

Knife River Indian Villages National Historic Site 2002 VEGETATION MAPPING PROJECT



FINAL REPORT October 15, 2002



Technical Memorandum 8260-02-07

Remote Sensing and GIS Group
Technical Service Center
U.S. Department of the Interior
Bureau of Reclamation
Denver, CO

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Mission Statement**

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to tribes.

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USGS-NPS VEGETATION MAPPING

KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

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EXECUTIVE SUMMARY

The 2002 Knife River Indian Villages National Historic Site Vegetation Mapping Project was conducted as part of and in accordance with the U.S. Geological Survey/National Park Service (USGS/NPS) Vegetation Mapping Program. This Program is being administered by the Center for Biological Informatics (CBI), Biological Resources Division of the USGS, Denver, Colorado and was initiated as part of the NPS Inventory & Monitoring Program. The primary goal of the Program is to classify, describe, and map vegetation for approximately 270 NPS units.

This mapping project was performed by the Remote Sensing and GIS Group (RSGIG), Technical Service Center, Bureau of Reclamation, Department of Interior, Denver, Colorado.

In addition to the main contractor, NatureServe provided initial descriptions and methodology for the vegetation classification.

The vegetation mapping protocol for KNRI was modified from the standard techniques due to its extremely small size and history of alteration to the native vegetation. No systematic survey was conducted to describe the vegetation. Instead, NatureServe developed a list of potential types. This list was then compared to vegetation types found during the site visit and the results are presented in this report. In addition, photointerpretation was conducted prior to the site visit. All vegetation types that could be delineated or differentiated were identified and assigned a vegetation type using the list provided by NatureServe. Each polygon delineated was visited in the field and assigned its respective vegetation type. This eliminated the need for a follow-up accuracy assessment.

A total of 17 vegetation (land cover) classes were used for interpretation of approximately 8872 acres encompassing the Park and surrounding environs. Vegetation map classes were determined through field reconnaissance and reference to the preliminary list of potential vegetation types provided by NatureServe. The vegetation map was created from photographic interpretation of June 20, 2002, 1:12,000 scale color aerial photographs (0.5 hectare minimum mapping unit). All vegetation and land-use information was then transferred to a GIS database using the latest grayscale USGS digital orthophoto quarter-quads as the base map and using a combination of on-screen digitizing and scanning techniques. Overall thematic map accuracy for the Park is considered 100% as all interpreted polygons received a field visit for verification.

Field work was conducted during the last week in August, 2002.

Final products described in this report and on the accompanying CD-ROM disk include the following:

- Vegetation Classification Descriptions;

- Representative photographs (including digital files) from field visits (hard copy photographs only in report delivered to KNRI);
- Digital and Hard Copy Vegetation Map;
- Digital Vegetation, Boundary, Field Data Point Coverages;
- FGDC-compliant Spatial Database Metadata;
- All aerial photography acquired for the project (only in report delivered to KNRI)
- Final Report

INTRODUCTION

This mapping effort originates from a long-term vegetation monitoring program that is part of a larger Inventory and Monitoring (I&M) program started by the National Park Service (NPS). I&M goals are, among others, to map the vegetation of all national parks and monuments and provide a baseline inventory of vegetation. The I&M program currently works in close cooperation with the Biological Resources Division (BRD) of the United States Geological Survey (USGS). The USGS/BRD continues overall management and oversight of all ongoing mapping efforts in close cooperation with the NPS. Contractors for each park vary. For Knife River Indian Villages National Historic Site the principal contractor is the U.S. Bureau of Reclamation (BOR), Denver Technical Center, Remote Sensing and Geographic Information Group (D-8260).

Objectives and Scope

The purposes of the mapping effort are varied and include the following:

- Provides support for NPS Resources Management
- Promotes vegetation-related research for both NPS and USGS/BRD
- Provides support for NPS Planning and Compliance
- Adds to the information base for NPS Interpretation
- Assists in NPS Operations

The history of land and vegetation use in the vicinity of Knife River Indian Villages National Historic Site begins with the Native American occupation. This occurred about 10,000 years ago when big game hunting and berry/nut gathering people traversed the area. For nearly a millennium this area was a trading hub established by the earthlodged Hidatsa and Mandan tribes with the primary commodity being Knife River flint. In addition, it is important as a place where Indian culture and agriculture developed. It should be noted that there were more people living along the Knife and Missouri Rivers in the 18th and early 19th Century than there are today. After the small-pox epidemic in 1837, the Hidatsa and Mandan tribes abandoned their villages here and moved approximately 60 miles up river to establish Like-a-Fishhook village.

During the second half of the 19th Century steamboats frequented the area and created "wood yards" on the Missouri River bottomlands. Their purpose and function were to cut and store wood to be used as fuel for the steamboats. The largest of these "wood yards" occurred at the mouth of the Knife River in what is now Knife River Indian Villages National Historic Site and present day Stanton.

It was originally believed that the park contained village sites that were hundreds of years old. The full significance and role of the park's cultural sites in our history is only beginning to be understood. Through archaeological studies we have found some sites that are not hundreds of years old but thousands of years old. The historical, archeological, and biological value of Knife River Indian Villages National Historic Site

is far greater than was first envisioned. It is one of the few units of the National Park System in which an intensive, parkwide archeological survey has been completed. The surveys conducted from 1976 through 1980 resulted in the identification and evaluation of all the archeological sites within the park.

Permanent settlement of the area by EuropeanAmericans occurred in 1882 when the village of Stanton was established. While we often tend to limit our consideration of environmental degradation to modern culture, it is clear that Knife River Indian Villages National Historic Site and the region surrounding it have experienced intense changes and impacts over the past few centuries. Today's faunal and floral communities are a product of those impacts.

Although the primary resources of Knife River Indian Villages National Historic Site are cultural, it possesses prime natural areas that include native prairie and riverain habitats. These are extremely significant because they are part of an almost exhausted resource. Energy development, dam building and intensive agriculture have either destroyed or seriously deteriorated similar ecosystems on the Missouri River. Natural areas like those found at the park are rapidly becoming ecological prototypes.

In managing the park's natural resources, a high degree of sensitivity must be shown toward the cultural, historical, and archeological values of the national historic site. The vegetative communities in the park, including Missouri River bottomlands and mid-grass native prairie, must be managed to compliment the historic scene and to maximize the ecological value of the area. We must determine what natural processes are taking place and define the optimum ecological communities.

The 1,759 acre park contains land on both sides of the Knife River just before its confluence with the Missouri River. The park lies approximately in the middle of that portion of the Missouri River that has not been flooded by dam building. While most of the park has been intensively cultivated or grazed for many years, it still remains an area where, with proper management and use, natural habitats can be reestablished or improved.⁽¹⁾

1 Portions of above introduction excerpted from <http://www.nps.gov/knri/overview.htm>.

PROJECT AREA

Location and Regional Setting

Knife River Indian Villages National Historic Site lies in Mercer County North Dakota just north of the town of Stanton. Immediately to the west is McLean County. Both counties are separated by the Missouri River (Figure 1). The park contains land on both sides of the Knife River just before its confluence with the Missouri River.

