock and Bock (2006) after a 1983 wildfire in the Custer unit and a 1991 wildfire in the Reno-Beenteen unit did not find any reestablishment of big sagebrush in the burn zones. Bock and Bock (2006) conclude that the current presence of big sagebrush is a Native American grazing era disclimax. Native American horse herds made extensive use of this area in the Nineteenth Century. Black greasewood (*Sarcobatus vermiculatus*) and skunkbush sumac (*Rhus trilobata* (syn. *aromatica*)) are common as scattered individuals or in low cover clumped distributions. The more mesic woody draws can support quite dense but small stands of western snowberry (*Symphoricarpos occidentalis*), Rocky Mountain juniper (*Juniperus scopulorum*), common chokecherry (*Prunus virginiana*), and box elder (*Acer negundo*). The transition zone from the lowest reaches of the woody draws to the floodplain can support green ash (*Fraxinus pennsylvanica*).

The largest dominants on the floodplain are green ash along with eastern or Great Plains cottonwood (*Populus deltoides*). Common chokecherry (*Prunus virginiana*) and box elder (*Acer negundo*) are common. Diagnostic short, woody species on the floodplain include silver sage (*Artemisia cana*), silver buffaloberry (*Shepherdia argentea*), and sandbar or coyote willow (*Salix exigua*). The exotics salt cedar (*Tamarix* sp.) and Russian olive (*Elaeagnus angustifolia*) have made a few small inclusions on the floodplain.

At a planning meeting held at the Little Bighorn Battlefield N.M. which included park staff, Inventory and Monitoring Program staff, and the project Principal Investigator, it was decided to census every polygon and community type rather than sample and conduct a supervised classification using field data to train the remote sensing software. This is a relatively small park, only 765 acres, making it a likely target for alternative methods. Further, an initial segmentation of the imagery indicated approximately 1,500 polygons would represent the two, combined units; this estimate confirmed that a census could be achieved with reasonable effort. This decision is in accordance with NPS Vegetation Mapping Program guidance for small park units (National Park Service 2008).

Vegetation Classification: Methods & Results

Vegetation classification for National Park Service Vegetation Mapping Program (NPS-VMP) projects follows the National Vegetation Classification Standards, as maintained by the Federal Geographic Data Committee (FGDC). The FGDC maintains definitions of vegetation types to the hierarchical level of Formation. Units comprising the finer (floristic) levels, alliances and associations, are not currently recognized by FGDC. NatureServe (NatureServe 2007) maintains a provisional list of alliances and associations. The NPS-VMP uses this list for defining alliances and associations, to the extent practicable.

A common (recommended for large units, >1000ac) practice is to define local (park unit) vegetation units based on adequately replicated local observations (sample units) that represent a reasonably complete span of the floristic variability of each purported vegetation type, preferably from quantitative [releve] plot data. Vegetation types (usually, associations) are grouped by similarity to one another and by an appropriate level of floristic differences from other groups. These groups are then matched ("crosswalked") to the most similar units maintained by NatureServe (NatureServe 2007). In most cases, a suitable concept can be found.

The upland and woody draw polygons at Little Bighorn were initially classified by the field mapping team according to Hansen and Hoffman (1988). The Little Bighorn River riparian zone was initially mapped according to Hansen et al. (1995). The uplands were mapped from June 10 through June 23, 2006. The floodplain was mapped from July 10 through July 18, 2006 after the river had receded.

Hansen and Hoffman (1988) developed a habitat typing classification for a western portion of the northern Great Plains by sampling upland vegetation plots from southeastern Montana to northwestern South Dakota. The Little Bighorn River drainage is approximately fifty miles west of the Hansen & Hoffman (1988) study area. Hansen et al. (1995) provides community and habitat types for riparian vegetation across the entire state of Montana. A major subsection of Hansen et al. (1995) covers riparian and wetland sites for the Northern Great Plains. The field mapping team used the two keys from the original classification systems. Topographic position determined which key to employ. There is a salient demarcation between uplands at Little Bighorn Battlefield and the river floodplain although the mouths of the woody draws form short ecotones from upland woody draw to floodplain vegetation.

Vegetation Mapping: Methods & Results

Base images

The University of Montana Wildlife Spatial Analysis Lab (WSAL) was contracted by the NPS to assist in the vegetation mapping and inventory of Little Bighorn Battlefield, specifically to provide GIS and Remote Sensing expertise to the project. The WSAL was provided with 2004 True Color NAIP Aerial photography with a 2 meter pixel size, as well as several GIS layers including the park boundary and soil layer.

Segmentation, assembly, and final modifications

Segmentation is the process of dividing an image into regions that are defined by greater spectral homogeneity within each segment than the spectral diversity found in the surrounding matrix. Whereas traditionally aerial photos were interpreted by manually delineating regions onto mylar overlays, this project used eCognition software (Definiens Corp.) to delineate the map unit regions using an automated algorithm. Initially we began by intersecting the Little Bighorn Battlefield park boundary layer with the soils layer. This layer was then attributed according to the complexity of the communities contained in each soil unit. We wanted less diverse areas (uplands) to be segmented into larger regions, and more complex communities (floodplain and woody draws) to be segmented into smaller regions.

Image segmentation using eCognition is an iterative process with some manual edits made between each of the automated runs. The base imagery used for this segmentation was 2004 NAIP true-color aerial photographs with a spatial resolution of 2 meters/pixel. The initial segmentation was based on this imagery but used the shapefile to force some of the region boundaries. In subsequent segmentations the shapefile was removed and the regions were then re-segmented according to the levels of segmentation desired for each initial zone. Before the regions were exported out of eCognition, the road and water features were merged into single contiguous polygons in order to simplify them. When completed the final segmentation resulted in 1516 regions within the park boundary not including water or roads. The largest region was 54.7 acres and the smallest region was .004 acres (4 pixels).

After the field mapping crew finished the initial polygon census, they entered the data into a MS access database. This data was quality checked and the final version was passed to WSAL. Several polygons were modified using Arcmap 9.1 according to coordinates supplied by the field crew. Any new polygons created had a letter added to their original polygon-id field, i.e. 1241 became 1241a, 1241b, etcetera. A crosswalk table links the initial field key types to the NVC series of hierarchical classifications and the field comments for each type. These classification attributes were then joined to the final WSAL GIS database.

Field mapping protocol

A two person botany team connected the initial polygon mapping to a field-identified vegetation type. They were provided with GPS (Garmin 63c) and Polygon Data Forms referencing each polygon number and the UTM coordinates for the approximate center of the polygon (Appendix XX). They also had printed map sheets with the NAIP base images, polygon boundaries, polygon numbers, and the approximate centroids for the polygons. The plant community mappers were assigned separate sets of polygons and mapped independently. These botanists navigated into the polygon using the GPS and reference to the printed map. Super Classes had been assigned to every polygon during segmentation based on whether that polygon was within or outside the Park boundary, upland or floodplain and woody draw topography, a vegetated or a non-vegetated polygon because of water, development, roading, or unclassified factors. The botanist confirmed or adjusted the segmentation assigned Super Class. After inspecting each vegetated polygon as a whole for dominants and indicator species the polygon

was assigned to a community type based on the original keys developed by Hansen and Hoffman (1988) for uplands and woody draws or Hansen et al (1995) for the floodplain. To facilitate accuracy assessment, a reference waypoint was recorded within each polygon in a location representative of the polygon (positioning error estimated and recorded, see the geodatabase table, 'tblPolygonFieldAssociation'). The cover class of dominant indicator species (one to three) was recorded at that representative, reference point. Cover classes were based on the traditional Braun-Blanquet cover scale: T=<1%, 1=1–5%, 2 = 6–25%, 3 = 26–50%, 4 = 51–75%, 5 = 76–95%, 6 = 96–100%. A supplemental Polygon Notes form was completed for any polygon that needed a boundary adjustment or had unusual aspects that could not be resolved immediately at the time of the initial mapping visit.

Initial map unit veg type classification summary & crosswalk to Association

Initial classification recognized 15 Hansen and Hoffman 1988 upland and woody draw habitat types (Table VM1). Two NVCS Alliance types were assigned for natural upland vegetation that could not be directly classified using Hansen and Hoffman 1988. These Alliances were the *Prunus virginiana* Shrubland Alliance characterized by upland draw chokecherry thickets and *Pseudoroegneria spicata* Herbaceous Alliance where the grassland community could not be typed to a finer level because of the lack of strong indication of a second diagnostic species. The upland also had some Disturbed Area polygons where severe disturbance of surface soil had allowed the formation of mixed species weedy communities that could not be typed. Also some portions of the uplands were Landscaped with bluegrass lawn or spruce trees. These Landscaped polygons consisted of the military cemeteries and areas around the buildings.

Ten Hansen et al 1995 floodplain vegetation types were initially recognized. Eight were native communities. Two were small stands of invasive woody species. The invader stands were 0.05 acres of *Elaeagnus angustifolia* community type and 0.7 acres of *Tamarix chinensis* community type.

Agropyron spicatum (*Pseudoroegneria spicata*) and *Agropyron smithii* (*Pascopyrum smithii*) habitat types comprise two-thirds of the Park acreage (Table VM2). These two grasses are often codominants or at least sympatric, but *Agropyron spicatum* is typically more abundant on steeper slopes and coarser soils while *Agropyron smithii* tends to dominate more level sites and clay textured soils. These upland native grass types also form the largest continuous polygons. Sagebrush communities (*Artemisia*) are much less prevalent than they were before the 1983 and 1991 wildfires, dead charred bases of sagebrush and other non-sprouting shrubs are still evident throughout the uplands. Although the sagebrush types are similar in abundance the patch size for *Artemisia cana*/*Agropyron smithii* is much smaller than *Artemisia tridentata*/*Agropyron smithii* or *Artemisia tridentata*/*Agropyron spicatum*. *Artemisia cana*/*Agropyron smithii* is generally associated with deeper soils.

Populus deltoides/*Symphoricarpos occidentalis* in the floodplain and *Symphoricarpos occidentalis* in the upland woody draws and the floodplain are the predominant woody vegetation types but the total acreage and the patch sizes are an order of magnitude smaller than the two most prevalent upland grass types. *Populus deltoides* regeneration (*Populus deltoides*/Recent alluvial bar) is very limited. *Salix exigua* is the principle initial colonizing type of the river edges but occupies less than 7 acres. *Fraxinus pennsylvanica*/*Prunus virginiana* floodplain is the second most prevalent large tree type but only totals 8 acres. There are also two small clumps of *Fraxinus pennsylvanica*/*Prunus virginiana* upland type in the lower reaches of the woody draws where greater seepage allows an ecotone transition to floodplain types.

There are a number of other low prevalence shrub and small tree types in upland, woody draw, and floodplain habitats. Numerous small low density patches of *Rhus trilobata*/*Agropyron spicatum*, *Sarcobatus vermiculatus*/*Agropyron smithii* and few patches of *Sarcobatus vermiculatus*/*Agropyron spicatum* are scattered throughout the uplands. The upland woody draw *Prunus virginiana* shrubland Alliance and the *Prunus virginiana* floodplain community type form

small but very dense thicket stands. Three stands of *Acer negundo/Prunus virginiana* habitat type were found in the floodplain. The *Shepherdia argentea* community type is a small component of the floodplain vegetation and the *Shepherdia argentea* habitat type is a very minor part of the upland communities. *Juniperus scopulorum/Agropyron spicatum* occupies less than one acre in the woody draws but numerous dead trunks indicate juniper was more prevalent before the wildfires.

Accuracy Assessment

AA field protocol

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Field key for AA team (see Appendix XX)

A dichotomous field community classification key was prepared for the accuracy assessment team. Subsequent to the accuracy assessment done in June 2007 the accuracy assessment leader modified the key to incorporate improvement that became evident during the assessment (Appendix A4).

Final Map Classes

The accuracy assessment found 58% agreement between the map classes and subsequent user assessment, based on the original 27 natural and semi-natural types proposed for Little Bighorn Battlefield N.M. In crosswalking these types to the NVC Associations recognized by NatureServe (2007) we realized that the original habitat type concepts were sometimes finer than NVC associations. This was due in part to the mapping methodology, which sometimes appeared to constrain the observation areas by defining very small stands, and also our inability to duplicate the field calls made by the mapping team at better than 58%. It could be assumed that there was no remote sensing "error" so that all errors made during the mapping process were due to difficulties in interpreting and repeating the original ecological treatment. Examining the accuracy assessment contingency table for patterns of type confusion (e.g. two types frequently, reciprocally misidentified as the other) that were also ecologically similar yielded several decisions to combine these types into a single map class in the final products. Details of the post-hoc aggregation of ecologically similar or operationally indistinguishable types are described (below) for the six types that appear as Map Classes.

The *Populus deltoides/Symphoricarpos occidentalis* Community Type, the *Acer negundo/Prunus virginiana* Community Type, and floodplain stands of the *Fraxinus pennsylvanica/Prunus virginiana* Habitat Type were merged into the *Populus deltoides-Fraxinus pennsylvanica* Forest. Upland draw stands of the *Fraxinus pennsylvanica/Prunus virginiana* Habitat Type were treated as the *Fraxinus pennsylvanica / Prunus virginiana* Forest.

The *Salix exigua* Community Type, and small stands of *Populus deltoides* saplings in swales in similar habitat were merged to create the *Salix exigua* Shrubland.

The *Shepherdia argentea* Community Type, and stands of *Tamarix chinensis* and *Eleagnus angustifolia* were merged to create the *Shepherdia argentea* Shrubland.

The *Sarcobatus vermiculatus/Agropyron spicatum* Habitat Type and the *Sarcobatus vermiculatus/Agropyron smithii* Habitat Type and merged into the *Sarcobatus vermiculatus/Pascopyrum smithii* Shrub Herbaceous Vegetation.

The *Agropyron spicatum*/*Carex filifolia* Habitat Type, the *Agropyron spicatum*/*Bouteloua curtipendula* Habitat Type, the *Calamovilfa longifolia*/*Carex heliophila* Habitat Type, and the *Pseudoroegneria spicata* Herbaceous Alliance were merged into the *Pseudoroegneria spicata* – *Carex filifolia* Herbaceous Vegetation.

The *Agropyron smithii*/*Carex filifolia* Habitat Type and the *Stipa comata*/*Carex filifolia* Habitat Type were merged into the *Pascopyrum smithii* – *Nassella viridula* Herbaceous Vegetation.

The analysis and synthesis of the accuracy assessment coalesced the original 27 natural and semi-natural types plus the weedy Disturbed Area polygons to 17 NVCS Associations. The resultant overall accuracy is 77.6% (final contiguency table in Appendix XX).

Hierarchical Summary of NVCS for Little Bighorn Battlefield National Monument

NVCS Association and Complex Common Name/Synonym

FOREST & WOODLANDS:

Populus deltoides - *Fraxinus pennsylvanica* Forest
Eastern Cottonwood - Green Ash Forest

Fraxinus pennsylvanica / *Prunus virginiana* Forest
Green Ash / Choke Cherry Forest

Juniperus scopulorum / *Pseudoroegneria spicata* Woodland
Rocky Mountain Juniper / Bluebunch Wheatgrass Woodland

SHRUBLANDS:

Prunus virginiana – (*Prunus americana*) Shrubland
Choke Cherry-(Wild Plum) Shrubland

Salix exigua Temporarily Flooded Shrubland
Coyote Willow Temporarily Flooded Shrubland

Shepherdia argentea Shrubland
Silver Buffalo-berry Shrubland

Symphoricarpos occidentalis Shrubland
Western Snowberry Shrubland

HERBACEOUS VEGETATION:

Pascopyrum smithii - *Nassella viridula* Herbaceous Vegetation
Western Wheatgrass - Green Needlegrass Mixedgrass Prairie

Agropyron cristatum - (*Pascopyrum smithii*, *Stipa comata*) Semi-natural Herbaceous Veg.
Crested Wheatgrass - (Western Wheatgrass, Needle-and-Thread Grass) Semi-natural Herbaceous Vegetation

Pseudoroegneria spicata - *Carex filifolia* Herbaceous Vegetation
Bluebunch Wheatgrass – Threadleaf Sedge Mixed Prairie

Artemisia cana ssp. *cana* / *Pascopyrum smithii* Shrub-Herbaceous Vegetation
Plains Silver Sagebrush / Western Wheatgrass Shrub Prairie

Artemisia tridentata ssp. *wyomingensis* / *Pascopyrum smithii* Shrub-Herbaceous Veg.
Wyoming Big Sagebrush / Western Wheatgrass Shrub Prairie

Artemisia tridentata ssp. *wyomingensis* / *Pseudoroegneria spicata* Shrub-Herb. Veg.
Wyoming Big Sagebrush / Bluebunch Wheatgrass Shrub Prairie

Rhus trilobata / *Pseudoroegneria spicata* Shrub-Herbaceous Vegetation
Skunkbush Sumac / Bluebunch Wheatgrass Shrub Prairie

Sarcobatus vermiculatus / *Pascopyrum smithii* - (*Elymus lanceolatus*) Shrub-Herb. Veg.
Greasewood / Western Wheatgrass Shrub Prairie

Great Plains Floodplain Herbaceous Vegetation

Weedy Annual Great Plains Herbaceous Vegetation

Table AA1 summarizes the prevalence of each post accuracy Association, and detailed descriptions of each type are provided in Appendix XX.

Summary Discussion

Two preexisting plant community classification systems, one for uplands and woody draws and the second for floodplains, allowed direct typing of most of the vegetation polygons at the Little Bighorn National Monument. Hansen and Hoffman (1988) had already developed a habitat type classification that applied to upland grasslands, shrubland, and woody draws by sampling western Great Plains vegetation starting immediately east of Little Bighorn. Hansen et al (1995) had developed an extensive habitat type and community classification system for riparian areas throughout Montana which included a strong focus on Great Plains river systems in eastern Montana. The keys provided by these two heritage classification projects were used based on the upland and woody draw or floodplain position of the polygon. Steep cliffs generally provided a strong demarcation between the uplands with narrow woody draws and the floodplain of the Little Bighorn River. These pre-existing vegetation types were already incorporated in the Associations maintained by NatureServe.

NAIP 2004 true-color aerial imagery with a spatial resolution of 2 meters was segmented into polygons based on spectral similarity and dissimilarity. The segmentation was done with eCognition software. Higher resolution segmentation yielding smaller polygons was applied to the floodplain and the woody draws while a lower resolution segmentation was used for the more uniform upland slopes. This image processing produced about 1,500 polygons within the initial ownership boundary used for defining the field mapping area. With only 1,500 polygons across approximately 850 easily accessible acres it was decided to conduct a complete census by direct inspection and classification of every polygon. A field mapping team of regionally experienced botanists were provided with GPS coordinates for the approximate centroid of each polygon and paper maps with the polygon boundaries overlaid on the NAIP imagery.

Twenty-seven vegetation types were observed by the botanists who censused the uplands and woody draws in June 2006 and the floodplain in July 2006. A group of managers and ecologist comprising an accuracy assessment team sampled and classified a small randomly chosen subset of the 1,500 polygons in June 2006. The classification correspondence between the initial census team and the manager team was only 58%. The disagreements were primarily resultant from some minor type indicator species being present as small patches rather than uniformly distributed throughout the polygon and lack of precision in visual quantification of the cover class of often codominant sympatric grasses. In some cases the initial habitat type classifications were finer scale than the NatureServe Associations. According to the initial twenty-seven types were compressed to form seventeen post accuracy assessment Associations.

The final seventeen Associations constitute three large and one much less abundant NVCS Ecological Systems within the Monument. These Ecological Systems are distributed according to the topographic positions. Northwestern Great Plains Mixedgrass Prairie constitutes the extensive upland slopes. The narrow woody draws dissecting these upland slopes form a Western Great Plains Wooded Draw and Ravine Ecological System. A minor upland Association *Sarcobatus vermiculatus* / *Pascopyrum smithii* - (*Elymus lanceolatus*) Shrub-Herbaceous Vegetation belongs to the Western Great Plains Badlands. The Little Bighorn River riparian zone belongs to the Northwestern Great Plains Floodplain Ecological System.

At the Association scale the two most prevalent types are *Pseudoroegneria spicata* - *Carex filifolia* Herbaceous Vegetation and *Pascopyrum smithii* - *Nassella viridula* Herbaceous Vegetation (Table SD1). These two mixed grass prairie community types occupy most of the upland slopes and comprise 78% of the natural vegetation. *Populus deltoides* - *Fraxinus pennsylvanica* Forest on the floodplain is the third most prevalent community but at 41 acres it

occupies an order of magnitude less area than the upland grass types. The low stature *Symphoricarpos occidentalis* Shrubland is the second most prevalent woody vegetation type. It is found in woody draws and on the floodplain. Three sagebrush types have a current total acreage (41) similar to *Symphoricarpos occidentalis* Shrubland. Sagebrush communities were more prevalent before the 1983 and 1991 wildfires but there appears to have been no recruitment since those burns. *Rhus trilobata* / *Pseudoroegneria spicata* Shrub-Herbaceous Vegetation and *Sarcobatus vermiculatus* / *Pascopyrum smithii* - (*Elymus lanceolatus*) Shrub-Herbaceous Vegetation each cover thirteen acres. The two shrub types are situated on the upland slopes and the upper edges of the woody draws but *Sarcobatus vermiculatus* / *Pascopyrum smithii* - (*Elymus lanceolatus*) Shrub-Herbaceous also develops along the upland to floodplain cliffs where there is active erosion.

The remaining eight Associations each occupy less than ten acres. The dense thicket forming *Prunus virginiana* – (*Prunus americana*) Shrubland is present in the deep bottoms of woody draws and on the floodplain. *Salix exigua* Temporarily Flooded Shrubland is the principal longer term colonizer of the edges of the Little Bighorn River and presumably more transient and less structured Great Plains Floodplain Herbaceous Vegetation also currently occupies some of the recent river edges. There is no recent regeneration of *Populus deltoides*. *Shepherdia argentea* Shrubland is also present on the floodplain, within which there have been small invasions of a *Tamarix* sp. and *Elaeagnus angustifolia*. *Fraxinus pennsylvanica* / *Prunus virginiana* Forest is found at two transition points where woody draws reach the floodplain. *Juniperus scopulorum* / *Pseudoroegneria spicata* Woodland occupies less than one acre in the woody draws but numerous dead trunks indicate juniper was more prevalent before the wildfires. A small disturbed upland area was planted with *Agropyron cristatum* (crested wheatgrass) and this was classified as *Agropyron cristatum* - (*Pascopyrum smithii*, *Stipa comata*) Semi-natural Herbaceous Vegetation.

Overall the Little Bighorn National Monument has an excellent array of relatively intact natural vegetation communities.