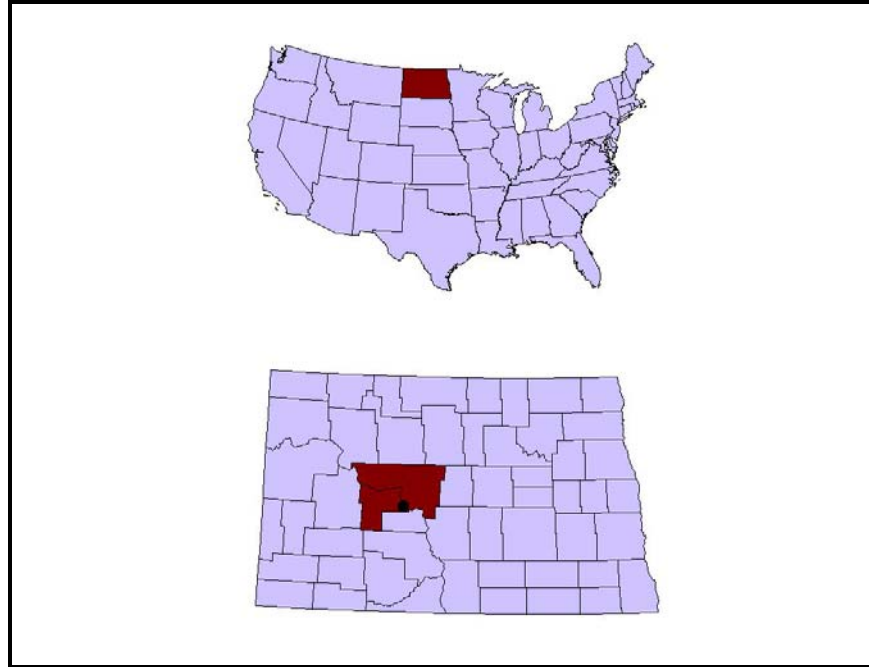


Figure 1. Location map for Knife River Indian Villages National Historic Site

KNRI is divided up into a number of informal tract names that are helpful in identifying general areas. Figure 2 shows the location and names of these areas.

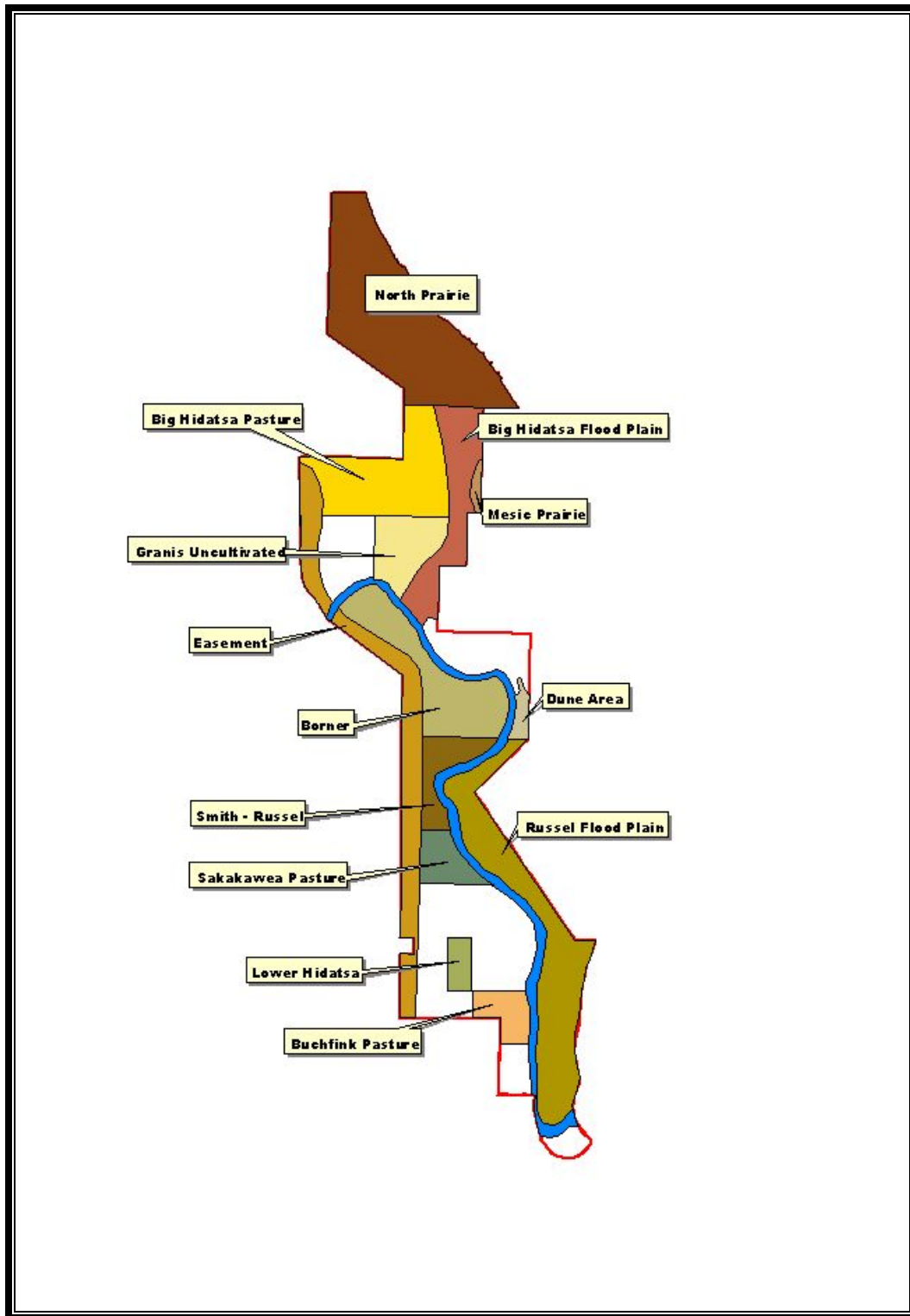


Figure 2. Informal land tract names

Climate and Weather

North Dakota lies in the center of the North American continent and therefore has a typical continental semi-arid climate. The cold, dry arctic air masses create a severe winter climate with temperatures dropping to 0° F on a regular basis. The summers are hot and dry. In both winter and summer one can expect large temperature fluctuations during the day and low relative humidity.

The historical precipitation trend has not changed since record keeping began (1895)(Figure 3). 3.53 inches of precipitation fell in August 2002. This was 1.42 inches more than the 1895 - 2002 average, the 7th wettest such month on record. The precipitation trend for the period of record (1895 to present) is 0.00 inches per decade. Historical temperature shows an increase since 1895 (Figure 4). The average temperature in August 2002 was 66.9 F. This was 0.3 F warmer than the 1895-2002 average, the 52nd warmest August in 108 years. The temperature trend for the period of record (1895 to present) is 0.3 degrees Fahrenheit per decade (Climate Monitoring Reports and Products National Climatic Data Center <http://lwf.ncdc.noaa.gov/oa/climate/research/monitoring.html>).

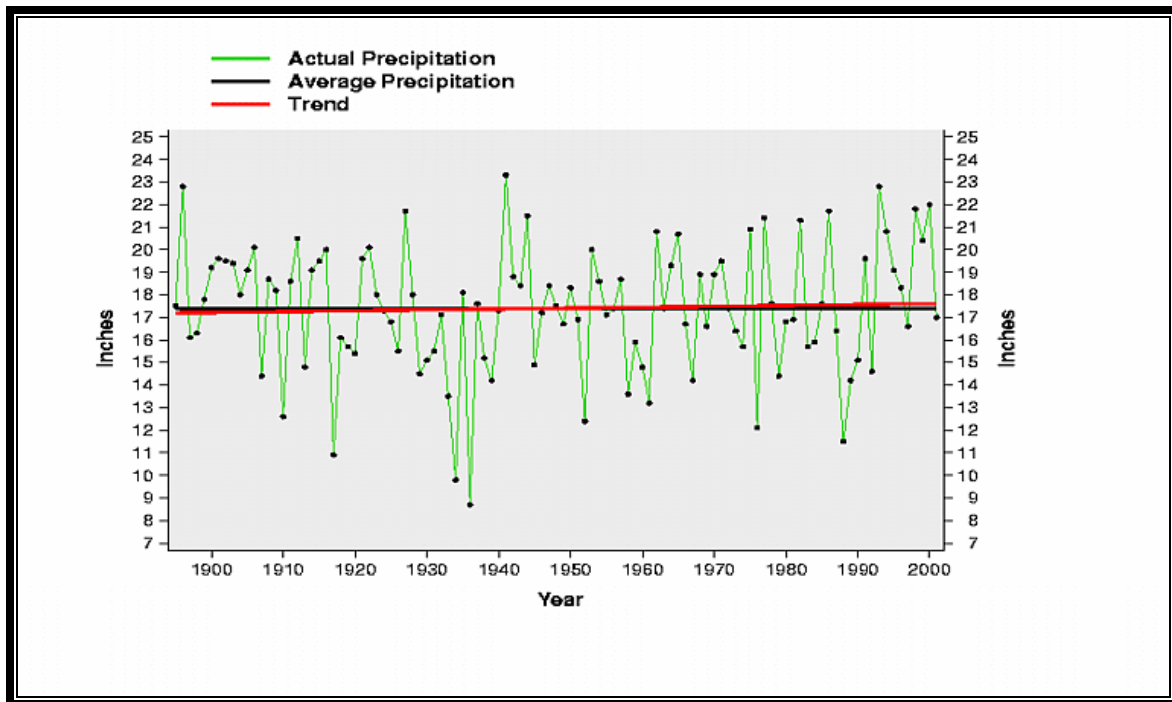


Figure 3. Historical precipitation trend 1895 – 2002, North Dakota (National Climatic Data Center).

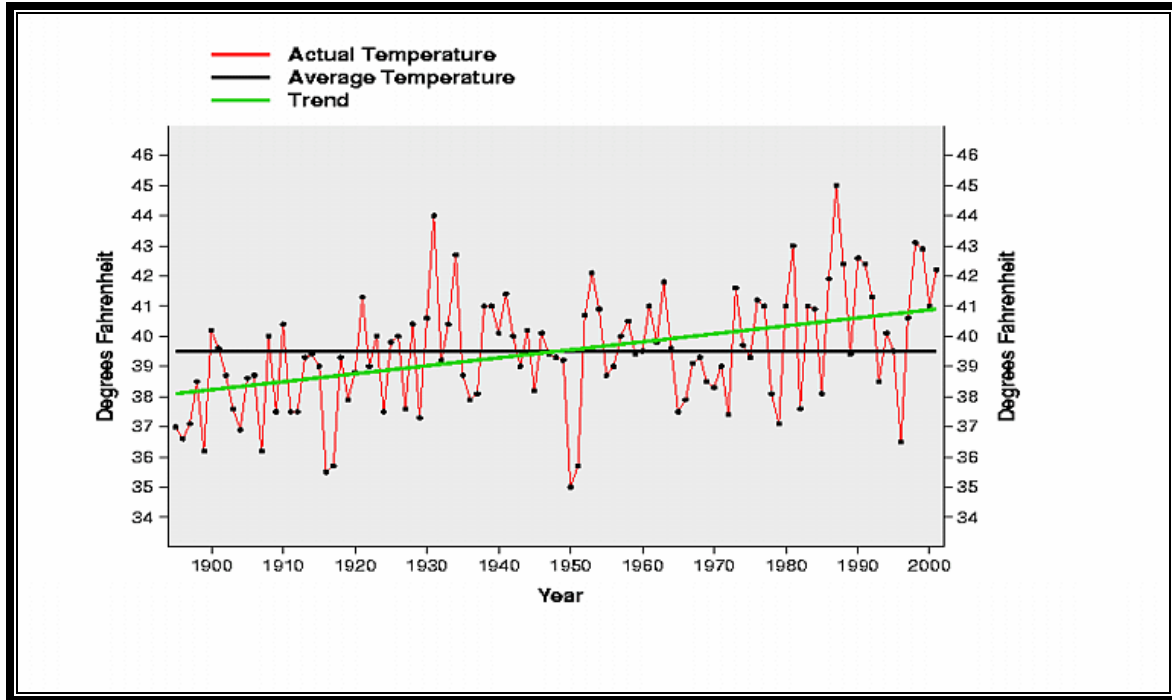


Figure 4. Historical temperature trend 1895 – 2002, North Dakota (National Climatic Data Center).

Geology and Soils

The geology of the Knife River Indian Villages National Historic Site and the immediately surrounding area consists of bedrock of the Paleocene age. Local formations consist of poorly lithified sandsilt, silty clay, and clay with shale and lignite. Fairly well consolidated sandstone occurs as a ledge in the channel or bed of the Knife River. The entire area was glaciated several times during the late Cenozoic. Eight geochronological units were identified by Reiten (1983). The range in dates is potentially 22,000 BP to the present (Figure 5). Although the area (Knife River Basin) was glaciated, erosion has removed much of the glacial sediment. A combination of wind and running water has reshaped the previous glacial sediment leaving sediments deposited in ponds, sloughs, trenches and flood plains (Groenewold et al. 1979)