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Tables

Table VM1. Initial H&H 1998 & H et al 1995 types with NVCS Association or default Alliance (organize by topographic position)

Table VM2. Prevalence of types assigned in the initial Little Bighorn census.

Table SD1. Prevalence of each post-acuarcy assessment NVCS Association

Table VM1. Initial field mapping classification types from the original source keys and their NVCS equivalent Association or Alliance.

Type Name from Original Key	Source	NVCS Association or Alliance ^s
UPLANDS & WOODY DRAWS		
Agropyron smithii/Carex filifolia	H&H 1988	Pascopyrum smithii - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation
Agropyron spicatum/Bouteloua curtipendula	H&H 1988	Pseudoroegneria spicata - Bouteloua curtipendula Herbaceous Vegetation
Agropyron spicatum/Carex filifolia	H&H 1988	Pseudoroegneria spicata - Carex filifolia Herbaceous Vegetation
Agropyron spicatum herbaceous alliance	NVCS	Pseudoroegneria spicata Herbaceous Alliance
Artemisia cana/Agropyron smithii	H&H 1988	Artemisia cana / Pascopyrum smithii Shrubland
Artemisia tridentata/Agropyron smithii	H&H 1988	Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrub Herbaceous Vegetation
Artemisia tridentata/Agropyron spicatum	H&H 1988	Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation
Calamovilfa longifolia/Carex heliophila	H&H 1988	Calamovilfa longifolia - Carex inops ssp. heliophila Herbaceous Vegetation
Fraxinus pennsylvanica/Prunus virginiana	H&H 1988	Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland
Juniperus scopulorum/Agropyron spicatum	H&H 1988	Juniperus scopulorum / Pseudoroegneria spicata Woodland
Prunus virginiana shrubland alliance	NVCS	Prunus virginiana Shrubland Alliance
Rhus trilobata/Agropyron spicatum	H&H 1988	Rhus trilobata / Pseudoroegneria spicata Shrub Herbaceous Vegetation
Sarcobatus vermiculatus/Agropyron smithii	H&H 1988	Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation
Sarcobatus vermiculatus/Agropyron spicatum	H&H 1988	Sarcobatus vermiculatus / Pseudoroegneria spicata Shrubland
Shepherdia argentea	H&H 1988	Shepherdia argentea Shrubland
Stipa comata/Carex filifolia	H&H 1988	Hesperostipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation
Symphoricarpos occidentalis	H&H 1988	Symphoricarpos occidentalis Shrubland
Disturbed area		Disturbed Area
Landscaped areas	FGDC-STD-005	Landscaped
FLOODPLAIN		
Acer negundo/Prunus virginiana	H et al 1995	Acer negundo / Prunus virginiana Forest
Elaeagnus angustifolia	H et al 1995	Elaeagnus angustifolia Semi-natural Woodland Alliance
Fraxinus pennsylvanica/Prunus virginiana	H et al 1995	Fraxinus pennsylvanica / Prunus virginiana Forest
Populus deltoides/Recent alluvial bar	H et al 1995	Populus deltoides Temporarily Flooded Woodland Alliance
Populus deltoides/Symphoricarpos occidentalis	H et al 1995	Populus deltoides / Symphoricarpos occidentalis Woodland
Prunus virginiana	H et al 1995	Prunus virginiana - (Prunus americana) Shrubland

Type Name from Original Key	Source	NVCS Association or Alliance [§]
Salix exigua	H et al 1995	Salix exigua Temporarily Flooded Shrubland
Shepherdia argentea	H et al 1995	Shepherdia argentea Shrubland
Symphoricarpos occidentalis	H et al 1995	Symphoricarpos occidentalis Shrubland
Tamarix chinensis	H et al 1995	Tamarix spp. Semi-natural Temporarily Flooded Shrubland Alliance

[§] Natural or semi-natural vegetation community name is for NVCS Association unless ending with Alliance

Table VM2. Prevalence of types assigned in the initial Little Bighorn census.

DESCRIPTION	TOTAL ACRES	# of POLYGONS	LARGEST POLYGON	SMALLEST POLYGON
<i>Agropyron spicatum</i> herbaceous Alliance	240	232	39.0	0
<i>Agropyron smithii</i> / <i>Carex filifolia</i>	238	323	54.7	0
<i>Agropyron spicatum</i> / <i>Carex filifolia</i>	52	108	5.4	0
<i>Agropyron spicatum</i> / <i>Bouteloua curtipendula</i>	44	140	3.1	0
WATER	43	3	31.6	2
ROAD	37	25	13.0	0
<i>Populus deltoides</i> / <i>Symphoricarpos occidentalis</i>	30	46	3.6	0
<i>Symphoricarpos occidentalis</i> upland	30	128	1.3	0
Landscaped areas	20	19	10.8	0
<i>Artemisia cana</i> / <i>Agropyron smithii</i>	18	61	3.5	0
<i>Artemisia tridentata</i> / <i>Agropyron smithii</i>	16	8	13.3	0
<i>Sarcobatus vermiculatus</i> / <i>Agropyron smithii</i>	12	82	1.2	0
Disturbed area	12	76	1.5	0
<i>Rhus trilobata</i> / <i>Agropyron spicatum</i>	12	37	1.3	0
<i>Fraxinus pennsylvanica</i> / <i>Prunus virginiana</i> floodplain	8.3	12	2.6	0
<i>Artemisia tridentata</i> / <i>Agropyron spicatum</i>	7.1	12	2.6	0
<i>Salix exigua</i>	6.5	5	4.2	0
<i>Symphoricarpos occidentalis</i> floodplain	6.1	24	1.3	0
<i>Stipa comata</i> / <i>Carex filifolia</i>	5.9	17	2.6	0
<i>Shepherdia argentea</i> floodplain	4.2	7	1.4	0
<i>Prunus virginiana</i>	2.9	11	1.0	0
<i>Acer negundo</i> / <i>Prunus virginiana</i>	2.5	3	2.1	0
<i>Prunus virginiana</i> shrubland Alliance	1.6	14	0.4	0
<i>Sarcobatus vermiculatus</i> / <i>Agropyron spicatum</i>	1.6	7	0.7	0
<i>Calamovilfa longifolia</i> / <i>Carex heliophila</i>	1.4	8	0.7	0
<i>Fraxinus pennsylvanica</i> / <i>Prunus virginiana</i> upland	1.4	2	1.4	0
<i>Juniperus scopulorum</i> / <i>Agropyron spicatum</i>	0.9	4	0.3	0
<i>Tamarix chinensis</i>	0.7	2	0.7	0
<i>Populus deltoides</i> /Recent_alluvial bar	0.1	1	0.1	0
<i>Shepherdia argentea</i> upland	0.06	2	0.04	0
<i>Elaeagnus angustifolia</i>	0.05	1	0.05	0
	854	1420		

Table SD1. Prevalence of each post-accuracy assessment NVCS Association

NVCS ASSOCIATION as Maintained by NatureServe	TOTAL ACRES	# POLY
<i>Pseudoroegneria spicata</i> - <i>Carex filifolia</i> Herbaceous Vegetation	339	
<i>Pascopyrum smithii</i> - <i>Nassella viridula</i> Herbaceous Vegetation	245	
<i>Populus deltoides</i> - <i>Fraxinus pennsylvanica</i> Forest	41	
<i>Symphoricarpos occidentalis</i> Shrubland	34	
<i>Artemisia cana</i> ssp. <i>cana</i> / <i>Pascopyrum smithii</i> Shrub-Herbaceous Vegetation	19	
Landscaped areas	16	
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Pascopyrum smithii</i> Shrub-Herbaceous Veg.	15	
ROAD	14	
<i>Sarcobatus vermiculatus</i> / <i>Pascopyrum smithii</i> - (<i>Elymus lanceolatus</i>) Shrub-Herb. Veg.	13	
<i>Rhus trilobata</i> / <i>Pseudoroegneria spicata</i> Shrub-Herbaceous Vegetation	13	
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Pseudoroegneria spicata</i> Shrub-Herb. Veg.	7.2	
<i>Prunus virginiana</i> – (<i>Prunus americana</i>) Shrubland	4.6	
WATER	4.6	
<i>Salix exigua</i> Temporarily Flooded Shrubland	4.0	
Weedy Annual Great Plains Herbaceous Vegetation	3.3	
<i>Shepherdia argentea</i> Shrubland	3.1	
<i>Fraxinus pennsylvanica</i> / <i>Prunus virginiana</i> Forest	1.4	
Great Plains Floodplain Herbaceous Vegetation	2.2	
<i>Juniperus scopulorum</i> / <i>Pseudoroegneria spicata</i> Woodland	0.9	
<i>Shepherdia argentea</i> Shrubland - <i>Tamarix chinensis</i> invaded	0.6	
<i>Agropyron cristatum</i> - (<i>Pascopyrum smithii</i> , <i>Stipa comata</i>) Semi-natural Herbaceous Veg.	0.4	
<i>Shepherdia argentea</i> Shrubland - <i>Elaeagnus angustifolia</i> invaded	0.04	
	783	

Figures

General location schematic map ((LIBI) VegMap_ParkLocation.pdf to LIBI Location map.eps)

Geology map (LIBIgeology.pdf clipped to LIBI Geology clipped.eps)

Soils map (LIBISoils.pdf clipped to LIBI Soils 2 units.eps)

Monthly hi-low temp and precipitation graph.

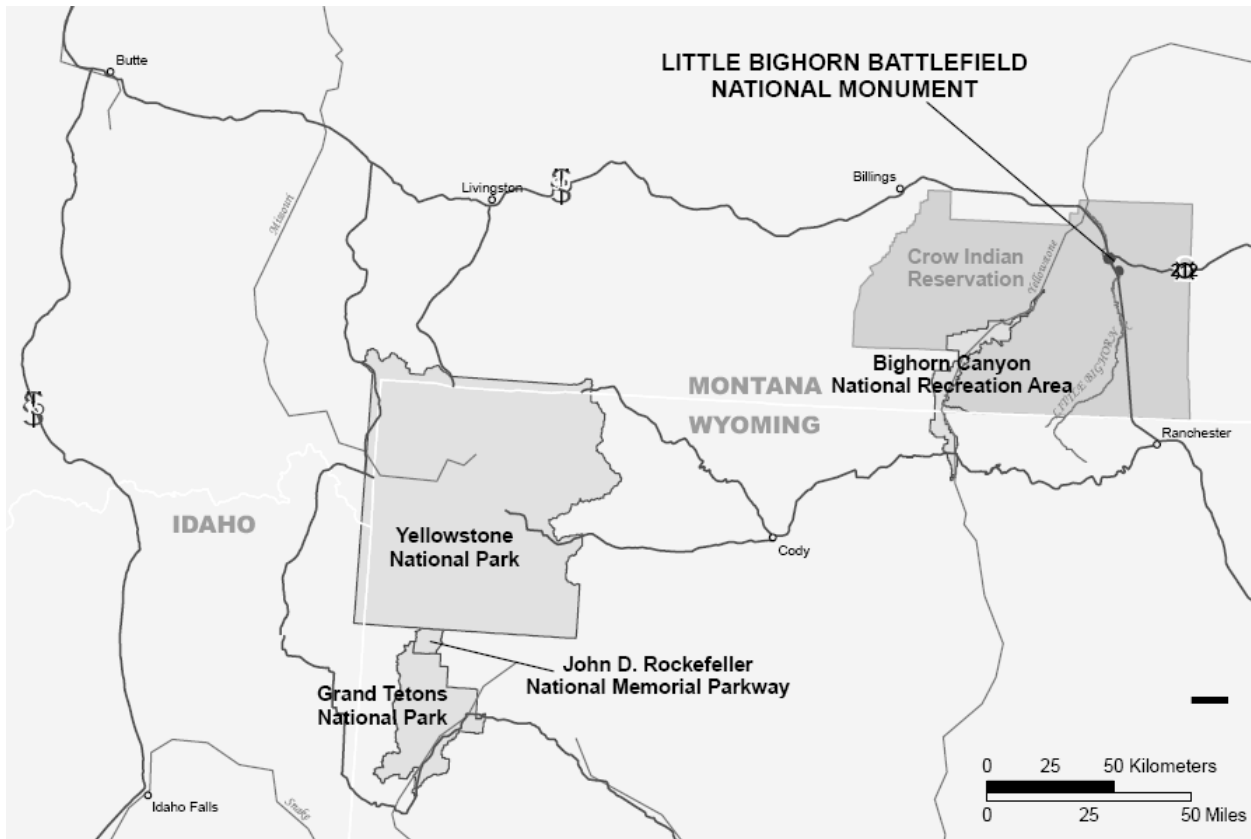


Figure 1. General location of Little Bighorn Battlefield National Monument in southeastern Montana.

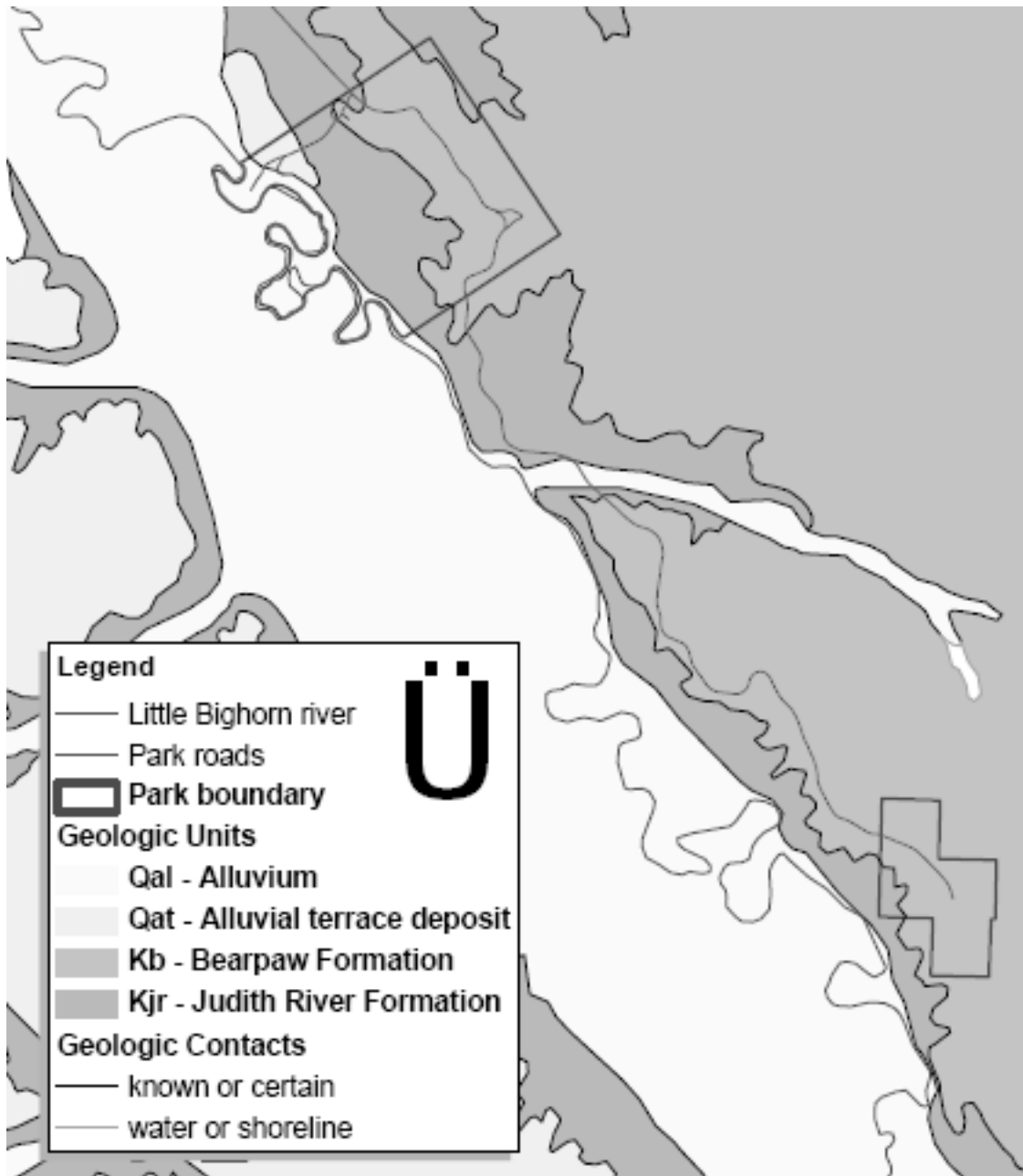


Figure 2. LIBI geology (NPS has color pdf version of this).

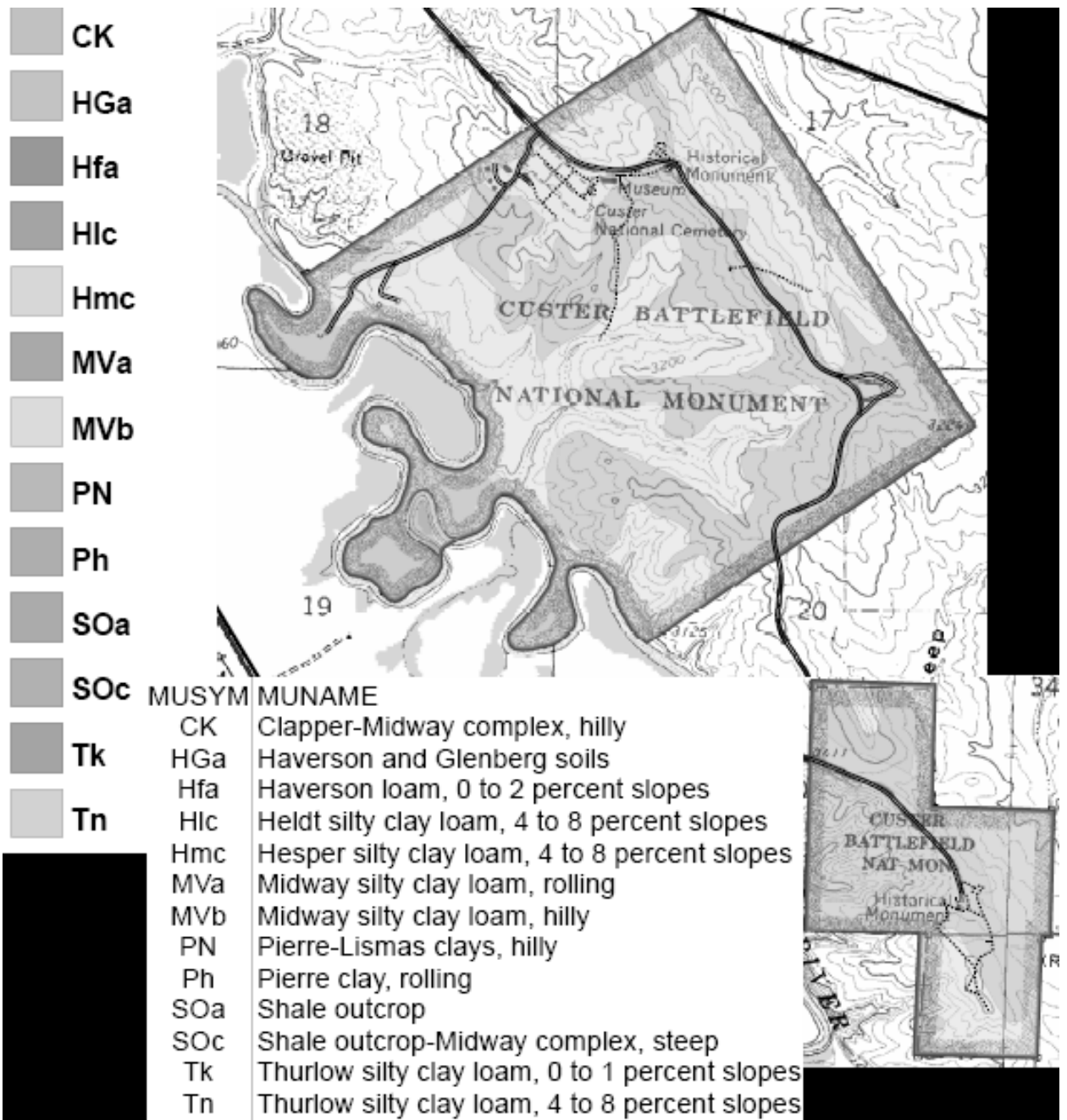


Figure 3. LIBI soils for two units (NPS Has color version of this from which I clipped 4 segments)

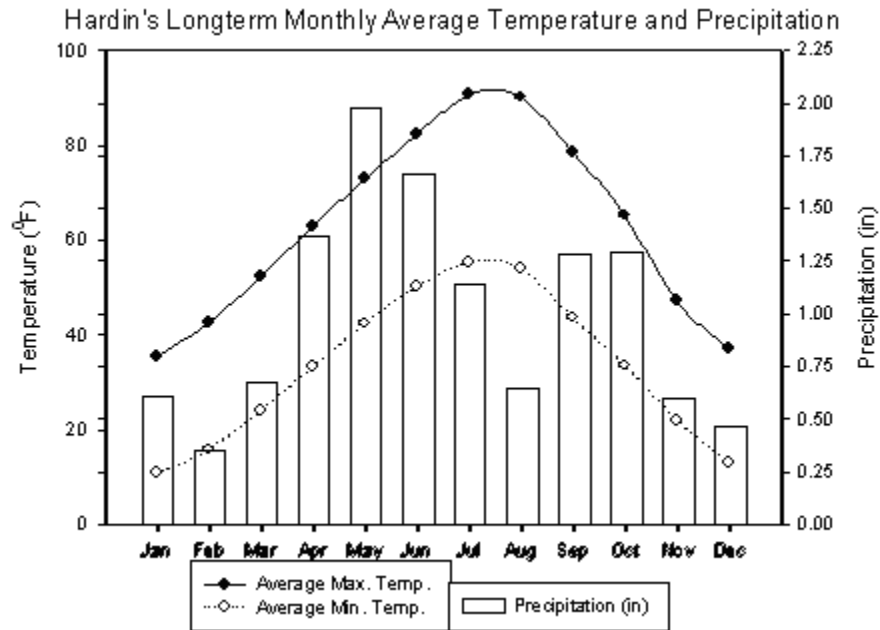


Figure 4. Monthly mean precipitation, minimum and maximum temperatures at Hardin (13 miles northwest of Little Bighorn)

Appendices

- A1. Project plant species list (indicator species cross-walked to ITIS)
- A2. Final (post accuracy assessment) map class descriptions, local & global plant association descriptions
- A3. Ecological system descriptions
- A4. Plant association key
- A5. Appendix Table xx. Crosswalk for community type names
- A6. Field Data Collection Forms
- A7. Accuracy assessment matrix
- A8. Description of project database

A1. Project plant species list (indicator species cross-walked to ITIS)