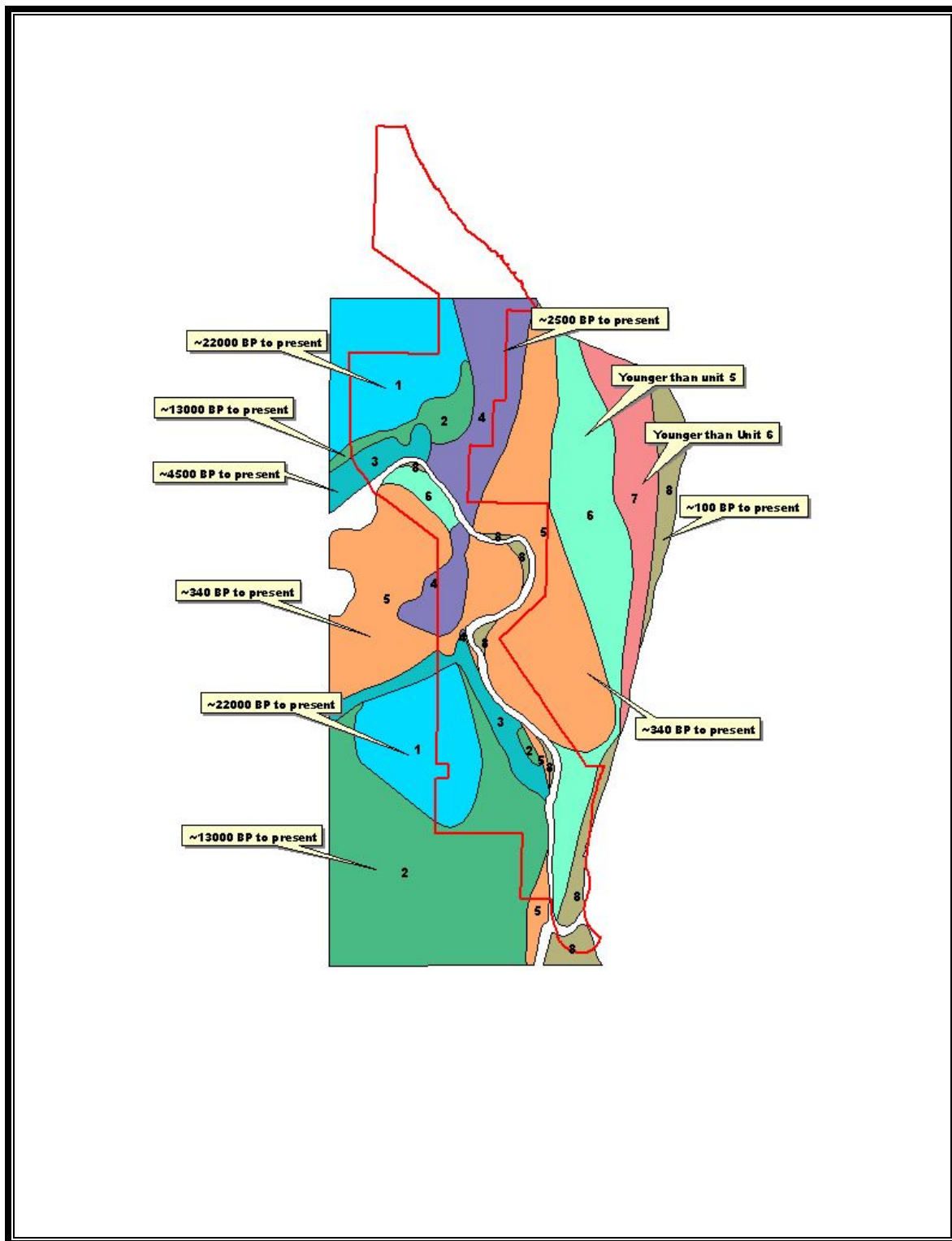


Figure 5. Geochronologic map of KNRI (from Reiten 1983).

Soils within the mapping area are primarily loams, silt loams and silty clay loams. Table 1 shows the soil texture acreage within the mapping area and table 2 shows the soil

texture within KNRI boundaries. Figure 6 shows the distribution of soil texture within the mapping boundary. Figure 6 and Table 1 were derived from digitizing soils maps and associated tables from Mercer County and McLean County soils reports (Wilhelm 1978, Brockman et al. 1979). The associated digital files include soil names and are included with the deliverables for this project.

Soil Texture	Acres	
	Within KNRI	Within Mapping Boundary
Riverwash	-	140.2
Silty Clay Loam	56.6	198.2
Channeled	7.1	60.1
Complex	9.2	9.2
Fine Sandy Loam	27.4	431.0
Loam	567.5	2225.4
Loamy Fine Sand	102.4	717.2
No Descrip.	52.9	118.3
Silt Loam	226.0	1378.6
Silty Clay	94.4	349.2
Silty Clay Loam	439.6	1673.9
Very Fine Sandy Loam	-	68.9
Water	122.9	1637.4
Total	1706.0	9007.8

Table 1. Soil textures within KNRI and mapping boundary.

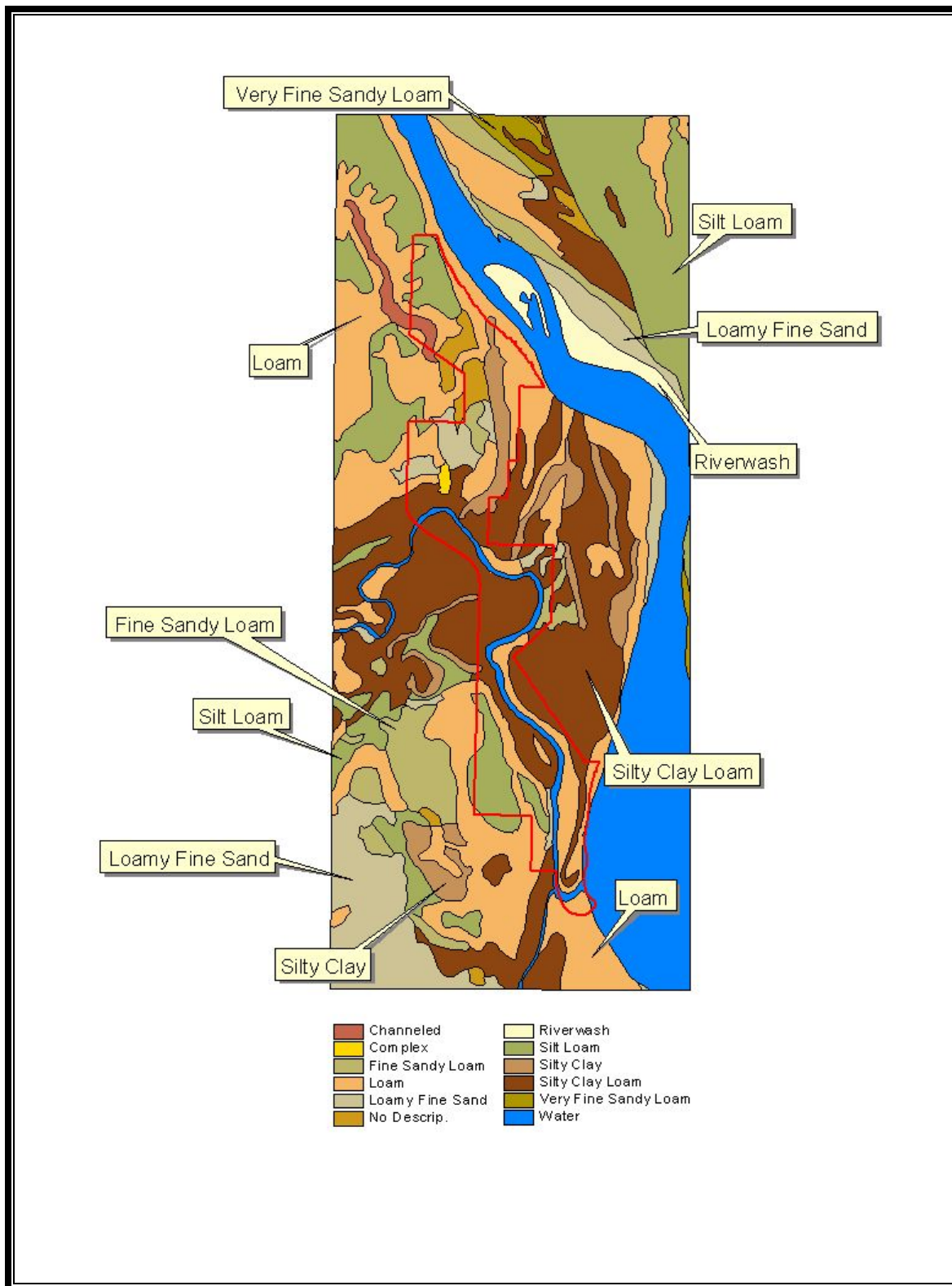


Figure 6. KNRI soil texture map.

Topography

The topography of the mapping area is dominated by two former meltwater trenches derived from previous glaciations. These are the drainages for the Knife and Missouri Rivers (Reiten 1983).

Three physiographic zones exist within the mapping boundaries. The first and lowest of these is the floodplain. It is found immediately adjacent to the rivers, and is where historically both the Knife and Missouri floodplains were subject to inundations during spring runoffs or excessive rainstorms. Historically the floodplain was forested and much of it is now comprised of a forest type known as "Missouri River bottomlands". These floodplains, since the earliest of human occupations until present day, have been intensely impacted and altered. A second zone is a sloping area that leads to the upper most terraces. This zone creates a distinct scarp or terrace edge separating the terrace zone from the floodplain zone. These slope areas are typically steep, rugged badlands or flat terraces and terrace slopes. The third zone is the high "terrace" which is the older and higher floodplains. It is comprised of gently sloping to nearly level surfaces.. Prairie grasses dominate vegetation on the terraces (Reiten 1983). Figures 7 and 8 provide 3D and planimetric perspectives of the mapping area.

There are a number of terraces within the Park. Reiten (1983) identified 7 terraces in his mapping area, five of which lie within the mapping boundary for this project (Figure 9). The A and B terraces are Holocene in age and occur from 0 to 8 meters above the Missouri River. The Stanton, Hensler and McKenzie terraces are Pleistocene in age and range from 8 to 42 meters above the Missouri River.

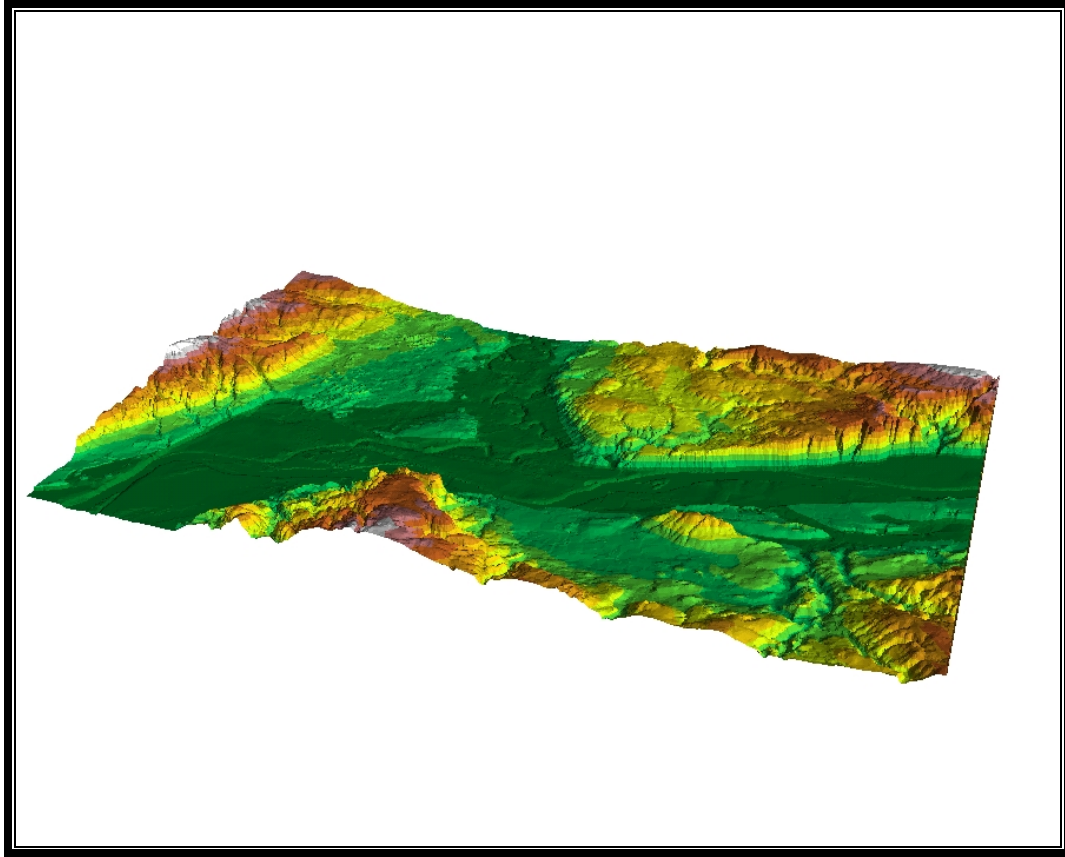


Figure 7. Three dimensional view of KNRI and surrounding area. View is looking toward the west southwest.