Binomial in Regional Flora	Local Common Name	ITIS Binomial	ITIS #
<i>Acer negundo</i>	box elder	<i>Acer negundo</i>	28749
<i>Agropyron cristatum</i>	crested wheatgrass	<i>Agropyron cristatum</i>	40371
<i>Agropyron smithii</i>	western wheatgrass	<i>Pascopyrum smithii</i>	504124
<i>Agropyron spicatum</i>	bluebunch wheatgrass	<i>Pseudoroegneria spicata</i>	524600
<i>Artemisia cana</i>	silver sagebrush	<i>Artemisia cana</i>	35454
<i>Artemisia tridentata</i> (ssp. <i>wyomingensis</i>)	Wyoming big sagebrush	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	183741
<i>Bouteloua curtipendula</i>	side oats grama	<i>Bouteloua curtipendula</i>	41500
<i>Calamovilfa longifolia</i> (var. <i>longifolia</i>)	prairie sand reed grass	<i>Calamovilfa longifolia</i> (var. <i>longifolia</i>)	527009
<i>Carex filifolia</i>	threadleaf sedge	<i>Carex filifolia</i>	39600
<i>Carex heliophila</i> [†] (syn. <i>inops</i>)	sun sedge	<i>C. inops</i> ssp. <i>heliophila</i>	523761
<i>Elaeagnus angustifolia</i>	Russian olive	<i>Elaeagnus angustifolia</i>	27770
<i>Fraxinus pennsylvanica</i>	green ash	<i>Fraxinus pennsylvanica</i>	32929
<i>Juniperus scopulorum</i>	Rocky Mountain juniper	<i>Juniperus scopulorum</i>	194872
<i>Populus deltoides</i> (ssp. <i>monilifera</i>)	Great Plains cottonwood	<i>Populus deltoides</i> (ssp. <i>monilifera</i>)	22447
<i>Prunus virginiana</i>	common chokecherry	<i>Prunus virginiana</i>	24806
<i>Rhus aromatica</i>	skunkbush sumac	<i>Rhus trilobata</i>	28791
<i>Salix exigua</i>	sandbar (coyote) willow	<i>Salix interior</i>	520829
<i>Sarcobatus vermiculatus</i>	black greasewood	<i>Sarcobatus vermiculatus</i>	20707
<i>Shepherdia argentea</i>	silver buffaloberry	<i>Shepherdia argentea</i>	27778
<i>Stipa comata</i>	needle and thread grass	<i>Hesperostipa comata</i>	507974
<i>Symphoricarpos occidentalis</i>	western snowberry	<i>Symphoricarpos occidentalis</i>	35336
<i>Tamarix</i> sp.*	salt cedar	<i>Tamarix</i> sp.	22303

[†] *Carex heliophila* was not observed in 2006 on Little Bighorn Battlefield

**Tamarix chinensis* and *T. parviflora* are reported to occur in Montana, but we did not distinguish.

A2. Final (post accuracy assessment) map class descriptions, local & global plant association descriptions

Final NVCS Association and Complex Common Name/Synonym

FOREST & WOODLANDS:

Populus deltoids - *Fraxinus pennsylvanica* Forest
Eastern Cottonwood - Green Ash Forest

Fraxinus pennsylvanica / *Prunus virginiana* Forest
Green Ash / Choke Cherry Forest

Juniperus scopulorum / *Pseudoroegneria spicata* Woodland
Rocky Mountain Juniper / Bluebunch Wheatgrass Woodland

SHRUBLANDS:

Prunus virginiana – (*Prunus americana*) Shrubland
Choke Cherry-(Wild Plum) Shrubland

Salix exigua Temporarily Flooded Shrubland
Coyote Willow Temporarily Flooded Shrubland

Shepherdia argentea Shrubland
Silver Buffalo-berry Shrubland

Symphoricarpos occidentalis Shrubland
Western Snowberry Shrubland

HERBACEOUS VEGETATION:

Pascopyrum smithii - *Nassella viridula* Herbaceous Vegetation
Western Wheatgrass - Green Needlegrass Mixedgrass Prairie

Agropyron cristatum - (*Pascopyrum smithii*, *Stipa comata*) Semi-natural Herbaceous Vegetation
Crested Wheatgrass - (Western Wheatgrass, Needle-and-Thread Grass) Semi-natural Herbaceous Vegetation

Pseudoroegneria spicata - *Carex filifolia* Herbaceous Vegetation
Bluebunch Wheatgrass – Threadleaf Sedge Mixed Prairie

Artemisia cana ssp. *cana* / *Pascopyrum smithii* Shrub Herbaceous Vegetation
Plains Silver Sagebrush / Western Wheatgrass Shrub Prairie

Artemisia tridentata ssp. *wyomingensis* / *Pascopyrum smithii* Shrub Herbaceous Vegetation
Wyoming Big Sagebrush / Western Wheatgrass Shrub Prairie

Artemisia tridentata ssp. *wyomingensis* / *Pseudoroegneria spicata* Shrub Herbaceous Vegetation
Wyoming Big Sagebrush / Bluebunch Wheatgrass Shrub Prairie

Rhus trilobata / *Pseudoroegneria spicata* Shrub Herbaceous Vegetation
Skunkbush Sumac / Bluebunch Wheatgrass Shrub Prairie

Sarcobatus vermiculatus / *Pascopyrum smithii* - (*Elymus lanceolatus*) Shrub Herbaceous Vegetation
Greasewood / Western Wheatgrass Shrub Prairie

Great Plains Floodplain Herbaceous Vegetation

Weedy Annual Great Plains Herbaceous Vegetation

EXPLANATION OF FIELD NAMES USED IN VEGETATION ASSOCIATION DESCRIPTIONS

The association name, using Latin names of nominal taxa as conferred by NatureServe (2007) is listed first

COMMON NAME

The association name, using common (English) names of nominal taxa as conferred by NatureServe (2007)

LOCAL NAME

An additional descriptive name for the association is listed, if available.

CLASS

1997 National Vegetation Classification Standard (NVCS) Class assignment of association.

SUBCLASS

1997 NVCS Subclass assignment of association.

GROUP

1997 NVCS Subclass assignment of association.

SUBGROUP

1997 NVCS Subclass assignment of association.

FORMATION

1997 NVCS Subclass assignment of association.

ALLIANCE

The alliance assignment of the association, as conferred by NatureServe (2007).

ASSOCIATION IDENTIFIER

The unique alphanumeric identifier of the association, as conferred by NatureServe (2007).

USFWS WETLAND SYSTEM

The Cowardin et al. assignment of the association, including National Wetlands Inventory (NWI) mapping code, if applicable.

NS ECOLOGICAL SYSTEM

Most likely NatureServe Ecological System assignment for association at Little Bighorn Battlefield National Monument (Comer et al. 2003) (NatureServe 2007).

RANGE

The geographic range of the association, both at Little Bighorn Battlefield National Monument (as defined by this study) and global (NatureServe 2007).

ENVIRONMENTAL DESCRIPTION

The environmental setting of the association, both at Little Bighorn Battlefield National Monument, as defined by this study, including National Park Service (2006a, 2006b) and global, as defined by NatureServe (2007).

MOST ABUNDANT SPECIES

The most abundant species in each vegetation stratum for the association at Little Bighorn Battlefield National Monument (as defined by this study).

CHARACTERISTIC SPECIES

Characteristic species for the association at Little Bighorn Battlefield National Monument (as defined by this study).

VEGETATION DESCRIPTION

A qualitative description of the vegetation (floristic) composition of the association, both at Little Bighorn Battlefield National Monument (as defined by this study) and global (NatureServe 2007).

GLOBAL CLASSIFICATION CONFIDENCE

A relative ranking of the confidence in the robustness of the association concept on a global scale (1="Strong"; 2="Moderate"; 3="Weak" (NatureServe 2007).

CONSERVATION RANK

A ranking of the global abundance of the association (see Grossman et al. 1998 for symbol explanations) (NatureServe 2007).

SIMILAR ASSOCIATIONS

Distinguishing characters between the association and similar and/or intergrading associations that also occur at Little Bighorn Battlefield National Monument (if applicable).

CLASSIFICATION COMMENTS

Discussion of association assignments as derived at Little Bighorn Battlefield National Monument (if applicable). Also, discussion of distinguishing characters between the association and similar and/or intergrading associations that also occur at Little Bighorn Battlefield National Monument (if applicable).

Populus deltoides - *Fraxinus pennsylvanica* Forest

COMMON NAME	Eastern Cottonwood - Green Ash Forest
LOCAL NAME	Cottonwood - Green Ash Floodplain Forest
CLASS	Forest (I)
SUBCLASS	Deciduous forest (I.B)
GROUP	Cold-deciduous forest (I.B.2)
SUBGROUP	Natural/Semi-natural cold-deciduous forest (I.B.2.N)
FORMATION	Temporarily flooded cold-deciduous forest (I.B.2.N.d)
ALLIANCE	<i>POPULUS DELTOIDES</i> TEMPORARILY FLOODED FOREST
ASSOCIATION IDENTIFIER	CEGL000658
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Floodplain (CES303.676)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this forest is limited to the floodplain of the Little Bighorn River in the Main Unit, where it occurs extensively.

Global

This association is reported from throughout the northern and central Great Plains of the United States and adjacent Canada, ranging from the Dakotas northwest to Montana and Saskatchewan, and south to Nebraska.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands are found on the floodplain of the Little Bighorn River on Quaternary alluvium. Soils are mapped as Haverson and Glenberg soils.

Global

This association occurs along rivers and streams and around ponds and lakes. The soils are developed from alluvium. In southwest North Dakota, Girard et al. (1989) found this type on silty clay loam, clay loam, clay, and loam. The soils were alkaline. Johnson (1971) found sandy loams, loamy sands, and silty clays along the Missouri River.

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Tree	<i>Populus deltoides</i> , <i>Fraxinus pennsylvanica</i>
Shrub	<i>Prunus virginiana</i> , <i>Symphoricarpos occidentalis</i> , <i>Rosa woodsii</i> , <i>Fraxinus pennsylvanica</i>
Herbaceous	<i>Bromus inermis</i> , <i>Poa pratensis</i> , <i>Cynoglossum officinale</i> , <i>Thalictrum</i> sp. <i>Galium aparine</i>

CHARACTERISTIC SPECIES

Populus deltoides, *Fraxinus pennsylvanica*, *Acer negundo*, *Galium aparine*, *Bromus inermis*, *Thalictrum* sp., *Cynoglossum officinale*, *Vitis riparia*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 10 accuracy assessment observations)

This type ranges in physiognomic expression from a woodland to a closed canopy forest. *Populus deltoides* is important to the sole dominant in the tree canopy, with large specimens contributing from 20-90%. It is generally absent from the subcanopy and lower strata. *Fraxinus pennsylvanica* is often present in the tree canopy and occasionally exceeds *P. deltoides* in cover; it is almost always present at considerable cover (5-50%) in the tree subcanopy and/or tall shrub (sapling) layers, suggesting a gradual replacement of *P. deltoides* by more shade-tolerant *F.*

pennsylvanica with floodplain accretion and stability. *Acer negundo* and/or *Salix amygdaloides* may contribute minor amounts of cover, usually in more open (woodland) stands. *Prunus virginiana* and *Symphoricarpos occidentalis* are the most abundant shrubs and can be frequent but scattered to densely patch-dominant. *Rosa woodsii* and *Shepherdia argentea* may be present at low cover. The vines *Vitis riparia*, *Clematis ligusticifolia*, and *Toxicodendron radicans* are often present, especially in more open stands. The herbaceous layer may be moderately dense to dense, depending on canopy closure of the upper strata. The non-native *Bromus inermis* and/or *Poa pratensis* are often dominant. *Thalictrum* sp., *Solidago canadensis*, *Galium aparine*, and *Cynoglossum officinale* are frequent forbs.

Global

This association is a riparian forest with an open to closed canopy dominated by deciduous trees. Girard et al. (1989) sampled two stands in southwestern North Dakota that had an average of 293 trees/ha. Hansen et al. (1984) sampled four stands that had an average basal area of 41 m²/ha and 427 trees/ha. They found that the average cover by strata was shrubs 76.8%, graminoids 64.2%, and forbs 43.5%. *Populus deltoides* and *Fraxinus pennsylvanica* are the most abundant mature trees. *Acer negundo*, *Salix amygdaloides*, and *Juniperus scopulorum* may also be present in the tree layer. This association is seral and in younger stands *Populus deltoides* is the dominant, but as stands age *Fraxinus pennsylvanica* becomes more prominent until the stand becomes a different type. The closed canopy leads to poor reproduction by *Populus deltoides* in stands of all ages. The shrub layer is often vigorous. Species such as *Rosa woodsii*, *Symphoricarpos occidentalis*, *Juniperus scopulorum*, *Juniperus communis*, and *Cornus sericea* ssp. *sericea* can be abundant. The composition of the herbaceous layer is variable. Along the Missouri River, Keammerer (1972) found *Poa pratensis* to be the most prevalent species, with *Amphicarpaea bracteata*, *Bromus inermis*, and *Elymus virginicus* common. *Carex* spp., *Juncus* spp., *Leymus cinereus*, *Lysimachia ciliata*, *Thalictrum venulosum*, and *Elymus canadensis* are common. Weedy species are almost ubiquitous, among them *Poa* spp., *Bromus inermis*, *Mellilotus officinalis*, *Ambrosia* spp., and *Urtica* spp.

CONSERVATION RANK G2G3

GLOBAL CLASSIFICATION CONFIDENCE 3

CLASSIFICATION COMMENTS

This type was originally mapped as *Populus deltoides* / *Symphoricarpos occidentalis* Habitat Type, *Fraxinus pennsylvanica* / *Prunus virginiana* Habitat Type, and the *Acer negundo* / *Prunus virginiana* Habitat Type. Confusion in recognizing these as three NVCS associations stemmed from (1) occurrence of *Acer negundo* more as isolated trees than pure stands, (2) the treatment of Girard et al. (1989) and the NVCS equivalent to the *Fraxinus pennsylvanica* / *Prunus virginiana* Habitat Type as a forest of upland ravines (see *Fraxinus pennsylvanica* / *Prunus virginiana* Forest), rather than floodplains, and (3) more-or-less continuous variation between the dominance or importance of *Populus deltoides* and of *Fraxinus pennsylvanica* in the tree layer and, similarly between that of *Prunus virginiana* and of *Symphoricarpos occidentalis* in the shrub layer, for most parts of the Little Bighorn floodplain. Girard et al. (1989) observe that a *Populus deltoides* – *Fraxinus pennsylvanica* Community Type in southwestern North Dakota is seral to a *Fraxinus pennsylvanica* / *Symphoricarpos occidentalis* Habitat Type, a situation that seems to occur at Little Bighorn Battlefield National Monument. In general, an overstory of *P. deltoides*, usually in a relatively monospecific layer, but sometimes with *F. pennsylvanica* co-dominant, occurs above strongly regenerating *F. pennsylvanica* cohorts in the subcanopy and sapling (tall shrub) layers, making it difficult to assign many individual stands with confidence to multiple types. A single NVCS concept (*Populus deltoides*-*Fraxinus pennsylvanica* Forest) seemed the best fit for this continuum and the limited amount of vegetation at this site.

Fraxinus pennsylvanica / *Prunus virginiana* Forest

COMMON NAME	Green Ash / Choke Cherry Forest
LOCAL NAME	Green Ash / Choke Cherry Wooded Draw
CLASS	Forest (I)
SUBCLASS	Deciduous forest (I.B)
GROUP	Cold-deciduous forest (I.B.2)
SUBGROUP	Natural/Semi-natural cold-deciduous forest (I.B.2.N)
FORMATION	Temporarily flooded cold-deciduous forest (I.B.2.N.d)
ALLIANCE	<i>FRAXINUS PENNSYLVANICA</i> - (<i>ULMUS AMERICANA</i>) TEMPORARILY FLOODED FOREST
ASSOCIATION IDENTIFIER	CEGL000642
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Western Great Plains Wooded Draw and Ravine (CES303.680)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this forest was observed in two very small patches – one in each unit.

Global

This association is reported from Montana and Wyoming.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

These forests occupy bottoms of steep, narrow upland draws. One stand is below a *Juniperus scopulorum* / *Pseudoroegneria spicata* Woodland that occupies a higher, steep north-facing slope. These are mapped as Midway silty clay loams on the Judith River and Bearpaw Formations.

Global

In western South Dakota and North Dakota, this association occurs in upland ravines and broad valleys or on moderately steep slopes. It also occurs along small permanent or ephemeral streams. In central North Dakota, this association is also found along the north slopes of end moraines or kames and along lakeshores (Williams 1979 and Godfread 1976). On these sites, soil and topography permit greater than normal moisture conditions. In south-central South Dakota this association occurs on steep, north-facing escarpments and around boulder outcrops. In the western Dakotas soils are clay loams, sandy clay loam, silty clay, and sandy loam. Soil pH ranges from 6.3 to 7.5 in South Dakota, while soils in North Dakota have pH of 6.0-8.1. Slopes range from 0 to 40 percent. In south-central South Dakota soils are dry to moist, and moderately drained (Hansen and Hoffman 1988, Girard *et al.* 1989).

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Tree	<i>Fraxinus pennsylvanica</i>
Shrub	<i>Prunus virginiana</i> , <i>Symphoricarpos occidentalis</i>
Herbaceous	Unknown

CHARACTERISTIC SPECIES

Fraxinus pennsylvanica, *Prunus virginiana*, *Symphoricarpos occidentalis*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

Fraxinus pennsylvanica is the dominant tree species, with *Prunus virginiana* is the most common shrub. *Symphoricarpos occidentalis* is usually present. The herbaceous layer was not observed, but is assumed to be comprised of mesic species.

Global

This association is an open to closed canopy woodland dominated by *Fraxinus pennsylvanica*. *Ulmus americana* sometimes achieves codominance. The largest trees are 50 to 60 cm dbh, but most trees are 20 to 30 cm dbh. In sharply cut, V-shaped upland ravines, the largest trees are near the center or bottom of the ravine where there is greater soil moisture. The average tree age is 70 to 80 years. In undisturbed stands, the understory is composed of two layers. The taller and more conspicuous layer is a shrub layer 2 to 3 m tall. This layer is dominated by *Prunus virginiana* with smaller amounts of *Symphoricarpos occidentalis*. The lower layer is dominated by grasses and sedges such as *Elymus virginicus* and *Carex sprengeii*. Common herbaceous species include *Galium boreale*, *G. aparine*, and *Maianthemum stellatum*. In central South Dakota this association is a woodland with an open canopy of ash trees and an extremely dense shrubby understory. The average tree height is 6.7 m and the shrub understory is 1.6 m high. There are few

herbaceous species (U.S. Army Corp of Engineers 1979). The continuation of the status of *Ulmus americana* as a prominent part of this association is uncertain due to the effects of Dutch Elm disease (Hansen et al. 1984, Hansen and Hoffman 1988, Girard et al. 1989, Hansen et al. 1990).

GLOBAL CLASSIFICATION CONFIDENCE 2

CONSERVATION RANK G3?

CLASSIFICATION COMMENTS

This type was originally applied more widely at Little Bighorn Battlefield National Monument., including to some floodplain forests (see discussion under *Populus deltoides* – *Fraxinus pennsylvanica* Forest). Following the accuracy assessment, the concept was applied in a more limited manner, so that its occurrence was reduced to a few small patches in upland draws or ravines, in accordance with the concept attributed by Hansen and Hoffman (1988), Girard et al. (1989), and NatureServe.

The *Fraxinus pennsylvanica* – *Ulmus americana* / *Prunus virginiana* Woodland (CEGL000643) (NatureServe 2007) (apparently equivalent to the *Ulmus americana* phase of the *Fraxinus pennsylvanica* / *Prunus virginiana* Habitat Type (Girard et al. 1989)) seems nearly identical to this association, except for the presence of *Ulmus americana* in the former. Since *Ulmus americana* was not seen at Little Bighorn Battlefield National Monument, the *Fraxinus pennsylvanica* / *Prunus virginiana* Forest is recognized here.

Juniperus scopulorum / *Pseudoroegneria spicata* Woodland

COMMON NAME	Rocky Mountain Juniper / Bluebunch Wheatgrass Woodland
LOCAL NAME	Rocky Mountain Juniper / Bluebunch Wheatgrass Woodland
CLASS	Woodland (II)
SUBCLASS	Evergreen Woodland (II.A)
GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N)
FORMATION	Round-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a)
ALLIANCE	<i>JUNIPERUS SCOPULORUM</i> WOODLAND ALLIANCE
ASSOCIATION IDENTIFIER	CEGL000748
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Western Great Plains Wooded Draw and Ravine (CES303.680)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this woodland is known only from a single small stand in the Reno-Benteen Unit.

Global

This association is reported from Colorado, Montana and Wyoming.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

The stand is on a steep, north-facing slope on the lower slope of a ravine. Slope and aspect appear to be the most important factors for the occurrence of this vegetation. The area is mapped as a shale outcrop on the Midway soil complex at the interface of the Judith River and Bearpaw Formations.

Global

This association typically occurs on moderate to steep (16-70%) north-facing slopes, but can occur on a variety of aspects (Johnston 1988, Von Loh et al. 1999). The soils are poorly developed, shallow, loamy sands, sandy loams, and clay loams, sometimes with high gravel content. These woodlands are frequently associated with outcrops of sandstone (DeVelice et al. 1995) or scoria and clay slopes (Girard et al. 1989).

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Tree	<i>Juniperus scopulorum</i>
Short	<i>Symphoricarpos albus</i>
Herbaceous	<i>Pseudoroegneria spicata</i> , <i>Muhlenbergia cuspidata</i> , <i>Geum triflorum</i>

CHARACTERISTIC SPECIES

Juniperus scopulorum, *Pseudoroegneria spicata*, *Symphoricarpos albus*, *Geum triflorum*, *Muhlenbergia cuspidata*, *Maianthemum stellatum*, *Campanula rotundifolia*, *Cerastium arvense*, *Silene menziesii*, *Antennaria parvifolia*, *Cystopteris fragilis*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 1 classification plot and 2 accuracy assessment observations)

This association is densely wooded for a *Juniperus scopulorum*-dominated type, with short (mostly < 5 meters tall) *J. scopulorum* strongly dominant in the tree canopy, accompanied by minor amounts of *Fraxinus pennsylvanica*. The shrub layer is dominated by *Symphoricarpos*

albus, with small amounts of *Prunus virginiana*, *Symphoricarpos occidentalis*, *Amelanchier alnifolia*, *Fraxinus pennsylvanica*, *Rhus trilobata*, *Ericameria nauseosa*, *Artemisia frigida*, *Rosa arkansana*, *Ribes oxyacanthoides* ssp. *setosum*, and *Juniperus scopulorum*. The herb layer is dominated by *Pseudoroegneria spicata*, with a large number of lower cover species of both dry prairie and more mesic/higher elevation forest affinities. *Geum triflorum*, *Muhlenbergia cuspidata*, *Maianthemum stellatum*, *Campanula rotundifolia*, *Cerastium arvense*, *Silene menziesii*, *Antennaria parvifolia*, *Cystopteris fragilis*, *Parietaria pensylvanica*, *Achillea millefolium*, *Carex filifolia*, *Helianthella quinquenervis*, *Allium textile*, *Zigadenus venenosus*, *Koeleria micrantha*, *Galium aparine*, *Vicia americana*, *Phacelia linearis*, *Phlox hoodii*, *Crepis acuminata*, *Elymus trachycaulus*, and *Oxytropis sericea* were observed in the single classification plot. This type may be the most species-rich non-alluvial association at Little Bighorn Battlefield National Monument, with a number of species not observed in other habitats.

Global

No information available.

GLOBAL CLASSIFICATION CONFIDENCE 1

CONSERVATION RANK G4

CLASSIFICATION COMMENTS

Although *Oryzopsis micrantha* was not seen and *Pseudoroegneria spicata* was dominant in the herbaceous layer, the stand at Little Bighorn Battlefield has floristic and environmental similarities with the *Juniperus scopulorum* / *Oryzopsis micrantha* Woodland, as described from Theodore Roosevelt National Park.

Prunus virginiana – (*Prunus americana*) Shrubland

COMMON NAME	Choke Cherry – (American Plum) Shrubland
LOCAL NAME	Choke Cherry Shrubland
CLASS	Shrubland (III)
SUBCLASS	Deciduous shrubland (III.B)
GROUP	Cold-deciduous shrubland (III.B.2)
SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a)
ALLIANCE	<i>PRUNUS VIRGINIANA</i> SHRUBLAND ALLIANCE
ASSOCIATION IDENTIFIER	CEGL001108
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Western Great Plains Wooded Draw and Ravine (CES303.680), Northwestern Great Plains Floodplain (CES303.676)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known only from the Main Unit, where it is found in small patches, primarily on the floodplain of the Little Bighorn River, and also in upland draws.

Global

This association is a widespread, if small-patch, shrubland that is known from the Columbia Plateau of eastern Washington, eastern Oregon, eastern Nevada, southeastern Idaho, throughout Wyoming, Montana, Colorado and western South Dakota.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands are found on the floodplain of the Little Bighorn River on Quaternary alluvium (Haverson and Glenberg soils) and in wooded draws in upland settings (mapped mostly as Midway silty clay loams on the Judith River Formation).

Global

This is a widespread small-patch shrubland that is known from the Columbia Plateau of eastern Washington, eastern Oregon, eastern Nevada, southeastern Idaho, throughout Wyoming, Montana, Colorado and western South Dakota. It occurs in the foothills and lower slopes of mountains, along higher creeks, and in draws and ravines of plateaus and the Great Plains. The elevational range is 716 to 2652 m (2234-8700 feet). This association grows at the interface between larger riparian areas and the adjacent upland, as well as on high ridges where snow collects, and occurs as small dense thickets, narrow bands, or irregular patches. It often occupies draws, ephemeral creeks in steep narrow-bottomed canyons, and shallow ravines. It can occur on slopes below seeps and springs. Stands can also occur as small pockets on higher terraces or as narrow bands along the high-water mark of steep banks and incised channels. It also grows at the base of cliffs adjacent to rivers. Slope varies from flat to very steep, with variable aspects, and can be associated with rock outcrops and talus. Stands are typically on very well-drained, rocky soils but occasionally have finer soils. Soil texture ranges from sandy loam to clay loam.

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Tree	<i>Fraxinus pennsylvanica</i>
Shrub	<i>Prunus virginiana</i> , <i>Symphoricarpos occidentalis</i>
Herbaceous	<i>Poa pratensis</i>

CHARACTERISTIC SPECIES

Prunus virginiana

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 3 accuracy assessment observations)

Prunus virginiana is the dominant species, ranging from fairly open to dense cover. In the upland (draw) "phase," *Symphoricarpos occidentalis* may be associated with *P. virginiana*. The herbaceous cover is variable, and may be very high when *P. virginiana* cover is patchy to very low. *Pascopyrum smithii* and *Poa pratensis* are the highest cover species. In the floodplain phase, scattered short trees of *Fraxinus pennsylvanica*, *Acer negundo*, and/or *Salix amygdaloides* may occur, and *Symphoricarpos occidentalis*, *Shepherdia argentea*, *Rosa woodsii*, and the non-native *Eleagnus angustifolia* may be associated shrubs. The herbaceous layer in the floodplain "phase" is similarly variable to the "upland" phase, but floristically quite different, with the non-native grasses *Bromus inermis* and *Poa pratensis* and the native *Solidago canadensis* and *Galium aparine* characteristic. Vines (*Vitis riparia*, *Toxicodendron radicans*, and *Clematis ligusticifolia* often contribute substantial cover.

Global

Shrub cover ranges from 100% to more open stands of 30%, with the higher values tending to occur in sites located in drainage bottoms and on lowermost slopes, and the lower values on higher slopes. *Prunus virginiana* is usually the dominant shrub species, but *Prunus americana* may be solely present to codominant. Stands can be dominated by one species but are often a mix of three to six other shrub species, which can be as abundant and sometimes more abundant than the *Prunus*. Other shrubs include *Rhus trilobata*, *Ribes aureum*, *Ribes lacustre*, *Ribes inerme*, *Salix exigua*, *Sambucus* spp., *Amelanchier* spp., *Amorpha canescens*, *Artemisia tridentata*, *Symphoricarpos oreophilus*, *Symphoricarpos occidentalis*, *Juniperus scopulorum*, *Rosa woodsii*, *Mahonia repens*, and *Toxicodendron* spp. In drainage bottom situations, herbaceous cover is usually sparse, less than 10%. On slopes, the shrubs typically occur in a matrix of other shrubland or grassland types, and graminoid cover can be greater than 75%. Herbaceous species include *Bromus carinatus*, *Maianthemum stellatum* (= *Smilacina stellata*), *Poa pratensis*, *Poa fendleriana*, *Muhlenbergia montana*, *Leymus cinereus*, *Agastache urticifolia*, *Balsamorhiza sagittata*, and *Eriogonum umbellatum*. Exotic herbaceous species may be present, including *Cirsium arvense*, *Bromus inermis*, and *Bromus tectorum*.

GLOBAL CLASSIFICATION CONFIDENCE 2

CONSERVATION RANK G4Q

CLASSIFICATION COMMENTS

The distinction between mesic shrublands (*Prunus virginiana* - (*Prunus americana* Shrubland and the *Symphoricarpos occidentalis* Shrubland) is somewhat "artificial" at Little Bighorn Battlefield National Monument. *Prunus virginiana* and *Symphoricarpos occidentalis* show a considerable amount of ecological overlap with each other and exhibit considerable small-scale patch (clonal) dominance in both upland draws and on the Little Bighorn floodplain. In matching stands by dominant species to the best NVC fit, this treatment finds both types splits both types somewhat artificially, with each type exhibiting variable associates, especially in the herbaceous layer, depending on its environmental setting. The dominance of one species over the other, especially on the Little Bighorn floodplain, where grazing by cattle occurs, may relate to selective grazing pressure, as well as ecological site effects. Both NVC analogs describe both types as an upland draw or floodplain edge vegetation. A more ecologically meaningful treatment might recognize an (1) upland draw type characterized by variable dominance of the two shrub species (with *S. occidentalis* usually at higher cover) and mesic grassland associates (eg., *Pascopyrum smithii*) and (2) a floodplain type characterized by variable dominance of the two shrub species (with *P. virginiana* usually at higher cover) and more floodplain associates (*Solidago canadensis*, etc.). In the absence of plot data, the NVC treatment, and the reasonably high accuracy in mapping solely by the dominant shrub species in the stand, we retain this artificial distinction between the two types at Little Bighorn Battlefield National Monument.

Salix exigua Temporarily Flooded Shrubland

COMMON NAME	Coyote Willow Temporarily Flooded Shrubland
LOCAL NAME	Sandbar Willow Shrubland
CLASS	Shrubland (III)
SUBCLASS	Deciduous shrubland (III.B)
GROUP	Cold-deciduous shrubland (III.B.2)
SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N)
FORMATION	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d)
ALLIANCE	<i>SALIX (EXIGUA, INTERIOR)</i> TEMPORARILY FLOODED SHRUBLAND ALLIANCE
ASSOCIATION IDENTIFIER	CEGL001197
USFWS WETLAND SYSTEM	Palustrine Scrub-Shrub broad-leaved deciduous, temporarily flooded (PSS1A)
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Floodplain (CES303.676)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known only from the Main Unit, where it is found in small patches along the Little Bighorn River.

Global

This willow shrubland association is found along rivers and streams at lower elevations throughout the western United States and Great Plains, ranging sporadically from Oklahoma northwest to the Dakotas and Manitoba, west to Washington, and south to the Rio Grande, San Juan and Canadian River watersheds in northern New Mexico. In California, this association has been sampled along the Sacramento River, in the Central Coast Ranges, northern and central Sierra Nevada foothills, and Cascade Range foothills. Part of this type's former range in the Great Plains and eastward is actually occupied, at least in part, by *Salix interior* [see *Salix interior* Temporarily Flooded Shrubland (CEGL008562)].

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands are found on the banks and active channels of the Little Bighorn River on Quaternary alluvium (Haverson and Glenberg soils). They are lower in relative elevation (more frequently flooded) than other floodplain types, including the *Populus deltoides* – *Fraxinus pennsylvanica* Forest, the *Symphoricarpos occidentalis* Shrubland, the *Prunus virginiana* – (*Prunus americana*) Shrubland and the *Shepherdia argentea* Shrubland.

Global

This association is found on recently deposited or disturbed alluvial material. The parent material is alluvial sand, although silt, clay, or gravel may be present. Soil development is poor to absent. In New Mexico, this association occurs along wide, low-gradient streams and rivers in foothill regions and in lowland valleys and canyons at low to mid elevations of 1430 to 1910 m (4700-6250 feet). The type is common on low alluvial bars that are subject to repeated flooding (1- to 5-year recurrence intervals). Soils are poorly stratified and generally consist of a thin layer of sandy loam at the surface overlying deep deposits of sand, gravel, or cobble. Rock fragments comprise upwards of 80% of the soil profile. These well-drained soils provide good aeration and rapid movement of water through the profile. Sites composed mostly of riverwash are moist at the surface for much of the season, while high bars may be dry on the surface, but tend to be moist at depths of 15 to 30 cm (6-12 inches) during most years.

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Shrub	<i>Salix exigua</i> , <i>Fraxinus pennsylvanica</i> , <i>Populus deltoides</i>
Herbaceous	Unknown

CHARACTERISTIC SPECIES

Salix exigua

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 4 accuracy assessment observations)

Salix exigua is the dominant species, usually forming moderately dense to dense cover in the tall shrub layer. *Fraxinus pennsylvanica* and/or *Populus deltoides* saplings often also occur, and *P. deltoides* may be locally dominant and exceed *S. exigua* cover. *Cornus sericea* was important in one stand. Because the herbaceous layers of most stands were under water during the accuracy assessment, their composition at Little Bighorn Battlefield National Monument is largely unknown.

Global

This association is dominated by shrubs, generally between 2 and 4 m tall. The most common of these is *Salix exigua* (*Salix interior* or intermediates of the two willow species may be present in the eastern part of the range). *Salix irrorata*, *Salix lutea*, and saplings of *Populus deltoides* or *Salix amygdaloides* are also frequently found in the shrub layer in lower elevation stands. *Populus balsamifera* seedlings become more common in northern and western stands. This stratum can have moderate to high stem density in the association as a whole. The species in the shrub layer do not form a closed canopy, allowing significant light to reach the ground layer. There are often patches where the shrub layer is absent. The herbaceous cover is sparse to moderate but rarely exceeds 30%. Older stands and places with less competition from the shrubs have greater herbaceous cover. The composition of the herbaceous layer can vary greatly. Species that are often found in this association are *Cenchrus longispinus*, *Polygonum lapathifolium*, *Schoenoplectus americanus* (= *Scirpus americanus*), *Triglochin maritima*, *Xanthium strumarium*, *Juncus balticus*, *Eleocharis palustris*, *Elymus repens* (= *Elytrigia repens*), *Poa pratensis*, *Phleum pratense*, *Agrostis scabra*, *Bromus inermis*, *Heracleum maximum*, *Achillea millefolium*, *Solidago* sp., *Equisetum arvense*, and *Linaria vulgaris*.

GLOBAL CLASSIFICATION CONFIDENCE 1

CONSERVATION RANK G5

COMMENTS

A tiny stand of shrub-sized *Populus deltoides* observed during the mapping within a river channel was adjacent to and environmentally similar to a stand of this type. It was re-interpreted as patch dominance by rapidly colonizing *P. deltoides* within the *Salix exigua* Shrubland.

Shepherdia argentea Shrubland

COMMON NAME	Silver Buffaloberry Shrubland
LOCAL NAME	Silver Buffaloberry Floodplain Shrubland
CLASS	Shrubland (III)
SUBCLASS	Deciduous shrubland (III.B)
GROUP	Cold-deciduous shrubland (III.B.2)
SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N)
FORMATION	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d)
ALLIANCE	<i>SHEPHERDIA ARGENTEA</i> TEMPORARILY FLOODED SHRUBLAND ALLIANCE
ASSOCIATION IDENTIFIER	CEGL001128
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Floodplain (CES303.676), Western Great Plains Wooded Draw and Ravine (CES303.680)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known only from the Main Unit, where it is found in small patches along the Little Bighorn River.

Global

This association is found in the northern Great Plains of the United States and Canada, extending from Colorado northward to the Dakotas and to Alberta and Saskatchewan. It is found in the northern Great Plains on stream terraces, rolling uplands, and badlands. Although restricted in distribution in Alberta, it is a dominant type in many areas within its range.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands are found on the floodplain and banks of the Little Bighorn River on Quaternary alluvium (Haverson and Glenberg soils). They are evidently slightly lower in relative elevation (more frequently flooded) than the *Populus deltoids* – *Fraxinus pennsylvanica* Forest, the *Symphoricarpos occidentalis* Shrubland, and the *Prunus virginiana* – (*Prunus americana*) Shrubland. They are higher in relative elevation (less frequently flooded) than the *Salix exigua* Temporarily Flooded Shrubland.

Global

This association is found on stream terraces, rolling uplands, and badlands. It occurs where moisture is more plentiful than on the surrounding landscape, such as in swales, ravines, near streams, and on northwest- to east-facing slopes (Hansen and Hoffman 1988, DeVelice et al. 1995). This trend is more pronounced in Wyoming where Jones and Walford (1995) only found this association near streams, and it may be less pronounced in Saskatchewan and northern Montana. Soils are loamy sand, sandy loam, silty loam, or loam and are derived from glacial drift, siltstone, or sandstone (U.S. Forest Service 1992, DeVelice et al. 1995). This environment of this association does not flood often, but some sites show evidence of a high water table (DeVelice et al. 1995).

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Tree	<i>Fraxinus pennsylvanica</i>
Shrub	<i>Shepherdia argentea</i> , <i>Fraxinus pennsylvanica</i>
Herbaceous	<i>Poa pratensis</i> , <i>Bromus inermis</i> , <i>Solidago canadensis</i>

CHARACTERISTIC SPECIES

Shepherdia argentea, *Vitis riparia*, *Clematis ligusticifolia*, *Salix amygdaloides*, *Acer negundo*, *Bromus inermis*, *Solidago canadensis*, *Apocynum cannabinum*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 4 accuracy assessment observations)

Shepherdia argentea is the dominant or a co-dominant shrub, and occurs in sparse to dense patches (10-60% cover). A number of other species are usually present, including *Fraxinus pennsylvanica*, *Prunus virginiana*, *Symphoricarpos occidentalis*, *Ribes* sp., and *Rosa woodsii*. Occasionally, the invasive non-native *Tamarix chinensis* or *Eleagnus angustifolia* may be present and can exceed the native species in cover. In some cases, scattered young trees (*Fraxinus pennsylvanica*, *Salix amygdaloides*, *Acer negundo*, and/or *Populus deltoides*) may be present and emergent from the shrub layer. Vines (*Vitis riparia*, *Toxicodendron radicans*, *Clematis ligusticifolia*) are often present. The herbaceous layer is often dominated by the non-native grasses *Bromus inermis* and/or *Poa pratensis*. Characteristic native species include *Solidago canadensis*, *Carex* sp., *Apocynum cannabinum*, and *Cirsium* sp.

Global

The vegetation is dominated by a moderate to dense canopy of medium-tall shrubs. The most abundant of these, *Shepherdia argentea*, is typically 1.5-3 m tall. Other species commonly found in the shrub layer are *Juniperus horizontalis*, *Prunus virginiana*, *Ribes* spp., *Rhus aromatica*, *Rosa woodsii*, and *Symphoricarpos occidentalis*. Herbaceous species are not important in this association. Graminoids and forbs may be quite variable and have only half the coverage of the shrub layer (Hansen and Hoffman 1988, U.S. Forest Service 1992). Graminoids include *Poa pratensis*, *Pascopyrum smithii*, and *Bromus* spp. Common forbs are *Achillea millefolium*, *Artemisia ludoviciana*, and *Parietaria pensylvanica*. Litter may accumulate in this association (DeVelice et al. 1995).

GLOBAL CLASSIFICATION CONFIDENCE 2

CONSERVATION RANK G3G4

CLASSIFICATION COMMENTS

This type was originally mapped to include a *Tamarix chinensis* Shrubland. This was re-interpreted as an invaded stand of the *Shepherdia argentea* Shrubland, since only one small stand with *T. chinensis* dominant was found, *Shepherdia argentea* was second in importance in this stand. *T. chinensis* is not well-established within Little Bighorn Battlefield National Monument and can easily be and likely will be eliminated soon by National Park Service management in this stand. Similarly the *Eleagnus angustifolia* Shrubland, represented by one tiny mapped stand, was assumed to be a degraded stand of the *Shepherdia argentea* Shrubland. For management purposes, it seemed prudent to retain the identity of the native vegetation, as long as the exotic situation seemed currently manageable. If these exotics expand at Little Bighorn Battlefield to form more extensive stands that tend to obfuscate the identity of the native vegetation, the occurrence of these semi-natural types should be re-considered.

The global description of this type specifies its habitat as upland draws; at Little Bighorn Battlefield National Monument, it occurs primarily on floodplains. Further NVCS work may distinguish between *Shepherdia argentea* stands that occur in these different both settings and that appear to have different species associates.

Symphoricarpos occidentalis Shrubland

COMMON NAME	Western Snowberry Shrubland
LOCAL NAME	Western Snowberry Shrubland
CLASS	Shrubland (III)
SUBCLASS	Deciduous shrubland (III.B)
GROUP	Cold-deciduous shrubland (III.B.2)
SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N)
FORMATION	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d)
ALLIANCE	<i>SYMPHORICARPOS OCCIDENTALIS</i> TEMPORARILY FLOODED SHRUBLAND
ASSOCIATION IDENTIFIER	CEGL001131
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Western Great Plains Wooded Draw and Ravine (CES303.680), Northwestern Great Plains Floodplain (CES303.676)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known mostly from the Main Unit, where it is found in small patches on both the floodplain of the Little Bighorn River and in upland draws. Small amounts occur in the Reno-Benteen Unit in upland draws.

Global

This western snowberry shrubland is found in the western tallgrass, the northern Great Plains, and in the foothills of the northern Rocky Mountains of the United States and Canada.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands are found on the floodplain of the Little Bighorn River on Quaternary alluvium (Haverson and Glenberg soils) and in wooded draws in upland settings (mapped mostly as Midway silty clay loams on the Judith River Formation).

Global

This association is found in mesic swales, depressions, ravines and floodplains. Some examples of this association experience intermittent and brief flooding. In Glacier National Park, it occurs at 1022-1092 m (3350-3580 feet) elevation. The soils are fertile and well-drained to imperfectly drained silts and loams. The upper soil horizon is usually deep, although a thin layer of sand may be present if the site has been recently flooded (Jones and Walford 1995).

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Shrub	<i>Symphoricarpos occidentalis</i> , <i>Prunus virginiana</i>
Herbaceous	<i>Pascopyrum smithii</i> , <i>Poa pratensis</i>

CHARACTERISTIC SPECIES

Symphoricarpos occidentalis

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 4 accuracy assessment observations)

Symphoricarpos occidentalis is the dominant species usually forming dense patches, ranging from fairly open to nearly 100% cover. In the upland (draw) "phase," *Prunus virginiana*, *Artemisia cana*, *Artemisia tridentata*, and *Sarcobatus vermiculatus* may be associated with *S. occidentalis*. The herbaceous cover is variable, and may be very high when *S. occidentalis* cover is patchy to very low. *Pascopyrum smithii*, *Bromus japonicus*, and *Poa pratensis* are the highest cover species. In the floodplain phase, scattered short trees of *Fraxinus pennsylvanica*, *Acer negundo*,

and/or *Salix amygdaloides* may occur, and *Prunus virginiana* may be an associated shrub. The herbaceous layer in the floodplain phase is similarly variable to the upland phase, but floristically quite different, with the non-native grasses *Bromus inermis* and *Poa pratensis* and the native *Solidago canadensis*, *Apocynum cannabinum*, *Symphiotrichum laeve* (= *Aster laevis*), *Glycyrrhiza lepidota*, *Cirsium* sp., *Toxicodendron radicans*, and *Carex* sp. contributing cover.

Global

Throughout its range this association is dominated by shrubs approximately 1 m tall. Shrub cover is typically greater than 50%, and in places it can approach 100%. These shrubs form dense clumps that exclude most other species. *Symphoricarpos occidentalis* is the most common shrub, but *Rhus trilobata* and *Prunus virginiana* can be locally abundant and can grow to 2-3 m in places. *Toxicodendron rydbergii*, *Amelanchier alnifolia*, *Rubus idaeus*, and *Rosa acicularis* may also be present. Herbaceous species and smaller shrubs are most abundant at the edges of this association and in gaps between the clumps of taller shrubs where the shading is less complete. *Rosa woodsii* is a typical smaller shrub. Common graminoids include *Pascopyrum smithii*, *Calamagrostis canadensis*, *Calamagrostis rubescens*, *Achnatherum nelsonii*, and *Poa pratensis*. *Achillea millefolium*, *Artemisia ludoviciana*, *Galium boreale*, and *Solidago* spp. are common forbs of this association. Woody vines sometimes occur, including *Parthenocissus vitacea*.