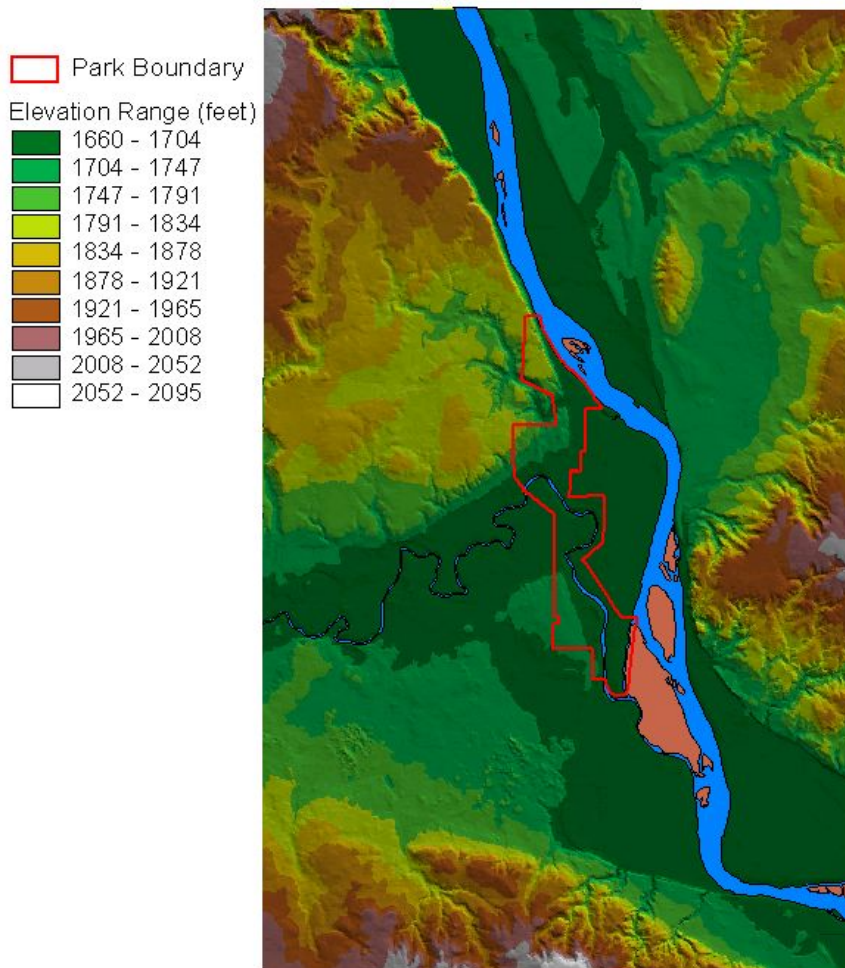


Figure 8. Topography of KNRI and surrounding area

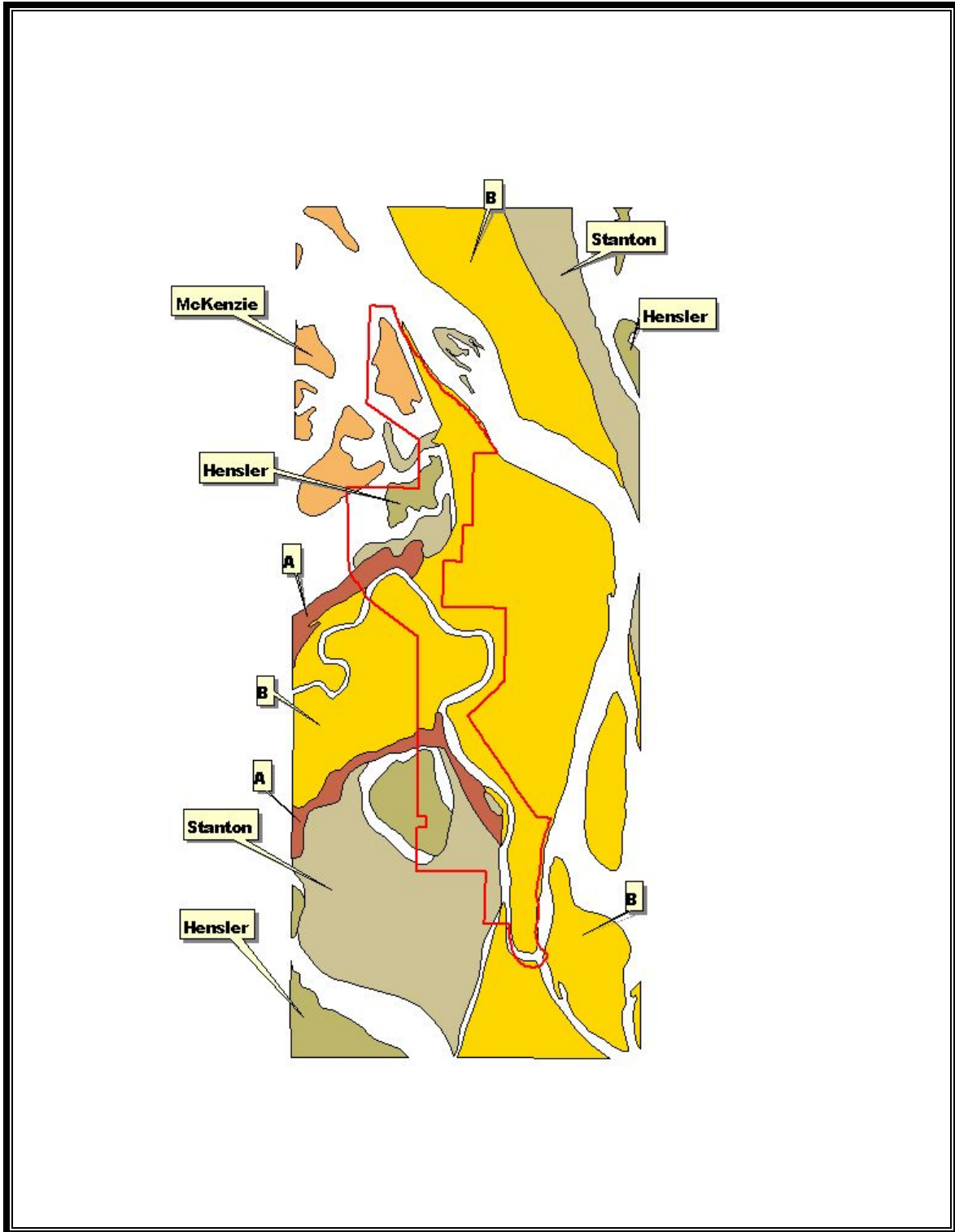


Figure 9. Geologic terraces of KNRI and surrounding area (from Reiten 1983).

Vegetation

KNRI lies within the Dry Domain, Temperate Steppe Division, Great Plains – Palouse Dry Steppe Province (Province 331) as described by Bailey (1995). The area is dominated by shortgrass prairie, as is most of this region. Given the proximity to the Missouri River, a wooded component is present.

Grasslands in the vicinity of KNRI are typically made up of mixed grass prairies that are dominated by midgrasses, shortgrasses, and upland sedges. Tall grasses dominated by Big Bluestem exist in the western portion of the state but only in isolated patches (Whitman and Wali 1975). Within the mixed grass prairie are a number of alliances and associations. NatureServe (2002) recognizes 15 associations within the Great Plains mixedgrass, shortgrass and sand prairies. Tall grass prairie components also are present within the mapping area but represent a small percent of the mapped area.

The wooded component is made up of Ash, Elm and Cottonwood. There are three associations within two alliances. These are found along the Missouri River and within woody draws. These typically include a shrub component that may include snowberry and wolfberry.

The vegetation within the mapping area can be broadly split into 4 categories. These are the floodplain and associated woodlands, terrace vegetation, upland vegetation (outside the park boundary) and croplands. Various grasses such as wheatgrass, needlegrass, gramma grass, upland sedges, and little and big bluestem and a wide variety of forbs dominate the upper terraces in the park. Several non-native and noxious plants that exist in the park include rhubarb, lilac, leafy spurge, Canada thistle, smooth brome, and sweet clover.