GLOBAL CLASSIFICATION CONFIDENCE 3

CONSERVATION RANK G4G5

CLASSIFICATION COMMENTS

See comments under the *Prunus virginiana* – (*Prunus americana*) Shrubland.

Pascopyrum smithii - *Nassella viridula* Herbaceous Vegetation

COMMON NAME	Western Wheatgrass - Green Needlegrass Herbaceous Vegetation
LOCAL NAME	Western Wheatgrass - Green Needlegrass Mixedgrass Prairie
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP	Temperate or subpolar grassland (V.A.5)
SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N)
FORMATION	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c)
ALLIANCE	<i>PASCOPYRUM SMITHII</i> HERBACEOUS ALLIANCE
ASSOCIATION IDENTIFIER	CEGL001583
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Mixedgrass Prairie (CES303.674)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this vegetation is widespread and extensive in both units. In the Main Unit, most stands are at lower elevations, especially in the west-central portion.

Global

This western wheatgrass - needlegrass association is common across much of the northern Great Plains of the United States and possibly Canada, ranging from Colorado and possibly Nebraska, north to Montana and North Dakota, and possibly Saskatchewan.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

This vegetation is widespread on lower, more gentle slopes than the *Pseudoroegneria spicata* – *Carex filifolia* Herbaceous Vegetation. Most sites are on soils mapped as Midway silty clay loam, with some mapped as Hesper silty clay loam and Pierre clay. Sites are distributed on the Judith River and Bearpaw geologic Formations, with a minority on Quaternary alluvial terraces.

Global

This association is found at the bottom of narrow valleys, on stream terraces, and on rolling uplands (Jones 1992, U. S. Forest Service 1992). Soils are fine-textured (clays, silty clays, clay loams, or rarely loams) and well-drained. The soil profile is typically well-developed. The parent material is siltstone and mixed sedimentary rock (U. S. Forest Service 1992). This association usually occurs on level or nearly level ground but sometimes may be on moderate slopes of any aspect.

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Herbaceous	<i>Pascopyrum smithii</i> , <i>Bromus japonicus</i>

CHARACTERISTIC SPECIES

Pascopyrum smithii, *Nassella viridula*, *Hesperostipa comata*, *Tragopogon dubius*, *Opuntia polyacantha*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(based on 36 accuracy assessment observations)

This type is a fairly densely vegetated grassland (usually >90% foliar cover), with *Pascopyrum smithii* the dominant species. *Nassella viridula* and *Hesperostipa comata* are frequent at lower cover, and *H. comata*, while less constant than *N. viridula*, can be patch-dominant and contribute higher cover. *Pseudoroegneria spicata* is present in about one-third of the stands, especially as

this type approaches the habitat of the *Pseudoroegneria spicata* – *Carex filifolia* Herbaceous Vegetation, but, even when present, almost always contributes much less cover than *P. smithii*. *Calochortus nuttallii* and *Achillea millefolium* and the non-native *Tragopogon dubius* are often present at low cover, while *Opuntia polyacantha* is often present as a low shrub. The non-native *Bromus japonicus* is usually rampant in stands of this association and will often be the leading dominant in terms of foliar cover early in the growing season, while *Poa pratensis* is less constant but may occasionally contribute high cover.

Global

This association is dominated by mid grasses, generally between 0.6 and 1 m tall. The vegetation cover tends to be moderate to high, with almost all of the canopy provided by graminoids (Redmann 1975, U. S. Forest Service 1992). The dominant species are *Pascopyrum smithii* and *Nassella viridula*, although *Elymus lanceolatus* (another rhizomatous wheatgrass that is similar in morphology and ecology to *Pascopyrum smithii*) is the dominant species in some stands. At least 5% canopy cover of *Nassella viridula* may be diagnostic for this association. Other common grasses are *Hesperostipa comata* (= *Stipa comata*), *Koeleria macrantha*, *Poa secunda* (= *Poa junceifolia*), *Poa pratensis*, *Sporobolus cryptandrus*, and, on sandier soils, *Calamovilfa longifolia*. Shorter graminoids are less common, but may include *Bouteloua gracilis*, *Carex duriuscula* (= *Carex eleocharis*), *Carex filifolia*, *Carex inops* ssp. *heliophila*, and *Carex pensylvanica*. These species are present in many stands, but they usually contribute little cover. The wheatgrass basin association of Nebraska (Steinauer and Rolfsmeier 2000), which may belong to this association, also contains *Schizachyrium scoparium*. Cheatgrasses (*Bromus commutatus*, *Bromus japonicus*, *Bromus tectorum*) are present in many stands and contribute substantial cover in some. The forbs *Symphotrichum falcatum* (= *Aster falcatus*), *Astragalus* spp., *Achillea millefolium*, *Sphaeralcea coccinea*, *Artemisia ludoviciana*, *Lepidium densiflorum*, and *Vicia americana* are also typical of this association. *Artemisia cana* ssp. *cana* or *Artemisia tridentata* ssp. *wyomingensis* may be present, often as scattered shrubs contributing little cover. Stands with denser shrubs are transitional to shrub-herbaceous vegetation.

GLOBAL CLASSIFICATION CONFIDENCE 1

CONSERVATION RANK G3G4

CLASSIFICATION COMMENTS

This type was originally mapped as two types: the *Agropyron smithii* / *Carex filifolia* Habitat Type* and the *Stipa comata* / *Carex heliophila* Habitat Type* of Hansen and Hoffman (1988). Our inability to consistently distinguish the two led us to conclude that stands mapped as being dominated by *Hesperostipa comata* may have been largely due to artifacts of sampling scale imposed by the mapping process and that *H. comata* probably is best treated as a patch-dominant, rather than stand-forming, species at Little Bighorn Battlefield National Monument. The floristic differences between the Hansen and Hoffman concepts and *Pascopyrum smithii* dominated stands at Little Bighorn Battlefield National Monument (*Carex inops* ssp. *heliophila* absent, and *Pascopyrum smithii* is almost never associated with *Carex filifolia*) led us to conclude that a more mesic *P. smithii* dominated concept is warranted in place of the Hansen and Hoffman types. The NVCS concept of the *Pascopyrum smithii* - *Nassella viridula* Herbaceous Vegetation and the *Pascopyrum smithii* – *Hesperostipa comata* Herbaceous Vegetation both reflected the Little Bighorn vegetation reasonably well, with the former a better fit because of the greater constancy of *N. viridula* over *H. comata*. Despite the occasional small-scale patch-dominance of *H. comata*, neither *N. viridula* over *H. comata* achieves co-dominance with *P. smithii* over stand scales.

*Note that *Agropyron smithii* = *Pascopyrum smithii*; *Stipa comata* = *Hesperostipa comata*; *Carex heliophila* = *Carex inops* ssp. *heliophila*)

Agropyron cristatum - (*Pascopyrum smithii*, *Hesperostipa comata*)
Semi-natural Herbaceous Vegetation

COMMON NAME Crested Wheatgrass - (Western Wheatgrass, Needle-and-Thread Grass)
Semi-natural Herbaceous Vegetation
LOCAL NAME Crested Wheatgrass Grassland
CLASS Herbaceous Vegetation (V)
SUBCLASS Perennial graminoid vegetation (V.A)
GROUP Temperate or subpolar grassland (V.A.5)
SUBGROUP Natural/Semi-natural temperate or subpolar grassland (V.A.5.N)
FORMATION Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d)
ALLIANCE *AGROPYRON CRISTATUM* SEMI-NATURAL HERBACEOUS
ASSOCIATION IDENTIFIER CEG005266
USFWS WETLAND SYSTEM Upland
NS ECOLOGICAL SYSTEM Northwestern Great Plains Mixedgrass Prairie (CES303.674)

RANGE

Little Bighorn Battlefield National Monument

A single small stand (about 0.1 hectare) was seen and mapped at the park headquarters area in the Main Unit. This vegetation is likely to be more widespread outside the Monument.

Global

This association occurs in the northern Great Plains of the United States and Canada (Von Loh et al. 2000).

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

The stand observed appeared to be established by seeding or planting of *Agropyron cristatum* to stabilize a small area of previously disturbed soil. The site is on a rolling upland, with soils mapped as Midway silty clay loam over the Judith River Formation.

Global

This type can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, jeep trails, etc. It is also widely planted to revegetate pastures and rangelands (Von Loh et al. 2000).

MOST ABUNDANT SPECIES

STRATUM SPECIES
Herbaceous *Agropyron cristatum*

CHARACTERISTIC SPECIES

Agropyron cristatum

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(based on 1 accuracy assessment observation)

The non-native *Agropyron cristatum* is dominant, and the non-native *Bromus japonicus* occurs at high cover. Native (*Hesperostipa comata*, *Yucca glauca*) and non-native (*Bromus inermis*, *Sisymbrium altissimum*, *Convolvulus arvensis*, *Tragopogon dubius*) species contribute small amounts of cover.

Global

The vegetation is dominated by medium-tall (0.5 - 1 m) graminoids. The dominant grass is *Agropyron cristatum*, a naturalized species from Europe. Other weedy species may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass

prairie grasses, such as *Pascopyrum smithii* and *Hesperostipa comata*, as well as others (Von Loh et al. 2000).

GLOBAL CLASSIFICATION CONFIDENCE 3

CONSERVATION RANK GW

CLASSIFICATION COMMENTS

The global information for this type was derived from Von Loh et al. (2000).

Pseudoroegneria spicata - *Carex filifolia* Herbaceous Vegetation

COMMON NAME	Bluebunch Wheatgrass - Threadleaf Sedge Herbaceous Vegetation
LOCAL NAME	Bluebunch Wheatgrass - Threadleaf Sedge Mixed Prairie
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP	Temperate or subpolar grassland (V.A.5)
SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N)
FORMATION	Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d)
ALLIANCE	<i>PSEUDOROEGNERIA SPICATA</i> HERBACEOUS
ASSOCIATION IDENTIFIER	CEGL001665
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Mixedgrass Prairie (CES303.674)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this vegetation is widespread and extensive in both units. In the Main Unit, most stands are at higher elevations, especially in the northeast and southeast portions.

Global

This association has been described from two stands in southeastern Montana (Hansen and Hoffman 1988) and from two stands (Fisser 1964) and cursory information (Despain 1973) in north-central Wyoming.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

This vegetation is widespread on higher elevations of both units, usually above the *Pascopyrum smithii* – *Nassella viridula* Herbaceous Vegetation on drier ridges and slopes. Most sites are on soils mapped as Midway silty clay loam, with a smaller number mapped as Pierre-Lismas clays, shale outcrops, and Thurlow silty clay loams. Sites are more limited to the Bearpaw Formations than is the *Pascopyrum smithii* – *Nassella viridula* Herbaceous Vegetation, with a minority on the Judith River formation.

Global

Stands of this association have been described from nearly level sites (some windswept) with loam and silt loam soils. Elevations range from about 4100 feet on the Great Plains to about 7000 feet on the west flank of the Bighorn Mountains.

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Shrub	<i>Yucca glauca</i>
Herbaceous	<i>Pseudoroegneria spicata</i> , <i>Pascopyrum smithii</i> , <i>Carex filifolia</i>

CHARACTERISTIC SPECIES

Pseudoroegneria spicata, *Carex filifolia*, *Phlox hoodii*, *Yucca glauca*, *Koeleria micrantha*, *Linum lewisii* var. *lewisii*, *Bouteloua curtipendula*, *Calamovilfa longifolia*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(based on 48 accuracy assessment observations)

This type is a moderately densely vegetated grassland (usually >70% foliar cover), with *Pseudoroegneria spicata* usually the leading dominant species. *Pascopyrum smithii* is often present at lower cover than *P. spicata*, but may contribute equal or slightly greater cover than *P. spicata* (these stands are transitional toward the *Pascopyrum smithii* – *Nassella viridula*

Herbaceous Vegetation, and the increasing abundance of *P. smithii* relative to *P. spicata* usually indicates a trend toward more mesic conditions. *Carex filifolia* and the dwarf shrub *Yucca glauca* are usually present, especially so in the driest sites. *Phlox hoodii*, *Linum lewisii* var. *lewisii*, *Nassella viridula*, and *Koeleria micrantha* often occur at low cover. The grasses *Bouteloua curtipendula* and *Calamovilfa longifolia* occur infrequently, but may occasionally be patch-dominant and nearly as abundant as *P. spicata*. The non-natives *Bromus japonicus*, *Poa pratensis*, and *Tragopogon dubius* may be present, especially in more mesic stands.

Global

Graminoids contribute most of the cover, and forbs are secondary; shrubs may be present as scattered individuals or clumps that contribute little cover to the vegetation. *Pseudoroegneria spicata* dominates the vegetation, and *Carex filifolia* contributes substantial cover. *Hesperostipa comata* (= *Stipa comata*), *Koeleria macrantha*, and *Carex inops* ssp. *heliophila* (= *Carex heliophila*) (in Great Plains stands) often are present in smaller amounts, but they may contribute as much cover as does *Carex filifolia*. *Bouteloua gracilis* is absent or present only in small amounts. Cheatgrass (*Bromus japonicus*, *Bromus tectorum*) is present in many stands and may contribute nearly as much cover as does *Pseudoroegneria spicata*. The vegetation may contain small amounts of numerous forbs. Shrubs are absent or present only as scattered individuals (especially *Artemisia tridentata* ssp. *wyomingensis*), but the subshrubs *Artemisia frigida* and *Gutierrezia sarothrae* usually are present in small amounts.

GLOBAL CLASSIFICATION CONFIDENCE 1

CONSERVATION RANK G4

CLASSIFICATION COMMENTS

This type was originally mapped as four types: the *Agropyron spicatum* / *Carex filifolia* Habitat Type,* the *Agropyron spicatum* / *Bouteloua curtipendula* Habitat Type,* and the *Calamovilfa longifolia* / *Carex heliophila* Habitat Type* of Hansen and Hoffman (1988) and the *Pseudoroegneria spicata* Herbaceous Alliance of the NVCS (representing a relatively even mix of *Pseudoroegneria spicata* and *Pascopyrum smithii*). Our inability during the accuracy assessment to consistently distinguish these types, led us to conclude that stands mapped as being dominated by *Calamovilfa longifolia* and those co-dominated by *Bouteloua curtipendula* may have been largely due to artifacts of sampling scale imposed by the mapping process and that these species probably are best treated as occasional patch-dominants within a more generalized dry *P. spicata*-dominated type, rather than stand-forming, species at Little Bighorn Battlefield National Monument. We were able to detect more floristic differences between a widespread dry *P. spicata* dominated type and a more mesic mixture of *P. spicata* and *P. smithii*. While we considered that this might be the basis for recognizing a *Pseudoroegneria spicata* – *Pascopyrum smithii* Herbaceous Vegetation (CEGL001675) at little Bighorn Battlefield, this stands were not consistently separable from the more widespread, dry *P. spicata* – dominated expression. Since *Carex filifolia* is the most constant of the diagnostic associates (*B. curtipendula* and *C. longifolia* were inconstant and *C. inops* ssp. *heliophila* absent) of dry, *P. spicata* – dominated grasslands at Little Bighorn Battlefield, the NVCS concept of *Pseudoroegneria spicata* – *Carex filifolia* Herbaceous Vegetation is recognized, with the more mesic mix with more *P. smithii* probably best recognized as a more mesic phase or an ecotone with the *Pascopyrum smithii* – *Nassella viridula* Herbaceous Vegetation. Although *Bouteloua gracilis* occasionally occurs in dry *P. spicata*-dominated stands at Little Bighorn, it is too infrequent to consider the occurrence of the *Pseudoroegneria spicata* – *Bouteloua gracilis* Herbaceous Vegetation (CEGL001664).

While the two major grassland types are fairly distinct, when dominance of the major species is clear, some indicators may assist in placing intermediate stands. *Pascopyrum smithii* is more constant in *Pseudoroegneria spicata* / *Carex filifolia* Herbaceous Vegetation (approximately 75% constancy) than is *P. spicata* in stands of *Pascopyrum smithii* – *Nassella viridula* Herbaceous Vegetation (approximately 33% constancy). Thus, *P. spicata* is the better indicator species, so

that stands with nearly equal cover by both species will tend toward the *Pseudoroegneria spicata* – *Carex filifolia* Herbaceous Vegetation. Though not always constant, *Yucca glauca*, *Carex filifolia*, *Phlox hoodii*, *Koeleria micrantha*, *Bouteloua curtipendula*, *Calamovilfa longifolia*, and *Linum lewisii* var. *lewisii* are indicators of *Pseudoroegneria spicata* / *Carex filifolia* Herbaceous Vegetation. The *Pascopyrum smithi* – *Nassella viridula* Herbaceous Vegetation has fewer good diagnostic species, but *Tragopogon dubius*, *Opuntia polyacantha*, and *Hesperostipa comata* tend to be more frequent in that type than in the *Pseudoroegneria spicata* / *Carex filifolia* Herbaceous Vegetation, and the non-native *Bromus japonicus*, though fairly ubiquitous in both types, has higher cover *Pascopyrum smithi* – *Nassella viridula* Herbaceous Vegetation in in early season. Finally, it is worth mentioning that, although a nominal species of the Global-named *Pascopyrum smithi* – *Nassella viridula* Herbaceous Vegetation, *N. viridula* may be as frequent or more so in the *Pseudoroegneria spicata* / *Carex filifolia* Herbaceous Vegetation.

The *Pseudoroegneria spicata* / *Carex filifolia* Herbaceous Vegetation occupies drier sites (higher slopes and convex exposures) than does the *Pascopyrum smithi* – *Nassella viridula* Herbaceous Vegetation, which is extensive on lower, gentler slopes of Little Bighorn Battlefield National Monument.

*Note that *Agropyron spicatum* = *Pseudoroegneria spicata* and *Carex heliophila* = *Carex inops* ssp. *heliophila*)

Great Plains Floodplain and Riverbank Tall Herbaceous Vegetation

COMMON NAME	Great Plains Floodplain and Riverbank Tall Herbaceous Vegetation
LOCAL NAME	Great Plains Floodplain and Riverbank Tall Herbaceous Vegetation
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP	Temperate or subpolar grassland (V.A.5)
SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Temporarily flooded temperate or subpolar grassland (V.A.5.N.j)
ALLIANCE	Undefined
ASSOCIATION IDENTIFIER	None (described from this project)
USFWS WETLAND SYSTEM	Palustrine Emergent persistent, temporarily flooded (PEM1A)
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Floodplain (CES303.676)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this vegetation is known only from the Main Unit, where it is found in small patches along the Little Bighorn River.

Global

This range of this vegetation is currently unknown.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands are found on the floodplain and banks of the Little Bighorn River on Quaternary alluvium (Haverson and Glenberg soils). They are evidently slightly lower in relative elevation (more frequently flooded) than the *Populus deltoids* – *Fraxinus pennsylvanica* Forest, the *Symphoricarpos occidentalis* Shrubland, and the *Prunus virginiana* – (*Prunus americana*) Shrubland and appear to have a similar hydrologic regime to the *Shepherdia argentea* Shrubland. They are higher in relative elevation (less frequently flooded) than the *Salix exigua* Temporarily Flooded Shrubland.

Global

Not known (no information), but likely to occur in similar habitats.

MOST ABUNDANT SPECIES

STRATUM SPECIES

Herbaceous *Bromus inermis*, *Poa pratensis*, *Solidago canadensis*, *Carex* sp.

CHARACTERISTIC SPECIES

Bromus inermis, *Solidago canadensis*, *Carex* sp., *Apocynum cannabinum*, *Symphiotrichum laeve*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

Spartina pectinata is the dominant species. Species richness is generally low in most stands. *Hordeum jubatum* and *Pascopyrum smithii* are typically the most common secondary species.

Global

Not known (no information).

GLOBAL CLASSIFICATION CONFIDENCE Not Ranked

CONSERVATION RANK Not Ranked

CLASSIFICATION COMMENTS

This vegetation was mapped as unclassifiable from any existing floristic descriptions. It was determined to the lowest determinable level of the NVCS (the Formation as defined by the 1997 standard) and given a provisional (project-specific description) as a "placeholder" to classify mapped stands for the Little Bighorn Battlefield project and as an occurrence record for future work.

Artemisia cana ssp. *cana* / *Pascopyrum smithii* Shrub Herbaceous Vegetation

COMMON NAME	Plains Silver Sagebrush / Western Wheatgrass Shrub Herbaceous Vegetation
LOCAL NAME	Silver Sagebrush / Western Wheatgrass Shrub Prairie
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP	Temperate or subpolar grassland with a sparse shrub layer (V.A.7)
SUBGROUP	Natural/Semi-natural temperate or subpolar grassland with a sparse shrub layer (V.A.7.N)
FORMATION	Medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub layer (V.A.7.N.e)
ALLIANCE	ARTEMISIA CANA SSP. CANA SHRUB HERBACEOUS
ALLIANCE	
ASSOCIATION IDENTIFIER	CEGL001556
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Western Great Plains Badlands (CES303.663), Northwestern Great Plains Mixedgrass Prairie (CES303.674), Northwestern Great Plains Floodplain (CES303.676), Western Great Plains Wooded Draw and Ravine (CES303.680)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known mostly from the Main Unit. Small amounts occur in the Reno-Benteen Unit.

Global

This silver or coaltown sagebrush shrubland is found in the northwestern Great Plains and Rocky Mountains of the western United States, ranging from Montana and North Dakota, south to Nebraska.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands occur on low slopes, sides of draws, and, possibly, on eroding badland bluffs above the Little Bighorn River. Soils at sites confirmed to be this association are mapped as Midway silty clay loams, Hesper silty clay loams, or the Clapper-Midway complex. Geologic settings include the Judith River Formation and Quaternary alluvial terrace deposits.

Global

This association occurs on flat alluvial deposits on floodplains, terraces or benches, or alluvial fans. The soils are moderately deep to deep (U.S. Forest Service 1992) and either silt loam, clay loam, or sandy loam (Johnston 1988, Hansen and Hoffman 1988). The soils may have moderate salt content (Hanson and Whitman 1938). Flooding occurs periodically and this tends to retard soil profile development (Hirsch 1985).

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Shrub	<i>Artemisia cana</i> , <i>Symphoricarpos occidentalis</i> , <i>Prunus virginiana</i> ,
Herbaceous	<i>Bromus japonicus</i> , <i>Pascopyrum smithii</i> , <i>Pseudoroegneria spicata</i>

CHARACTERISTIC SPECIES

Artemisia cana, *Pascopyrum smithii*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(based on 6 accuracy assessment observations and one classification plot)

This type is compositionally similar to or nearly identical to the *Pascopyrum smithii*-*Nassella viridula* Herbaceous Vegetation, with the primary distinction being the presence of a low (<1 meter tall) shrub layer of *Artemisia cana*. Other shrubs (*Sarcobatus vermiculatus*, *Symphoricarpos occidentalis*, *Artemisia tridentata*, *Rhus trilobata*, and/or *Prunus virginiana*) are inconstant, but, when present, may sometimes be important to co-dominant. The exotic *Bromus japonicus* is nearly always present, and usually rampant. Major species found in the herbaceous layer. An assemblage of low cover native species is present, with *Hesperostipa comata* and *Achillea millefolium* most constant. *Gaura coccinea*, , were low-cover natives recorded in the single classification plot. The non-native *Sisymbrium altissimum* and/or *Tragopogon dubius* are often frequent, but usually at low cover. Additional species recorded in the single classification plot include *Artemisia frigida*, *Calochortus nuttallii*, *Gaura coccinea*, *Phacelia linearis*, *Cisium undulatum*, *Nassella viridula*, *Psoralea tenuiflorum*, *Camelina microcarpa*, *Melilotus officinalis*, *Poa pratensis*, and *Lactuca serriola*.

Global

This association is dominated by a combination of shrubs and graminoids. The total vegetation cover is typically moderate, but depends on frequency of flooding. The tallest and most conspicuous stratum is a shrub layer that is usually 0.6-1.2 m (Hansen and Hoffman 1988). In 14 stands in western North Dakota shrubs averaged 28% canopy cover, graminoids 59%, and forbs 2% (U.S. Forest Service 1992). Stands in Nebraska often have less than 15% cover. The variation in soils within and between stands of this association results in variable species composition. *Artemisia cana* is the dominant shrub. *Symphoricarpos occidentalis* is frequently present. There are also shorter shrubs such as *Artemisia frigida*, *Krascheninnikovia lanata*, *Rosa woodsii*, and *Gutierrezia sarothrae*. The most abundant graminoid is *Pascopyrum smithii*. This species is typically 0.5-1.0 m tall. It is often accompanied by *Nassella viridula* and sometimes *Koeleria macrantha*, *Poa pratensis*, and *Hesperostipa comata* (= *Stipa comata*). *Bouteloua gracilis* is the most abundant short graminoid. Typical forb constituents of this association are *Achillea millefolium*, *Gaura coccinea*, *Sphaeralcea coccinea*, and *Lactuca tatarica* var. *pulchella*.

GLOBAL CLASSIFICATION CONFIDENCE 1

CONSERVATION RANK G4

CLASSIFICATION COMMENTS

At Little Bighorn Battlefield National Monument, *Artemisia cana* appears to be an opportunistic species that is somewhat variable in occurrence, although it is clearly more affiliated with more mesic (*Pascopyrum smithii* dominated) sites than more xeric (*Pseudoroegneria spicata* dominated) sites. Thus, stands that key to this type may be transitional to or only arbitrarily distinct from types dominated by other shrubs (eg., *Artemisia tridentata* or *Sarcobatus vermiculatus* types in open grasslands and on badlands bluffs or *Prunus virginiana* or *Symphoricarpos occidentalis* types in draws. Periodic flooding occurs in many stands of this association.

Artemisia cana was not determined to subspecies in the field during this study. Based on range, it is assumed to be ssp. *cana*.

Artemisia tridentata ssp. *wyomingensis* / *Pascopyrum smithii* Shrub
Herbaceous Vegetation

COMMON NAME	Wyoming Big Sagebrush / Western Wheatgrass Shrub Herbaceous Vegetation
LOCAL NAME	Big Sagebrush / Western Wheatgrass Shrub Prairie
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP (V.A.7)	Temperate or subpolar grassland with a sparse shrub layer
SUBGROUP	Natural/Semi-natural temperate or subpolar grassland with a sparse shrub layer (V.A.7.N)
FORMATION	Medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub layer (V.A.7.N.e)
ALLIANCE	<i>ARTEMISIA TRIDENTATA</i> SSP. <i>WYOMINGENSIS</i> SHRUB HERBACEOUS
ASSOCIATION IDENTIFIER	CEGL001047
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Mixedgrass Prairie (CES303.674)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known from the Main Unit.

Global

This Wyoming big sagebrush type is found throughout the northern Great Plains and adjacent basins, Black Hills, and Rocky Mountains of the United States, particularly in Colorado and Wyoming.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands occur on lower upland slopes and upper sides of draws. Soils are mapped as Hesper silty clay loams and, less frequently, as Midway silty clay loams. Geologic settings include the Judith River Formation and Quaternary alluvial terrace deposits.

Global

Stands occur on gently rolling uplands, swales or upper parts of stream terraces and drainageways. Drier examples may be found on more exposed slope positions or steeper slopes. Soils are moderately deep to deep clay, clay loam, silt loam or sandy loam. Soil moisture conditions are relatively mesic. Soil pH ranges from 5.8 to 7.8 (Hirsch 1985, Hansen and Hoffman 1988, Thilenius et al. 1995).

MOST ABUNDANT SPECIES

Little Bighorn Battlefield National Monument

STRATUM	SPECIES
Shrub	<i>Artemisia tridentata</i>
Herbaceous	<i>Pascopyrum smithii</i> , <i>Bromus japonicus</i> , <i>Poa pratensis</i> , <i>Tragopogon dubius</i>

CHARACTERISTIC SPECIES

Little Bighorn Battlefield National Monument

Artemisia tridentata, *Pascopyrum smithii*

Global

Buteloua gracilis, *Carex filifolia*, *Stipa comata*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 5 accuracy assessment observations)

Artemisia tridentata is dominant, and, often, the only species in the shrub layer, but at low cover (1-20%). Herbaceous layer foliar cover is generally quite high (75-100%) and dominated by *Pascopyrum smithii*. *P. smithii* is often exceeded in cover by the non-native *Bromus japonicus* and sometimes by the non-native *Poa pratensis*. The native grasses *Hesperostipa comata* and *Nassella viridula* and the non-native forb *Tragopogon dubius* may be present at low cover in the herbaceous layer, and *Opuntia polyacantha* may be present as a dwarf shrub.

Global

The vegetation contains an open short-shrub layer, approximately 0.5 m tall, dominated by microphyllous-leaved shrubs, and a dense herbaceous layer dominated by medium-tall graminoids. Shrub cover averages between 15 and 30% (Hirsch 1985, Hansen and Hoffman 1988, Thilenius et al. 1995) but may range as high as 55%. *Artemisia tridentata* ssp. *wyomingensis* dominates the shrub layer. Other shrubs present may include *Symphoricarpos oreophilus*, *Ericameria nauseosa*, *Amelanchier utahensis*, or *Purshia tridentata*. The dense herbaceous layer has a canopy cover ranging between 10% in heavily grazed sites to over 75% in protected, mesic sites. *Pascopyrum smithii* is the leading dominant. Important associates include *Koeleria macrantha*, *Poa secunda*, and *Nassella viridula* (= *Stipa viridula*). In drier or more heavily grazed phases, *Bouteloua gracilis*, *Hesperostipa comata* (= *Stipa comata*), and *Carex filifolia* may be more common, along with the succulent *Opuntia polyacantha*. Forbs contribute low cover, often less than 10%, and are typically of low constancy. More constant species (>50%) include *Artemisia frigida*, *Sphaeralcea coccinea*, and *Vicia americana*. Grassy leaf litter covers over 75% of the ground; stones and bare soil comprise the remainder. Nonvascular plants are rare (Hirsch 1985, Hansen and Hoffman 1988, Thilenius et al. 1995).

GLOBAL CLASSIFICATION CONFIDENCE 2

CONSERVATION RANK G4

CLASSIFICATION COMMENTS

Artemisia tridentata was not determined to subspecies in the field during this study. The assignments of *Artemisia tridentata* stands to *Artemisia tridentata* ssp. *wyomingensis* associations were based on determinations of *A. tridentata* specimens from the immediate vicinity of Little Bighorn Battlefield by Steve Cooper (Montana Natural Heritage Program, retired) (S.Cooper, pers. comm. 2008) and by comparison of overall floristic composition and range to the global description of the association described here.

Artemisia tridentata ssp. *wyomingensis* / *Pseudoroegneria spicata*
Shrub Herbaceous Vegetation

COMMON NAME	Wyoming Big Sagebrush / Bluebunch Wheatgrass Shrub
Herbaceous Vegetation	
LOCAL NAME	Big Sagebrush / Bluebunch Wheatgrass Shrub Prairie
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP	Temperate or subpolar grassland with a sparse shrub layer (V.A.7)
SUBGROUP	Natural/Semi-natural temperate or subpolar grassland with a sparse shrub layer (V.A.7.N)
FORMATION	Medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub layer (V.A.7.N.e)
ALLIANCE	ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS SHRUB HERBACEOUS
ASSOCIATION IDENTIFIER	CEGL001535
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Mixedgrass Prairie (CES303.674)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known mostly from the Main Unit. Small amounts occur in the Reno-Benteen Unit.

Global

This association is known from Montana, Wyoming, Colorado, Idaho, Washington, Oregon (apparently), Nevada, and British Columbia, Canada. It probably also occurs in western North Dakota and Utah, and it may occur in South Dakota. This association is known to occur on the Thunder Basin National Grassland and on the Custer National Forest, Ashland District. It may also occur on the Sioux District and the Grand River Districts of the Custer National Forest.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands occur on rolling upland slopes. Soils at sites confirmed to be this association are mapped as Midway silty clay loams, Hesper silty clay loams, or the Clapper-Midway complex. Geologic settings include the Judith River Formation and Quaternary alluvial terrace deposits.

Global

On the Great Plains of eastern Montana and Wyoming (Hansen and Hoffman 1988, Thilenius et al. 1995), stands of this association occur on moderately steep to steep (16-45%) slopes and on gentle footslopes with various aspects, at 4400-5000 feet elevation. Soils are loams, sandy loams, and sandy clay loams, often with coarse fragments in the upper horizons. Stands on the Wyoming plains often are on slopes of sandstone or porcelanite buttes (Thilenius et al. 1995). In the basins and foothills of south-central Montana (DeVelice and Lesica 1993) and north-central and central Wyoming (Fisser 1964, Tweit and Houston 1980, Knight et al. 1988), this association occupies mainly gentle to moderately steep (<35%) slopes at 4000-6000 feet elevation. Soils are moderately deep, usually loamy (although one stand has been described from a clay soil), may have a considerable volume of coarse fragments, and have low electrical conductivity. In central and northwestern Colorado, stands of this association occupy gentle to steep slopes (to 65%) on a variety of landforms at elevations from about 7000-8200 feet. Soils are derived from a variety of parent materials and often are gravelly. In southwestern Montana (Mueggler and Stewart 1980, Cooper et al. 1995), stands grow at elevations from 4000-7500 feet, on slopes up to 54% with various exposures. Soils are shallow to moderately deep and derived from a variety of parent materials. In eastern Washington (Daubenmire 1988), this association occupies silt loam and

sandy loam soils on gentle to moderately steep (8-38%) slopes with a variety of aspects, up to about 2700 feet elevation. In British Columbia, this type grows on relatively warm, dry sites (Tisdale 1947), generally from 1300-1970 feet elevation with stands on steep, south-facing slopes occurring as high as 2950 feet (McLean 1970). Soils are loams, silt loams, and sandy loams.

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Shrub	<i>Artemisia tridentata</i>
Herbaceous	<i>Pseudoroegneria spicata</i> , <i>Bromus japonicus</i> , <i>Pascopyrum smithii</i>

CHARACTERISTIC SPECIES

Artemisia tridentata, *Pseudoroegneria spicata*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 7 accuracy assessment observations)

Artemisia tridentata is dominant in the shrub layer, but at low cover (1-20%), with *Artemisia cana* a frequent to co-dominant associate. *Yucca glauca* may be present at low cover as a dwarf shrub. Herbaceous layer foliar cover is generally quite high (75-100%) and dominated by *Pseudoroegneria spicata*. *Pascopyrum smithii* is often present and may achieve co-dominance with *P. spicata*. The non-native *Bromus japonicus* is usually present and may contribute high cover, as [less frequently] can *Poa pratensis*. The natives *Nassella viridula*, *Hesperostipa comata*, *Carex filifolia*, and *Calochortus nuttallii* and the non-native *Tragopogon dubius* can contribute low cover in the herbaceous layer.

Global

Throughout the range of this association, the vegetation consists of an open to moderately dense shrub layer (about 10-25% canopy cover) dominated by *Artemisia tridentata* ssp. *wyomingensis*, and a herbaceous layer dominated by *Pseudoroegneria spicata* with lesser amounts of *Poa secunda* (sometimes a codominant grass). Other shrubs (especially *Chrysothamnus* sp.) and herbaceous species (especially *Hesperostipa comata* (= *Stipa comata*)) usually are present. *Festuca idahoensis* is absent or present in small amounts. The stands in the eastern half of the geographic range often contain small amounts of *Gutierrezia sarothrae*, *Artemisia frigida*, *Sphaeralcea coccinea*, *Phlox hoodii*, *Koeleria macrantha*, and *Opuntia polyacantha*. Less constant species are *Bouteloua* spp. (especially *Bouteloua gracilis*) *Carex filifolia*, and *Pascopyrum smithii* (Hansen and Hoffman 1988, Thilenius et al. 1995, Mueggler and Stewart 1980, DeVelice and Lesica 1993, Cooper et al. 1995, Tweit and Houston 1980, Fisser 1964, Knight et al. 1988, Baker and Kennedy 1985, Tiedemann et al. 1988). Missing from these stands is *Achnatherum thurberianum* (= *Stipa thurberiana*). In the western half of the geographic range, the vegetation generally lacks the associated species listed above (although Tisdale (1947) reports *Artemisia frigida* in British Columbia) and often contains *Antennaria dimorpha* and *Achnatherum thurberianum* (Hironaka et al. 1983, Blackburn 1967, Blackburn et al. 1968b, Daubenmire 1988, Tisdale 1947, McLean 1970). In addition, the stands in Washington often contain large amounts of crustose lichens as ground cover. Descriptions and photographs of stands show that shrub height also varies across the range of this type. From the Great Plains westward to eastern Idaho and south to Colorado, the sagebrush seldom exceeds 0.5 m in height, but in western Idaho and Washington, the shrubs typically are 1 m tall.

GLOBAL CLASSIFICATION CONFIDENCE 2

CONSERVATION RANK G4

CLASSIFICATION COMMENTS

Artemisia tridentata was not determined to subspecies in the field during this study. The assignments of *Artemisia tridentata* stands to *Artemisia tridentata* ssp. *wyomingensis* associations were based on determinations of *A. tridentata* specimens from the immediate vicinity of Little

Bighorn Battlefield by Steve Cooper (Montana Natural Heritage Program, retired) (S.Cooper, pers. comm. 2008) and by comparison of overall floristic composition and range to the global description of the association described here.

Rhus trilobata / *Pseudoroegneria spicata* Shrub Herbaceous
Vegetation

COMMON NAME	Skunkbush Sumac / Bluebunch Wheatgrass Shrub Herbaceous Vegetation
LOCAL NAME	Skunkbush Sumac / Bluebunch Wheatgrass Shrub Prairie
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP (V.A.7)	Temperate or subpolar grassland with a sparse shrub layer
SUBGROUP	Natural/Semi-natural (V.A.7.N)
FORMATION	Medium-tall temperate or subpolar grassland with a sparse cold-deciduous shrub layer (V.A.7.N.g)
ALLIANCE	<i>RHUS TRILOBATA</i> SHRUB HERBACEOUS ALLIANCE
ASSOCIATION IDENTIFIER	CEGL001120
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Northwestern Great Plains Mixedgrass Prairie (CES303.674)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known from both units, with larger stands in the Reno-Benteen Unit.

Global

This shrub prairie type is found in the United States on dry mid to upper slopes and ridgetops in the eastern plains and mountains of Wyoming and Montana.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands occur on rolling uplands and upper sides of draws. Soils at sites confirmed to be this association are mostly mapped as Midway complex shale outcrops and also as Midway silty clay loams and Pierre clay. The most common geologic settings is mapped as the Bearpaw Formation.

Global

This association is typically found on dry mid to upper slopes and ridgetops. It has been identified on butte tops in eastern Wyoming (Thilenius et al. 1995). Slope and aspect are variable, but soils are consistently shallow and rocky. They often form from sandstone parent materials, and rock fragments, outcrops, and bare soil cover much of the ground (Mueggler and Stewart 1980).

MOST ABUNDANT SPECIES

STRATUM SPECIES

Shrub *Rhus trilobata*, *Prunus virginiana*, *Yucca glauca*

Herbaceous *Pseudoroegneria spicata*, *Bromus japonicus*, *Pascopyrum smithii*

CHARACTERISTIC SPECIES

Rhus trilobata, *Pseudoroegneria spicata*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 1 classification plot and 9 accuracy assessment observations)

This is a dry grassland, with a [usually] sparse (1-15% cover) shrub layer of *Rhus trilobata*. Other shrubs, (primarily *Prunus virginiana*, *Artemisia tridentata*, *Symphoricarpos occidentalis*) may be present, but at lower cover. *Yucca glauca* and *Opuntia polyacantha* are sometimes present at low cover as dwarf shrubs. The herbaceous layer is dense (usually >90%) and dominated by graminoids, with *Pseudoroegneria spicata* the leading dominant, or at least co-dominant.

Pascopyrum smithii is a frequent associate and may be co-dominant. *Nassella viridula*, *Koeleria micrantha*, *Hesperostipa comata*, *Achillea millefolium*, and *Artemisia ludoviciana* were recorded at multiple sites. The invasive non-native *Bromus japonicus* may have high cover in or may co-dominate the herbaceous layers also fairly frequent. In the single classification plot, the native *Festuca idahoensis* and the non-native *Poa pratensis* were co-dominant with *P. spicata*. Native herbaceous species recorded at low cover were *Helianthella quinquenervia*, *Crepis acuminata*, *Calochortus nuttalli*, *Phacelia linearis*, *Elymus trachycaulus*, *Allium textile*, *Gaura coccinea*, *Phlox hoodii*, *Vicia americana*, and *Thermopsis rhombifolia*.

Global

Herbaceous species dominate the vegetation with short shrubs and nonvascular plants present but of lesser importance. Total vegetation cover is moderate (Brown 1971, Thilenius et al. 1995) and few plants grow taller than 1 m. Shrubs generally have from 10-25% cover. *Rhus trilobata* is the most common. It is often found with *Artemisia frigida*, *Artemisia tridentata*, *Prunus virginiana*, *Ribes cereum*, or *Eriogonum* spp. *Pseudoroegneria spicata* is the most abundant herbaceous species. Others commonly found include *Koeleria macrantha*, *Schizachyrium scoparium*, *Bouteloua curtipendula*, *Bromus tectorum*, and *Opuntia polyacantha*.

GLOBAL CLASSIFICATION CONFIDENCE 1

CONSERVATION RANK G4

CLASSIFICATION COMMENTS

Although *Festuca idahoensis* was present and contributed significant cover in the single classification plot, it was lower in cover than *Pseudoroegneria spicata* and was not seen elsewhere during the accuracy assessment, which likely examined most, if not all, *R. trilobata* stands. The *Rhus trilobata* / *Festuca idahoensis* Shrub Herbaceous Vegetation probably does not occur at Little Bighorn battlefield National Monument.

Sarcobatus vermiculatus / *Pascopyrum smithii* - (*Elymus lanceolatus*)
Shrub Herbaceous Vegetation

COMMON NAME	Greasewood / Western Wheatgrass - (Streamside Wildrye) Shrub Herbaceous Vegetation
LOCAL NAME	Greasewood / Western Wheatgrass Shrub Prairie
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Perennial graminoid vegetation (V.A)
GROUP	Temperate or subpolar grassland with a sparse shrub layer (V.A.7)
SUBGROUP	Natural/Semi-natural (V.A.7.N)
FORMATION	Intermittently flooded temperate or subpolar grassland with a sparse xeromorphic (evergreen and/or deciduous) shrub layer (V.A.7.N.n)
ALLIANCE	SARCOBATUS VERMICULATUS INTERMITTENTLY FLOODED SHRUB HERBACEOUS
ASSOCIATION IDENTIFIER	CEGL001508
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Western Great Plains Badlands (CES303.663), Northwestern Great Plains Mixedgrass Prairie (CES303.674), Western Great Plains Wooded Draw and Ravine (CES303.680)

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this shrubland is known in small patches, mostly from the Main Unit. Small amounts occur in the Reno-Benteen Unit.

Global

This greasewood shrub prairie is found in saline habitats in the northwestern Great Plains of the United States and Canada, ranging from northwestern Nebraska north to the Dakotas and Saskatchewan.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

Stands occur on rolling upland slopes, sides of draws, and on eroding badland bluffs above the Little Bighorn River. Soils are mapped as Midway silty clay loams. Geologic settings include the Judith River and Bearpaw Formations, and Quaternary alluvial terrace deposits (badland bluffs).

Global

This association is found on flat to gently sloping alluvial fans, terraces, lakebeds, and floodplains (Mueggler and Stewart 1980, Hansen and Hoffman 1988). Dodd and Coupland (1966) found *Sarcobatus vermiculatus* in association with *Pascopyrum smithii* only on the most arid parts of southwestern Saskatchewan. The soil is usually deep clay, silty clay, sandy clay, or loam (Hirsch 1985, Jones and Walford 1995), although coarse soils are possible (U. S. Forest Service 1992, Thilenius et al. 1995). They are saline or alkaline, but salt crusts on the surface are absent (Thilenius et al. 1995, but see Steinauer and Rolfsmeier 2000). Parent material is usually alluvium. Flooding during the spring is possible.

MOST ABUNDANT SPECIES

STRATUM	SPECIES
Shrub	<i>Sarcobatus vermiculatus</i>
Herbaceous	<i>Pascopyrum smithii</i> , <i>Bromus japonicus</i>

CHARACTERISTIC SPECIES

Pascopyrum smithii, *Sarcobatus vermiculatus*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(from 11 accuracy assessment observations)

The shrub layer is comprised of sparse layer (usually, 1-5% cover) of *Sarcobatus vermiculatus*, *Artemisia tridentata*, and, less commonly, *Artemisia cana*, *Rhus trilobata*, *Symphoricarpos occidentalis*, and/or *Prunus virginiana* may occur. Herbaceous layer foliar cover is generally quite high (75-100%) and dominated by *Pascopyrum smithii*, with *Pseudoroegneria spicata* often present and sometimes co-dominant with *P. smithii*. *Nassella viridula* and *Achillea millefolium* are frequently present, and *Yucca glauca* and *Opuntia polyacantha* may occur as dwarf shrubs. The native grasses may be exceeded in cover by the non-native *Bromus japonicus*. *Poa pratensis* and *Tragopogon dubius* are other non-natives that may be present.