Species List

During the field portion of this study no attempt was made to compile a species list as a floristic inventory exists and is provided in Appendix 1. The species list has been revised and updated. The original list was compiled in 1982 (Clambey) and species names have undergone considerable revision. All species were compared to the USDA Plants database (USDA, NRCS 2002) which was accessed over the internet. In addition, Clambey's list was compared to "Species in Parks Flora and Fauna Database Online Query System" (<http://ice.ucdavis.edu/nps/sbypark.html>) and omissions were updated. Scientific names and references were updated. Included are the USDA common names. Appendix 1 includes Clambey's nomenclature for common names followed by the USDA's nomenclature if different. A total of 269 species have been catalogued.

A few species deserve some note. *Ribes americanum* is now in its new family Grossulariaceae. *Melilotus albus* has been combined with *Melilotus officinalis* and therefore has been removed from the list. *Sphaerelcea coccinea* is listed under the USDA Plants database as belonging to the Malvaceae however Van Bruggen (1996) lists this under its own family, Sphaeralcea. In order to maintain consistency we maintained the

USDA classification. Clambey (1985) lists Leafy Spurge as *Euphorbia podperae* which is currently known as *E. agraria*. *E. agraria* is actually Urban Spurge. The correct nomenclature for Leafy Spurge is *E. esula* and has therefore been substituted in the list.

Appendix 4 (Under separate cover) is a partial pictorial flora of the species list. All photographs for Appendix 2 are from USDA, NRCS. 2002. The PLANTS Database, Version 3.5.

Burn History

KNRI has conducted a rather extensive prescribed burn program starting in 1999. Much of the park has received some treatment and this program continues (Figure 10). The North Prairie is scheduled for a burn treatment in the fall of 2002.

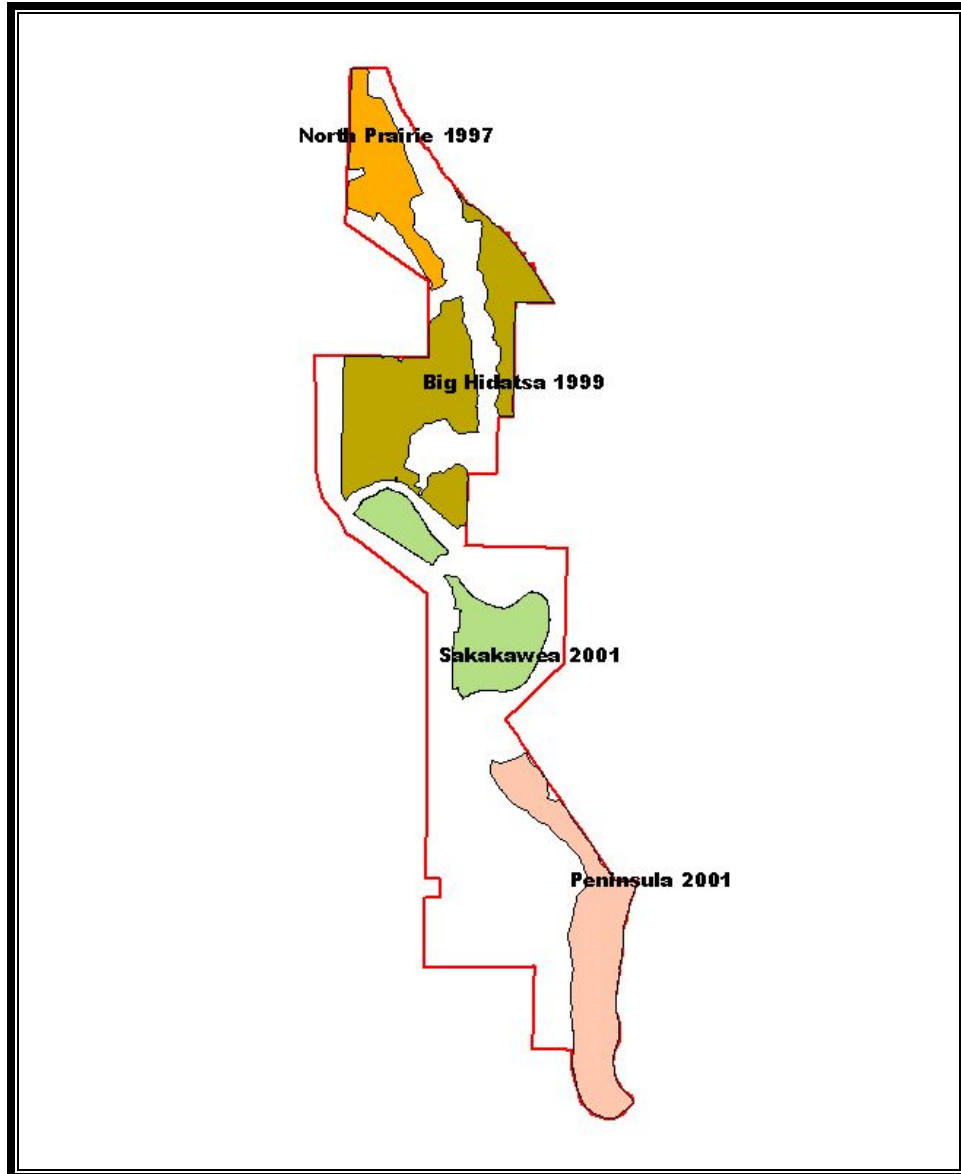


Figure 10. Burn history of KNRI.

METHODS

The organization of this project followed the protocols outlined in “Field Methods for Vegetation Mapping” and “Standardized National Vegetation Classification System” (NVCS)(The Nature Conservancy 1994).

Planning and Scoping

Scoping Meeting

A scoping meeting was held at the KNRI visitor center with all interested parties during Spring 2002. The purpose of this meeting was to determine the project mapping extent, discuss logistics, and develop a sampling approach. Following the data sampling protocols for small parks outlined in the “Field Methods for Vegetation Mapping” (TNC 1994), it was decided that a 100% ground survey sampling approach would be used at KNRI.

Preliminary Data Collection and Review of Existing Information

To minimize duplication of previous work and to aid in the overall mapping project, existing maps and reports were obtained from various sources. The staff at Theodore Roosevelt National Park provided digital material for numerous themes including geology. Digital elevation models (DEM's), digital line graphics (DLG's), and digital raster graphics (DRG's) were obtained from the USGS. The DEM's were further manipulated to create slope and aspect maps.

A preliminary list of community types thought to have a high likelihood of being in the mapping area was used to develop the preliminary vegetation classification. Modifications were made to the list through additional literature review and by contacting knowledgeable experts.