Global

This association has moderate to dense vegetation cover (Jones and Walford 1995, Thilenius et al. 1995). Medium-tall (0.5-1.5 m) shrubs are scattered throughout, with a total shrub canopy of 10-25% (Hansen and Hoffman 1988, USFS 1992). The shrub layer is dominated by *Sarcobatus vermiculatus*, with *Atriplex confertifolia*, *Atriplex argentea*, *Artemisia tridentata*, and *Chrysothamnus viscidiflorus* in smaller amounts. *Symphoricarpos occidentalis* and *Rhus aromatica* are sometimes found in more mesic microhabitats within this type (Hirsch 1985). Herbaceous cover is sparse beneath the shrubs and moderate to dense in between. The dominant species are typically 0.5-1 m tall. The most abundant species is *Pascopyrum smithii*, usually accompanied by *Bouteloua gracilis*, *Bromus japonicus*, *B. tectorum*, and *Stipa comata*. Few forbs are found in this association. *Achillea millefolium* and *Opuntia polyacantha* are the only species with high constancy. Other species present may include *Grindella squarrosa*. Overall species diversity in this association is low (Hansen and Hoffman 1988, Von Loh et al. 1999).

GLOBAL CLASSIFICATION CONFIDENCE 1

CONSERVATION RANK G4

COMMENTS

This type was originally divided into two concepts at Little Bighorn Battlefield National Monument: a *S. vermiculatus* / *Pascopyrum smithii* Shrub Herbaceous Vegetation and a *Sarcobatus vermiculatus* / *Pseudoroegneria spicata* Shrubland (Hansen and Hoffman 1988). The former was more abundant as mapped and as found during the accuracy assessment. Stands mapped as the latter were in a setting that showed little environmental differentiation from the former. Stands mapped in the field were usually not in the correct map class. Of the three stands found in the field, the field crew were clearly ambiguous as to which type, and, in all three cases, *Pascopyrum smithii* was listed as co-dominant or characteristic. Finally, the NVCS and Hansen and Hoffman (1988) attribute *Sarcobatus vermiculatus* / *Pseudoroegneria spicata* to steep, often badlands, slopes, no mapped or stands or field calls found the type in this setting. Finally, very little was mapped at Little Bighorn Battlefield National Monument and no stands were correctly identified in the accuracy assessment, there seemed little benefit in retaining the more finely split interpretation.

Weedy Annual Great Plains Herbaceous Vegetation [Provisional]

COMMON NAME	Weedy Annual Great Plains Herbaceous Vegetation
LOCAL NAME	Weedy Annual Great Plains Herbaceous Vegetation
CLASS	Herbaceous Vegetation (V)
SUBCLASS	Annual graminoid or forb vegetation (V.D)
GROUP	Temperate or subpolar annual grasslands or forb vegetation (V.D.2)
SUBGROUP	Natural/Semi-natural (V.B.2.N)
FORMATION	Short temperate annual grassland (V.D.2.N.d)
ALLIANCE	Undefined
ASSOCIATION IDENTIFIER	None (described from this project)
USFWS WETLAND SYSTEM	Upland
NS ECOLOGICAL SYSTEM	Unknown

RANGE

Little Bighorn Battlefield National Monument

At Little Bighorn Battlefield National Monument, this vegetation was mapped in small patches in both units, usually near roads.

Global

This range of this vegetation is not known.

ENVIRONMENTAL DESCRIPTION

Little Bighorn Battlefield National Monument

This type is probably generally distributed throughout Little Bighorn Battlefield National Monument, especially in the headquarters area and along roads. It occurs in areas of anthropogenic soil disturbance, such as roadsides, pathways, waste sites, and maintenance areas, usually occurs in small patches (< 0.5 ha). The largest stand seen was at a maintenance area ("boneyard") that was being re-vegetated (perennial species were not yet established).

Global

Similar vegetation likely occurs in a variety of open disturbed habitats, throughout the Great Plains.

MOST ABUNDANT SPECIES

STRATUM SPECIES

Herbaceous *Bromus japonicus*, *Sisymbrium altissimum*, *Convolvulus arvensis*, *Bromus tectorum*

CHARACTERISTIC SPECIES

Convolvulus arvensis, *Bromus tectorum*

VEGETATION DESCRIPTION

Little Bighorn Battlefield National Monument

(based on 2 accuracy assessment observations)

This type is characterized by a dominance of weedy, mostly non-native, mostly low-growing, annual species. Cover and species composition may be variable and subject to time since disturbance and chance events of colonization and seed banks. *Bromus japonicus*, *Sisymbrium altissimum*, *Convolvulus arvensis*, *Bromus tectorum*, *Bromus inermis*, and *Lepidium perfoliatum* were the most frequent species in the few observed stands.

Global

The composition of this vegetation is likely highly variable and dependent in part on the breadth or narrowness of the classification treatment.

GLOBAL CLASSIFICATION CONFIDENCE Not Ranked

GLOBAL CONSERVATION RANK Not Ranked. Probably GW.

CLASSIFICATION COMMENTS

Classification of ruderal, semi-natural vegetation at alliance and association levels is very under-developed in the NVCS. This vegetation was mapped as unclassifiable from any existing floristic descriptions. It was determined to the lowest determinable level of the NVCS (the Formation, as defined by the 1997 standard) and given a provisional (project-specific description) as a “placeholder” to classify mapped stands for the Little Bighorn Battlefield project and as an occurrence record for future work.

A3. Ecological system descriptions

Initial mapping suggested 11 possible Ecological Systems at Little Bighorn Battlefield (Appendix Table XX). The accuracy assessment indicated that the four largest Ecological Systems would provide a map accuracy of 98.6% .

Appendix Table XX. Initial and final (post accuracy assessment) most likely NatureServe Ecological System assignment for associations at Little Bighorn Battlefield National Monument (Comer et al. 2003) (NatureServe 2007).

Initial Possible NVCS Ecological Systems
Inter-Mountain Basins Big Sagebrush Steppe
Inter-Mountain Basins Greasewood Flat
Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland
Northwestern Great Plains Floodplain
Northwestern Great Plains Mixedgrass Prairie
Northwestern Great Plains Riparian
Northwestern Great Plains Shrubland
Rocky Mountain Lower Montane Riparian Woodland and Shrubland
Western Great Plains Badlands
Western Great Plains Sand Prairie
Western Great Plains Wooded Draw and Ravine
Post Accuracy Assessment NVCS Ecological Systems
Northwestern Great Plains Floodplain
Northwestern Great Plains Mixedgrass Prairie
Western Great Plains Badlands
Western Great Plains Wooded Draw and Ravine

The following Ecological Systems descriptions were obtained from NatureServe Explorer <http://www.natureserve.org/explorer/> on March 24, 2008.

Scientific Name: Northwestern Great Plains Floodplain

Unique Identifier: CES303.676

Classification Confidence: 2 - Moderate

Northwestern Great Plains Floodplain ecological system is found in the floodplains of medium and large rivers of the northwestern Great Plains, ranging from the Dakotas Mixedgrass Prairie west through the Northern Great Plains Steppe and north into Canada. This system occurs in the upper Missouri River Basin and includes parts of the Niobrara, White, Cheyenne, Little Missouri, Yellowstone, Powder, Bighorn, Milk, and Musselshell rivers. Alluvial soils and periodic, intermediate flooding (every 5-25 years) typify this system. These are the perennial big rivers of the region with hydrologic dynamics largely driven by snowmelt in the mountains, rather than local precipitation events. Dominate communities within this system range from floodplain forests to wet meadows to gravel/sand flats, however, they are linked by underlying soils and flooding regime. Dominant species are *Populus balsamifera* ssp. *trichocarpa* or *Populus deltoides* and *Salix* spp. *Fraxinus pennsylvanica*, *Salix amygdaloides*, and *Ulmus americana* are common in some stands. If present, common shrub species include *Amorpha fruticosa*, *Cornus drummondii*, *Cornus sericea*, *Symphoricarpos occidentalis*, *Salix exigua*, *Salix interior*, and *Salix planifolia*. Grass cover underneath the trees is an important part of this system and is a mix of cool-season graminoid species, including *Carex pellita* (= *Carex lanuginosa*), *Elymus lanceolatus*, *Pascopyrum smithii*, and *Schoenoplectus* spp., with warm-season species such as *Panicum virgatum*, *Schizachyrium scoparium*, and *Spartina pectinata*. This system is often subjected to heavy grazing and/or agriculture and can be heavily degraded. In Montana, most occurrences are now degraded to the point where the cottonwood overstory is the only remaining natural

component; undergrowth is dominated by *Bromus inermis*, or a complex of pasture grasses. Another factor is that groundwater depletion and lack of fire have created additional species changes. In most cases, the majority of the wet meadow and prairie communities may be extremely degraded or extirpated from the system.

Classification Comments: Northwestern Great Plains Floodplain needs to be more clearly delineated from Northwestern Great Plains Riparian (CES303.677). The component plant association list is incomplete. All the riparian/floodplain/alluvial systems of the Great Plains region need to be revisited for naming conventions, along with better definitions of conceptual boundaries. There is much apparent overlap in their concepts and distribution, and the names add to the confusion. In particular, the difference between "riparian" and "floodplain" usage in the names needs revisiting and possible changing. These systems include Northwestern Great Plains Floodplain (CES303.676), Northwestern Great Plains Riparian (CES303.677), Western Great Plains Floodplain (CES303.678), and Western Great Plains Riparian (CES303.956).

Northwestern Great Plains Mixedgrass Prairie

Unique Identifier: CES303.674

Classification Confidence: 2 – Moderate

The Northwestern Great Plains Mixedgrass Prairie system extends from northern Nebraska into southern Canada and westward through the Dakotas to the Rocky Mountain Front in Montana and probably Wyoming, on both glaciated and non-glaciated substrates. Soil texture (which ultimately effects water available to plants) is the defining environmental descriptor; soils are primarily fine and medium-textured and do not include sands, sandy soils, or sandy loams. This system occurs on a wide variety of landforms (e.g., mesatops, stream terraces) and in proximity to a diversity of other systems. Most usually it is found in association with Western Great Plains Sand Prairie (CES303.670) which occupies the coarser-textured substrates. In various locales the topography where this system occurs is broken by many glacial pothole lakes, and this system may be proximate to Great Plains Prairie Pothole (CES303.661). On the eastern Montana plains, mixedgrass prairie is by far the predominant system. Here it occurs continuously for hundreds of square kilometers, interrupted only by riparian areas or sand prairies, which are associated with gentle rises, eroded ridges or mesas derived from sandstone. Historically, this system covered approximately 38 million ha in Nebraska, North and South Dakota, and Canada; now it covers approximately 270,000 square km in this region. The growing season and rainfall are intermediate to drier units to the southwest and mesic tallgrass regions to the east. Graminoids typically comprising the greatest canopy cover include *Pascopyrum smithii*, *Nassella viridula*, and *Festuca* spp. In Montana these include *Festuca campestris* and *Festuca idahoensis*. Other commonly dominant species in Montana are *Bouteloua gracilis*, *Hesperostipa comata*, and *Carex filifolia*, while *Festuca campestris* and *Festuca idahoensis* may be more abundant in the north and foothill/montane grassland transition areas. Remnants of *Hesperostipa curtiseta*-dominated vegetation are found in northernmost Montana and North Dakota associated with the most productive sites (largely plowed to cereal grains); this species, usually in association with *Pascopyrum smithii*, is much more abundant in Canada. Sites with a strong component of *Nassella viridula* indicate a more favorable moisture balance and perhaps a favorable grazing regime as well because this is one of the most palatable of the mid-grasses. *Hesperostipa comata* is also an important component and becomes increasingly so as improper grazing regimes favor it at the expense of (usually) *Pascopyrum smithii*; progressively more destructive grazing can result in the loss of *Pascopyrum smithii* from the system followed by drastic reduction in *Hesperostipa comata* and ultimately the dominance of *Bouteloua gracilis* (or *Poa secunda* and other short graminoids) and/or a lawn of *Selaginella densa*. *Koeleria macrantha*, at least in Montana and southern Canada, is the most pervasive grass; if it has high cover, past intensive grazing is the presumed reason. Shrub species such as *Symphoricarpos* spp. and *Artemisia frigida* and *Artemisia cana* also occur. Fire and grazing constitute the primary dynamics affecting this system. Drought can also impact this system, in general favoring the shortgrass component at the expense of the mid-grasses. With intensive grazing, cool-season exotics such as *Poa pratensis*, *Bromus inermis*, and *Bromus japonicus* can increase in dominance; both of the rhizomatous grasses have been shown to markedly depress species diversity. Shrub species

such as *Juniperus virginiana* can also increase in dominance with fire suppression. This system is one of the most disturbed grassland systems in Nebraska, North and South Dakota, and Canada.

Classification Comments: The Northwestern Great Plains Mixedgrass Prairie system was edited to expand the concept for central Montana mixedgrass prairie and to exclude specifically sandy soil grasslands, which are placed into Western Great Plains Sand Prairie (CES303.670). This system is similar to Central Mixedgrass Prairie (CES303.659) and can contain elements of Great Plains tallgrass and shortgrass systems. However, it differs from Central Mixedgrass Prairie (CES303.659) in that the cooler climate in this region allows natural cool-season grasses to be more important (greater than 50% cover). Cover of native, nongrazing-induced shrubs typically does not exceed 25% in conjunction with topographic relief (breaks); otherwise the stand would be considered part of Northwestern Great Plains Shrubland (CES303.662). Additional review and commentary by Canadian, Dakotan, and Nebraskan ecologists is needed to flesh out the compositional variation and range of distribution for this important grassland system. In Wyoming, this system transitions into Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland (CES306.040) in the foothills of the northern Wyoming mountains where *Pascopyrum smithii* communities finger up into foothills. If *Festuca idahoensis*, *Carex rossii*, *Artemisia nova*, or *Artemisia tripartita* ssp. *rupicola* occur, then the example is not this system.

Scientific Name: Western Great Plains Badlands

Unique Identifier: CES303.663

Classification Confidence: 1 - Strong

Western Great Plains Badlands ecological system is found within the northern Great Plains region of the United States and Canada with some of the better known and extensive examples in North and South Dakota. In contrast to Western Great Plains Cliff and Outcrop (CES303.665), this system is typified by extremely dry and easily eroded, consolidated clay soils with bands of sandstone or isolated consolidates and little to no cover of vegetation (usually less than 10% but can be as high as 20%). Vegetated patches within the badlands system may have cover higher than 20%. In north-central Montana, badlands often are a mosaic of bare substrate with small patches of grasses and/or shrubs that may exceed 10% cover. In those areas with vegetation, species can include scattered individuals of many dryland shrubs or herbaceous taxa, including *Grindelia squarrosa*, *Gutierrezia sarothrae* (especially with overuse and grazing), *Sarcobatus vermiculatus*, *Atriplex gardneri*, *Artemisia pedatifida*, *Eriogonum* spp., *Muhlenbergia cuspidata*, *Pseudoroegneria spicata*, and *Arenaria hookeri*. Patches of *Artemisia* spp. can also occur. This system can occur where the land lies well above its local base level or below and is created by several factors, including elevation, rainfall, carving action of streams, and parent material.

Classification Comments: It has been proposed to change the name of Western Great Plains Badlands to include "shale barrens." As with all predominantly "barren" systems, there will be patches of vegetated areas within the overall system. Small areas of "badlands" or "shale barrens" can also occur without major erosional processes actively taking place. An example location is Bitter Creek Area of Environmental Concern (BLM designation), which is much like a badland but not so eroded. The vegetation is sparse with *Juniperus horizontalis* and much bare ground; there is some grass cover as well. The driving process is erosion. Exactly where this transitions to Inter-Mountain Basins Shale Badland (CES304.789) in central Wyoming needs to be clarified.

Scientific Name: Western Great Plains Wooded Draw and Ravine

Unique Identifier: CES303.680

Classification Confidence: 2 – Moderate

The Western Great Plains Wooded Draw and Ravine ecological system is typically found associated with permanent or ephemeral streams and may occur on steep northern slopes or within canyon bottoms that do not experience periodic flooding, although soil moisture and topography allow greater than normal moisture conditions compared to the surrounding areas.

Occurrences can be either tree-dominated or predominantly shrubland. *Fraxinus* spp. with *Ulmus rubra* or *Ulmus americana* typically dominate this system, although in some areas of the western Great Plains steppe province, *Juniperus scopulorum* can dominate the canopy. *Populus tremuloides*, *Betula papyrifera*, or *Acer negundo* are commonly present in portions of the northwestern Great Plains, for example in areas of central and eastern Montana. In south-central portions of the Great Plains, *Quercus macrocarpa* can also be present. Component shrubs can include *Cornus sericea*, *Crataegus douglasii*, *Crataegus chrysocarpa*, *Crataegus succulenta*, *Elaeagnus commutata*, *Prunus virginiana*, *Rhus* spp., *Rosa woodsii*, *Shepherdia argentea*, *Symphoricarpos occidentalis*, or *Viburnum lentago*. Common grasses can include *Calamagrostis stricta*, *Carex* spp., *Pascopyrum smithii*, *Piptatherum micranthum*, *Pseudoroegneria spicata*, or *Schizachyrium scoparium*. This system was often subjected to heavy grazing and trampling by both domestic animals and wildlife and can be heavily degraded in some areas. In addition, exotic species such as *Ulmus pumila* and *Elaeagnus angustifolia* can invade these systems.

Classification Comments: More information from the broader division and from the Rocky Mountain division will be needed to determine if those areas dominated by ash and elm should be separated from areas dominated by *Juniperus scopulorum*. Those areas dominated by *Juniperus* are typically found in the Badlands and the western portions of North Dakota and Nebraska, and should probably be described based on data from the Great Plains Steppe or Rocky Mountain division. However, *Juniperus* can occur in stands with elm and ash in Nebraska and North Dakota.

A4. Plant association key

Key to Plant Communities at Little Bighorn National Battlefield

Chris Lea and Peter Rice

This dichotomous key is specific to the 17 final (post-accuracy assessment) natural vegetation types at the Little Bighorn Battlefield. The key also contains Cultural Vegetation (Developed) for the landscaped areas in the Park. Choices are made from paired couplets with the same number. After a choice is made from the couplet, the user either goes to the next higher numbered couplet, or if the selected choice is ended with a “go to #” statement the user skips to that even higher number. The key uses topographic position, vegetation height, and life form before considering specific indicator species.

To effectively use this key you should be able to identify the following 19 indicator species based on their growth form and vegetative characteristics.

<i>Agropyron cristatum</i>	crested wheatgrass
<i>Artemisia cana</i>	silver sagebrush
<i>Artemisia tridentata</i>	Wyoming big sagebrush
<i>Calamovilfa longifolia</i>	prairie sand reed grass
<i>Carex filifolia</i>	threadleaf sedge
<i>Elaeagnus angustifolia</i>	Russian olive
<i>Fraxinus pennsylvanica</i>	green ash
<i>Hesperostipa comata</i> (syn. <i>Stipa comata</i>)	needle and thread grass
<i>Juniperus scopulorum</i>	Rocky Mountain juniper
<i>Pascopyrum smithii</i> (syn <i>Agropyron smithii</i>)	Westrn wheatgrass
<i>Populus deltoides</i>	Great Plains cottonwood
<i>Prunus virginiana</i>	common chokecherry
<i>Pseudoroegneria spicata</i> (syn. <i>Agropyron spicatum</i>)	bluebunch wheatgrass
<i>Rhus trilobata</i> (syn. <i>aromatica</i>)	skunkbush
<i>Salix exigua</i>	sandbar willow
<i>Sarcobatus vermiculatus</i>	black greasewood
<i>Shepherdia argentea</i>	silver buffaloberry
<i>Symphoricarpos</i> <i>occidentalis</i>	western snowberry
<i>Tamarix sp.</i>	salt cedar

The regional flora useful for identifying these indicator species are:

- Dorn, Robert D. 1984. Vascular plants of Montana. Cheyenne, Wyoming: Mountain West Publishing. 276pp.
- Hitchcock, C. L.; Cronquist, Arthur. 1973. Flora of the Pacific Northwest an illustrated manual. Seattle WA: University of Washington Press. 730pp.

1. Managed areas where human actions preclude natural or semi-natural vegetation communities

2. Landscaped areas

Cultural Vegetation (Developed)

2. Disturbed areas that can't be typed to a natural or semi-natural vegetation community

The perennial grass *Agropyron cristatum* is important or dominant

***Agropyron cristatum* - (*Pascopyrum smithii*, *Hesperostipa comata*) Semi-natural Herbaceous**

The perennial grass *Agropyron cristatum* absent or unimportant; ruderal weeds predominate.

Weedy Annual Great Plains Herbaceous Vegetation

1. Natural or semi-natural vegetation areas

3. Floodplain of Little Bighorn River

4. Trees greater than 20 ft tall when mature $\geq 25\%$ absolute cover

7. *Populus deltoides* (Great Plains cottonwood) seedlings or saplings age classes (dbh <5 in.) dominate a recently deposited alluvial bar

***Salix exigua* Temporarily Flooded Shrubland (in part)**

7. Mature *Populus deltoides* with understory that may be dominated by *Symphoricarpos occidentalis* (western snowberry)

***Populus deltoides* – *Fraxinus pennsylvanica* Forest**

4. Short tree (< 20 ft) or shrub (< 10 ft) go to 8 (tall trees < 25 % absolute cover).

8. Short tree less than 20 ft tall when mature

9. *Elaeagnus angustifolia* (Russian olive) dominates overstory
***Shepherdia argentea* Shrubland (in part)**

9. *Elaeagnus angustifolia* (Russian olive) a minor component

10. *Tamarix sp.* (salt cedar) with at least 15% canopy cover and with the greatest canopy cover in the tallest layer
***Shepherdia argentea* Shrubland (in part)**

10. *Prunus virginiana* (common chokecherry) with at least 15% canopy cover and with the greatest canopy cover in the tallest layer
***Prunus virginiana* – (*Prunus americana*) Shrubland (in part)**

8. Shrubs (less than 10 ft tall) go to 11.

11. *Salix exigua* (sandbar willow) (6 to 9 ft tall and typically close to river or slough) dominates tallest layer
***Salix exigua* Temporarily Flooded Shrubland (in part)**

11. Short (less than 6 ft tall) shrubs

12. *Shepherdia argentea* (silver buffaloberry) with at least 15% canopy cover and with the greatest canopy cover in the tallest layer

***Shepherdia argentea* Shrubland (in part)**

12. *Symphoricarpos occidentalis* (western snowberry) with at least 15% canopy cover and with the greatest canopy cover in the tallest layer

***Symphoricarpos occidentalis* Shrubland (in part)**

3. Uplands including ravines or woody draws
go to 13.

13. Herbaceous aspect, trees absent, may have an occasional shrub but shrubs not distributed throughout the polygon

14. Rhizomatous grasses *Agropyron smithii* (western wheatgrass) dominant or *Calamovilfa longifolia* (prairie sand reed grass) abundant

15. *Calamovilfa longifolia* (prairie sand reed grass) abundant

***Pseudoroegneria spicata* – *Carex filifolia* Herbaceous Vegetation (in**

part)

15. *Pascopyrum smithii* (western wheatgrass) dominant

***Pascopyrum smithii* - *Nassella viridula* Herbaceous Vegetation (in part)**

14. Bunchgrasses *Pseudoroegneria spicata* (bluebunch wheatgrass) or *Hesperostipa comata* (needle and thread grass) dominant; or *Pseudoroegneria spicata* (bluebunch wheatgrass) approximately co-dominant with *Pascopyrum smithii* (western wheatgrass) go to 16.

part)

16. *Pseudoroegneria spicata* (bluebunch wheatgrass) dominant
***Pseudoroegneria spicata* – *Carex filifolia* Herbaceous Vegetation (in**

16. *Hesperostipa comata* (needle and thread grass) dominant
***Pascopyrum smithii* - *Nassella viridula* Herbaceous Vegetation (in part)**

13. Woody species present and distributed throughout the polygon go to 19

19. Short trees (10 to ~20 ft tall when mature) usually in a ravine

20. Evergreen *Juniperus scopulorum* (Rocky Mountain juniper) dominates the upper layer

***Juniperus scopulorum* / *Pseudoroegneria spicata* Woodland**

20. Deciduous trees dominate the upper layer

21. *Fraxinus pennsylvanica* (green ash) dominates upper layer
***Fraxinus pennsylvanica* / *Prunus virginiana* Forest**

21. *Prunus virginiana* (common chokecherry) thicket dominates
***Prunus virginiana* – (*Prunus americana*) Shrubland (in part)**

19. Shrubs (less than 10 ft tall) dominate the upper layer, tree species absent go to 22

22. Sagebrush species form the shrub layer, other shrubs absent or rare

23. *Artemisia tridentata* (Wyoming big sagebrush) dominates, *Artemisia cana* (silver sagebrush) absent or inconspicuous

24. *Agropyron spicatum* (bluebunch wheatgrass) dominant in the herbaceous layer, *Agropyron smithii* (western wheatgrass) inconspicuous or absent

Artemisia tridentata* ssp. *wyomingensis* / *Pseudoroegneria spicata

Shrub

Herbaceous Vegetation

24. *Pascopyrum smithii* (western wheatgrass) dominant in the herbaceous layer, *Pseudoroegneria spicata* (bluebunch wheatgrass) inconspicuous or absent

***Artemisia tridentata* ssp. *wyomingensis* / *Pascopyrum smithii* Shrub
Herbaceous Vegetation**

23. *Artemisia cana* (silver sagebrush) dominates, *Artemisia tridentata* (Wyoming big sagebrush) absent or very sparse

Artemisia cana ssp. cana / Pascopyrum smithii Shrub Herbaceous Vegetation

22. Sagebrush species absent or inconspicuous go to 25

25. *Rhus trilobata* (syn *aromatica*) (skunkbush) dominates the shrub layer

Rhus trilobata / Pseudoroegneria spicata Shrub Herbaceous Vegetation

25. *Rhus trilobata* (syn *aromatica*) (skunkbush) absent or inconspicuous

26. *Sarcobatus vermiculatus* (black greasewood) or *Shepherdia argentea* (silver buffaloberry) abundant; *Symphoricarpos occidentalis* (western snowberry) absent or not dominant

27. *Sarcobatus vermiculatus* (black greasewood) dominant in the shrub layer; *Shepherdia argentea* (silver buffaloberry) absent

Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation

27. *Shepherdia argentea* (silver buffaloberry) present; *Sarcobatus vermiculatus* (black greasewood) absent

Shepherdia argentea Shrubland (in part)

26. *Symphoricarpos occidentalis* (western snowberry) abundant and often forming a dense thicket; *Sarcobatus vermiculatus* (black greasewood) or *Shepherdia argentea* (silver buffaloberry) absent

Symphoricarpos occidentalis Shrubland (in part)

A5. Appendix Table xx. Crosswalk for community type

Key and Original Source Community Name	Source	NVCS Association or Alliance [§]	Map Unit Label
Acer negundo/Prunus virginiana	H et al 1995	Acer negundo / Prunus virginiana Forest	Riparian - Boxelder - Chokecherry
Agropyron smithii/Carex filifolia	H & H 1988	Pascopyrum smithii - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation	Herbaceous Upland - Western Wheatgrass - Blue
Agropyron spicatum herbaceous alliance	NVCS	Pseudoroegneria spicata Herbaceous Alliance	Herbaceous Upland - Bluebunch Wheatgrass
Agropyron spicatum/Bouteloua curtipendula	H & H 1988	Pseudoroegneria spicata - Bouteloua curtipendula Herbaceous Vegetation	Herbaceous Upland - Bluebunch Wheatgrass - Sic Gramma
Agropyron spicatum/Carex filifolia	H & H 1988	Pseudoroegneria spicata - Carex filifolia Herbaceous Vegetation	Herbaceous Upland - Bluebunch Wheatgrass - Th Sedge
Artemisia cana/Agropyron smithii	H & H 1988	Artemisia cana / Pascopyrum smithii Shrubland	Shrub - Silver Sage - Western Wheatgrass
Artemisia tridentata/Agropyron smithii	H & H 1988	Artemisia tridentata ssp. wyomingensis / Pascopyrum smithii Shrub Herbaceous Vegetation	Shrub - Sagebrush - Western Wheatgrass
Artemisia tridentata/Agropyron spicatum	H & H 1988	Artemisia tridentata ssp. wyomingensis / Pseudoroegneria spicata Shrub Herbaceous Vegetation	Shrub - Sagebrush - Bluebunch Wheatgrass
Calamovilfa longifolia/Carex heliophila	H & H 1988	Calamovilfa longifolia - Carex inops ssp. heliophila Herbaceous Vegetation	Herbaceous Upland - Sandreed - Sun Sedge
Disturbed Area - Management	project	Disturbed Area	Surface Disturbance
Elaeagnus angustifolia	H et al 1995	Elaeagnus angustifolia Semi-natural Woodland Alliance	Riparian - Russian Olive (invasive)
Fraxinus pennsylvanica/Prunus virginiana	H & H 1988	Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland	Woodland Ash - Chokecherry
Fraxinus pennsylvanica/Prunus virginiana	H et al 1995	Fraxinus pennsylvanica / Prunus virginiana Forest	Riparian - Ash - Chokecherry
Juniperus scopulorum/Agropyron spicatum	H & H 1988	Juniperus scopulorum / Pseudoroegneria spicata Woodland	Woodland Juniper - Bluebunch Wheatgrass
Deveolved Area - Landsaped	project	Landsaped	Developed Area
Populus deltoides/Recent alluvial bar	H et al 1995	Populus deltoides Temporarily Flooded Woodland Alliance	Riparian - Cottonwood (alluvial colony)
Populus deltoides/Symphoricarpos occidentalis	H et al 1995	Populus deltoides / Symphoricarpos occidentalis Woodland	Riparian - Cottonwood - Snowberry
Prunus virginiana	H et al 1995	Prunus virginiana - (Prunus americana) Shrubland	Riparian - Chokecherry
Prunus virginiana shrubland alliance	NVCS	Prunus virginiana Shrubland Alliance	Shrub - Chokecherry
Rhus trilobata/Agropyron spicatum	H & H 1988	Rhus trilobata / Pseudoroegneria spicata Shrub Herbaceous Vegetation	Shrub - Sumac - Bluebunch Wheatgrass
Salix exigua	H et al 1995	Salix exigua Temporarily Flooded Shrubland	Riparian - Narrowleaf Willow
Sarcobatus vermiculatus/Agropyron smithii	H & H 1988	Sarcobatus vermiculatus / Pascopyrum smithii - (Elymus lanceolatus) Shrub Herbaceous Vegetation	Shrub - Greasewood - Western Wheatgrass
Sarcobatus vermiculatus/Agropyron spicatum	H & H 1988	Sarcobatus vermiculatus / Pseudoroegneria spicata Shrubland	Shrub - Greasewood - Bluebunch Wheatgrass
Shepherdia argentea	H & H 1988	Shepherdia argentea Shrubland	Shrub - Buffaloberry
Shepherdia argentea	H et al 1995	Shepherdia argentea Shrubland	Shrub - Buffaloberry
Stipa comata/Carex filifolia	H & H 1988	Hesperostipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation	Herbaceous Upland - Needlegrass - Threadleaf S
Symphoricarpos occidentalis	H et al 1995	Symphoricarpos occidentalis Shrubland	Riparian - Snowberry
Symphoricarpos occidentalis	H & H 1988	Symphoricarpos occidentalis Shrubland	Shrub - Snowberry (ravine)
Tamarix chinensis	H et al 1995	Tamarix spp. Semi-natural Temporarily Flooded Shrubland Alliance	Riparian - Tamarisk (invasive)

[§] Natural or semi-natural vegetation community name is for NVCS Association unless ending with Alliance

A6. Field Data Collection Forms

Crew:				Year:					GPS Unit #:								
Poly ID	18 North - NAD83		Super class	Date mm/dd	18 North - NAD83		WP #	# pts	err	New Super Class	Association	D1	D1-CC	D2	D2-CC	D3	D3-C
	UTM E	UTM N			UTM E	UTM N											
LIBI.VM-395	310633	5049612	libl-i														
LIBI.VM-646	310370	5049463	libl-i														
LIBI.VM-647	310373	5049420	libl-h														
LIBI.VM-653	310367	5049437	libl-h														
LIBI.VM-655	310410	5049420	libl-h														
LIBI.VM-656	310394	5049408	libl-h														
LIBI.VM-658	310372	5049407	libl-h														
LIBI.VM-659	310416	5049344	libl-h														
LIBI.VM-665	310510	5049542	libl-i														
LIBI.VM-666	310470	5049506	libl-i														
LIBI.VM-667	310468	5049495	libl-i														
LIBI.VM-668	310439	5049509	libl-i														
LIBI.VM-669	310483	5049510	libl-i														
LIBI.VM-670	310579	5049507	libl-i														
LIBI.VM-671	310484	5049496	libl-i														
LIBI.VM-672	310519	5049470	libl-i														
LIBI.VM-673	310449	5049464	libl-i														
LIBI.VM-674	310526	5049449	libl-i														
LIBI.VM-675	310596	5049437	libl-i														
LIBI.VM-676	310514	5049462	libl-i														
LIBI.VM-677	310468	5049477	libl-i														
LIBI.VM-678	310523	5049422	libl-i														
LIBI.VM-679	310534	5049428	libl-i														
LIBI.VM-680	310549	5049415	libl-i														

supplemental notes for polygon observations

Polygon ID	Date	Dominant	Cover Class	Notes

A7. Accuracy assessment matrix

Use the 122408 version of the contingency table



Description of project database

National Park Service – Rocky Mountain Network

Inventory and Monitoring Program

LIBI Vegetation Map Geodatabase Documentation

Version: 1.0

Revision Date: May 1, 2008

Authors: Brent Frakes, Dan Manier

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1. Introduction

This document describes the relationships and entities of the relational geodatabase model used to house the LIBI vegetation map data. This model was developed for ArcGIS 9.2 using the personal geodatabase Microsoft Access JET engine.

The structure of this database differs from many of the other NPS Vegetation Maps. Because intensive field sampling was not involved, this vegetation map did not use the NatureServe Plots database. Thus, only a limited set of information was collected in the field. Records of dominant species composition are preserved in this geodatabase as a feature class, and in tables; these tables and data are identified with “Field” and “AA” (Accuracy Assessment) in their headings.

2. Entity Relationships

Figure 1 provides a diagram showing the relationships among the primary entities, both spatial and tabular. In total, there are three feature classes that contain geographic information, five main tables, and three lookup tables used for reference.

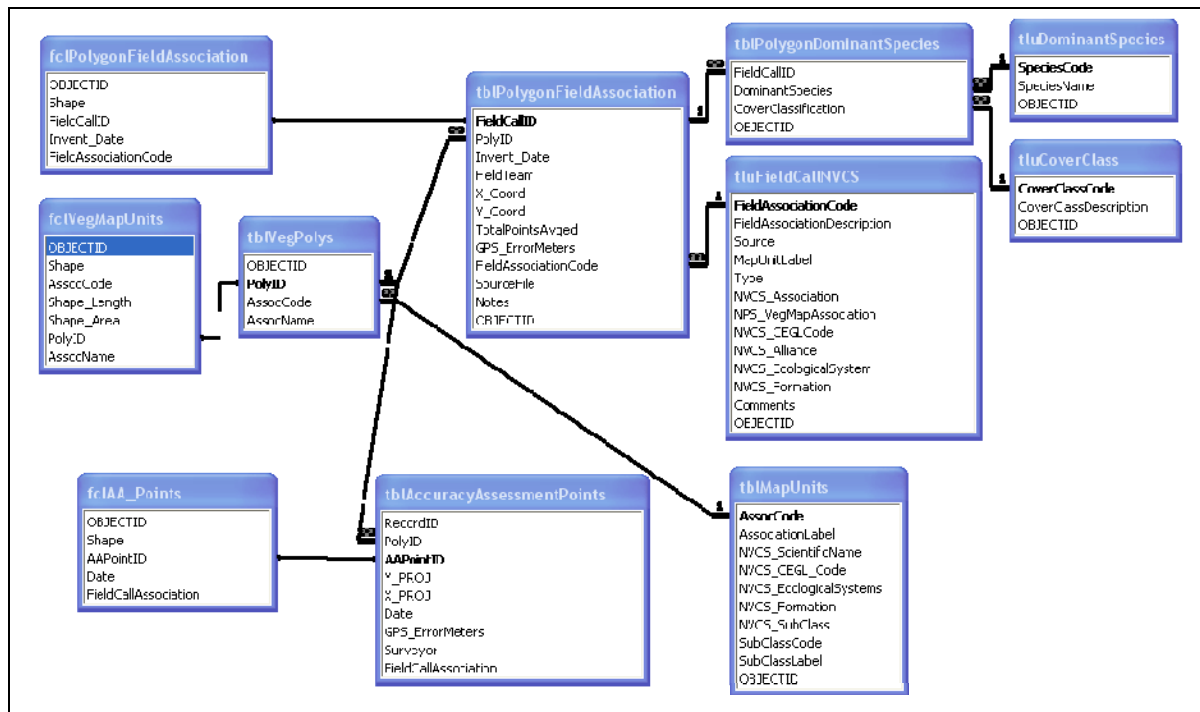


Figure 1. Relationships Among Core Tables in the Geodatabase Model

Referential integrity is enforced among the main tables (tbl) through MS Access. Due to the limitations of the geodatabase model, referential integrity is not enforced among the look-up (tlu) tables and the related feature classes (fcl).

This structure reflects a compromise between normalization and functionality. In general, all spatial information (especially polygons) was represented in the feature classes while all tabular information was housed in relational tables. However, there is sometimes redundancy between the two. For instance, the feature class containing the accuracy assessment points is partially redundant with the table 'tblAccuracyAssessmentPoints'. This simultaneously ensures that one can work in ArcGIS without having to plot x-y points while another can work in Access without the risk of corrupting the feature classes.

3. Table and Attribute Descriptions

Details for each table and data field (see Figure 1) are provided.

3.1. fclVegMapUnits

Contains the geographic location of all vegetation map polygons, their associated classifications and labels. The Map Unit Association code field ('AssocCode') is a four letter code derived from the standard scientific name (i.e. the first two letters of the Genus and specific epithet; some of the entries recognize two dominant species (separated by '/'). Most of these codes match the NVC standards (i.e. may be based on former nomenclature, as in the case of *Pseudoroegneria spicata* which is coded 'AGSP'); a few of the codes are custom names for this map (e.g. those other than natural vegetation types). Map Unit Label includes the common names for the dominant species (same species identified in 'AssocCode').

Attribute	Description	Type
OBJECTID	Autonumber. Internal to ESRI	Long
Shape	Shape. Internal to ESRI	Blob
AssocCode	Map Unit Association code	Text 50
Shape_Length	Length in meters. Internal to ESRI	Double
Shape_Area	Area in square meters. Internal to ESRI	Double
PolyID	Unique polygon identifier	Integer

AssocName	Map Unit Label	Text 15
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3.2. *tblPolygonFieldAssociation*

Point locations used as reference to assign the polygons an association. Additional details of the original “field call” related to these point features are included in ‘tblPolygonFieldAssociation’.

Attribute	Description	Type
OBJECTID	Autonumber. Internal to ESRI	Long
Shape	Shape. Internal to ESRI	Blob
FieldCallID	Field code from field census	Text 50
Invent_Date	Date the point was visited	Date
FieldAssociationCode	Association given to the point	Text 50

3.3. *tblAA_Points*

Contains the geographic location of all accuracy assessment points. This feature class is a spatial representation of ‘tblAccuracyAssessmentPoints’ and contains a subset of the full tabular information documenting the accuracy assessment process.

Attribute	Description	Type
OBJECTID	Unique record assigned by ESRI	Autonumber
Shape	Shape. Internal to ESRI	BLOB
AAPointID	Unique point ID for each AA point	Double
Date	Date of field call	Date
FieldCallAssociation	Association determined from the field	Text 255

3.4. *tblVegPolys*

Table containing supplementary information about each map unit polygon. Some of this information is found in the feature class.

Attribute	Description	Type
OBJECTID	Autonumber. Internal to ESRI	Long Integer
PolyID	Unique polygon ID	Text 10
AssocCode	Map Unit Association Code	Text 50

tblPolygonFieldAssociation

Contains the data collected in the field to determine the association for each polygon.

Attribute	Description	Type
FieldCallID	Unique ID for each field call	Text 50
PolyID	Code identifying each polygon	Integer
Invent_Date	Date the polygon was visited	Date
FieldTeam	Identifier initials from the field team	Text 2
X_Coord	UTM Easting, 13 North, NAD 83	Double
Y_Coord	UTM Northing, 13 North, NAD 83	Double
TotalPointsAvged	The number of points collected in recording the waypoint	Long
GPS_ErrorMeters	The estimated accuracy of the GPS unit when point was visited (meters)	Text 50
FieldAssociationCode	Community type assigned to the polygon during the fieldwork	Text 50
SourceFile	Name of the waypoint file used to assign the point	
Notes	Notes from the field sheet	Memo
OBJECTID	Autonumber. Unique to ESRI	Long

3.5. *tblAccuracyAssessmentPoints*

Contains the locations and field identification call made by the accuracy assessment team; these data were used to assess correlation between original field calls, assigned polygon associations and user accuracy.

Attribute	Description	Type
RecordID	Unique record identifier - autonumber	Long
PolyID	Polygon Unit from fclMapUnit	Integer
AAPointID	Unique AA point ID	Text 255
X_PROJ	UTM NAD 83, 13 North	Long Integer
P_PROJ	UTM NAD 83, 13 North	Long Integer
Date	Date the point was visited	Date
GPS_ErrorMeters	Estimated GPS positional error in meters	Double
Surveyor	Name of the surveyor making the field call	Text 255
FieldCallAssociation	Association observed in the field	Text 255

3.6. *tblMapUnits*

This table of classes represents the final crosswalk for the NVCS associations; it includes codes, scientific nomenclature and class hierarchy assignments.

Attribute	Description	Type
AssocCode	Unique code identifying each association	Text 50
AssociationLabel	Label for aggregated map units	Text 255
NVCS_Scientificname	Accepted scientific nomenclature from NatureServe Explorer Web site (Oct 2006)	Text 255
NVCS_C EGL_Code	Unique NVCS alpha-numeric from NVC (NatureServe): Association Code (CEGL#####), Alliance Code (A.####) or project specific NPS code (NPS.LIBI#) for non-natural types (Manier per Chris Lea recs.)	Text 255
NVCS_EcologicalSystems	NVCS/NatureServe Ecological System	Text 50
NVCS_Formation	NVCS/NatureServe Formation	Text 50
NVCS_SubClass	Subclass from NVC hierarchy	Text 50
SubClassCode	Code based on NVC Subclass	Text 5
SubClassLabel	Single word label for easy map display	Text 10
OBJECTID	Autonumber. Internal to ESRI	Long Integer

3.7. *tblPolygonDominantSpecies*

Dominant species found for each polygon based on a survey around the point of reference. These are the original field calls recorded by botanists during the polygon census.

Attribute	Description	Type
FieldCallID	Unique code identifying each field call	Text 50
DominantSpecies	Species code for one of the dominant species in a polygon	Text 10
CoverClassification	Percent cover for the particular species	Text 10
OBJECTID	Autonumber. Unique to ESRI.	Long

3.8. *tbluCoverClass*

Cover classes used to identify dominant species in each polygon.

Attribute	Description	Type
CoverClassCode	Shorthand code	Text 50
CoverClassDescription	Description of each cover class (% range)	Text 200

ObjectID	Autonumber. ESRI	Long
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3.9. *tluDominantSpecies*

Reference table connecting 4-letter species codes to the proper scientific name. Note that a species code can represent more than a single species.

Attribute	Description	Type
SpeciesCode	Shorthand 4 letter code	Text 10
SpeciesName	Scientific nomenclature	Text 200
ObjectID	Autonumber. ESRI	Long

3.10. *tluFieldCallNVCS*

This table preserves the original Association assigned by botanists mapping in the field; these are connected to the appropriate NVC hierarchical classes. Note that some codes change between the original field call and the final classification, which is why this information is preserved.

Attribute	Description	Type
FieldAssociationCode	Field mapping association codes	Text 50
FieldAssociationDescription	Formal community type name assigned by field level classification	Text 255
Source	Field key or other source for field level classification	Text 255
MapUnitLabel	Common Name Association Label	Text 100
Type	Hierarchy Level, e.g. habitat, community, alliance, etc.	Text 50
NVCS_Association	Association from NatureServe Explorer Web site (Oct 2006)	Text 255
NPS_VegMapAssociation	Association from NatureServe Explorer web site (Oct 2006). NA = field typed only to alliance level, or Association does not exist	Text 100
NVCS_CEGLCode	CEGL (NVCS/NatureServe) Association Code (CEGL#####) or Alliance Code (A.####)	Text 50
NVCS_Alliance	Alliance from NatureServe Explorer Web site (Oct 2006)	Text 100
NVCS_EcologicalSystem	Ecological System from NatureServe Explorer (Oct 2006)	Text 100
NVCS_Formation	Formation from from NatureServe Explorer (Oct 2006)	Text 255
Comments		Text 255
OBJECTID	Unique ID. Internal to ESRI	Long