Project Responsibilities

The technical responsibilities for the mapping effort were primarily that of BOR however NatureServe provided support. Responsibilities were as follows:

NatureServe responsibilities and deliverables included the following:

- Provide a preliminary list of probable vegetation types in the area.
- Provide documentation that describes the national classes at the local and global levels.
- Provide technical opinion to BOR as the mapping portion of the project proceeds.

BOR responsibilities and deliverables included the following:

- Digital files of vegetation on Compact (CD); including topology and labeling for height and density; location of field sample sites;
- Any ancillary digital files developed during the mapping process;
- Digital FGDC compliant metadata file for each digital file delivered;
- Annotated field site photographs;
- Hard copy vegetation map;
- Final report describing all procedures used in developing the final map;

Aerial Photography Acquisition

The aerial photo contract to Horizons, Incorporated of Rapid City, South Dakota was for the acquisition of color aerial photography for KNRI and vicinity at the standard 1:12,000 scale photography typically used for photointerpretation. Photographs were acquired June 20, 2002. The project area is covered by x 1:12,000 scale photos and 2 flightlines (Figure 11). A total of 22 color photographs were taken at 1:12,000 (1"=1,000') scale and printed on 9"x9" stock. Overlap for these photos were approximately 50-60% and sidelap between flight lines was approximately 20-30%.

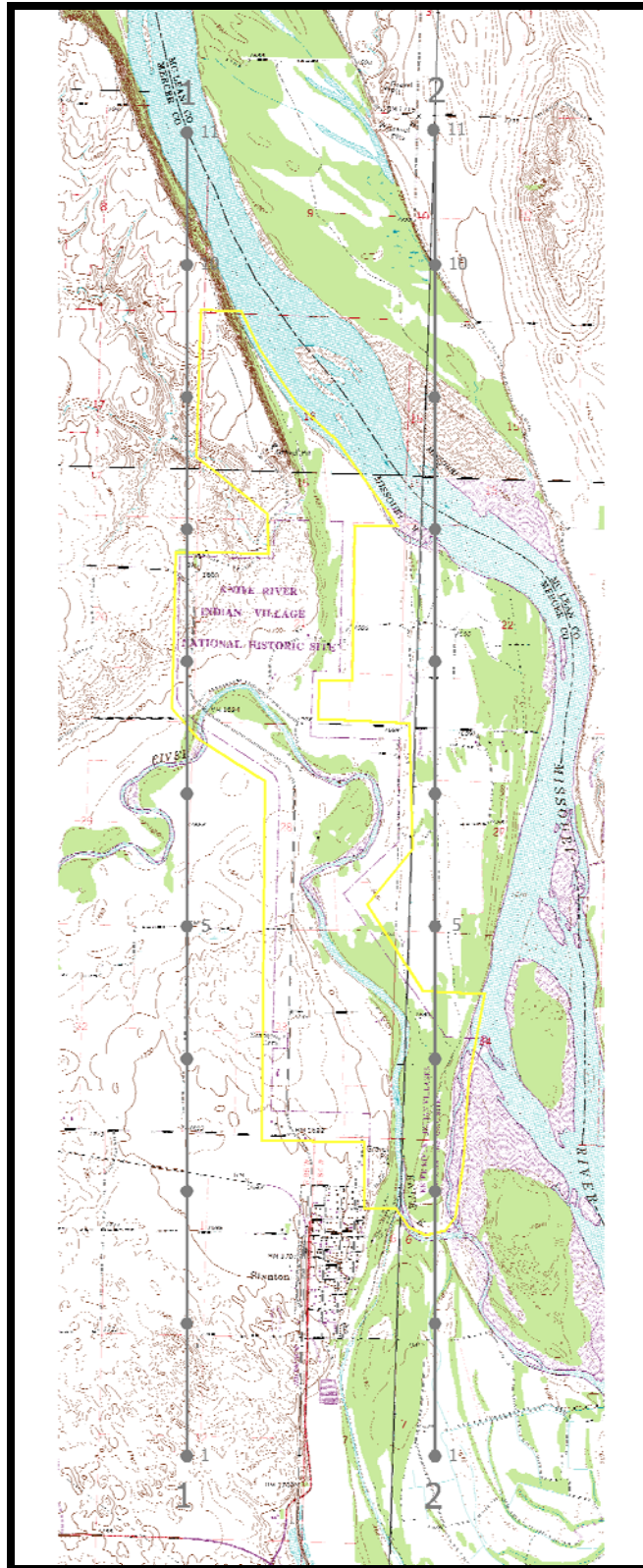


Figure 11. Flight lines and photograph centers for Knife River Indian Villages National Historic Site.

Field Survey

The field survey for this Park differs from other larger parks primarily in the vegetation characterization and ground survey. Vegetation for larger parks typically includes large numbers of vegetation plots which extensively document the species and their cover values. These data are then subjected to numerical analysis and comparison to existing vegetation types. New vegetation types may be described and existing vegetation types are updated with the information obtained from the new survey. Observation plots are also collected. Observation plots provide the data analysis with more data and are designed to provide a quick overview. These observation plots are extremely useful but are less complete. Both plot and observation data provide support to the photointerpretive effort. Ground surveys for larger parks are conducted using a statistical approach given that not all delineated polygons can receive a field visit to verify their vegetation classification. In addition, larger parks are also subjected to an accuracy assessment, again using a statistical sampling approach. Given KNRI's small size, almost all delineated polygons received a visit to verify its classification. Because almost all delineated polygons were visited, no accuracy assessment was required. In spite of the differences in field technique, the protocols employed for this park do comply with those described in "Field Methods for Vegetation Mapping NBS/NPS Vegetation Mapping Program" (1994) with one exception. The document calls for one plot per delineated polygon within very small parks. It was decided at the scoping meeting that the area most likely did not contain any unknown vegetation types and that it would suffice to create a list of potential associations that could be used as reference to determine the vegetation type within the delineated polygons. NatureServe provided a preliminary list of potential types that was used as a reference during the field visit. To assist in the field visit the photointerpreter also collected observation points whose primary use was as a photointerpretive tool. However, they also proved useful to clarify any unknown or different associations encountered. Deviations from the supplied vegetation descriptions were discussed with Mr. Jim Drake (NatureServe Minneapolis, MN) and changes were made accordingly. With only one or two minor exceptions, the preliminary list provided by NatureServe matched the vegetation encountered in the field.

Field surveys began in the last week of August 2002. Data from 30 observation points were collected between August 25 and August 29, 2002. Points were recorded subjectively, and were chosen to sample the range of habitat and vegetation variability observed on aerial photography, on preliminary maps, and in the field (Figure 12). Observation points were collected and used indicators such as dominant species within strata and cover values. Observation point datasheets are included in Appendix 4. Areas that were previously cultivated or planted were avoided. The observation point data were then compared to NatureServe (2002) community descriptions and appropriate labels were attached. Almost all polygons delineated were visited and received a label based upon NatureServe alliance and association descriptions.

The UTM coordinates and elevation of all observation points were logged using a hand-held Precision Light-weight Global Positioning System (GPS) Receiver (PLGR) unit. Photographs were taken at most sites and are included in the attached data set.

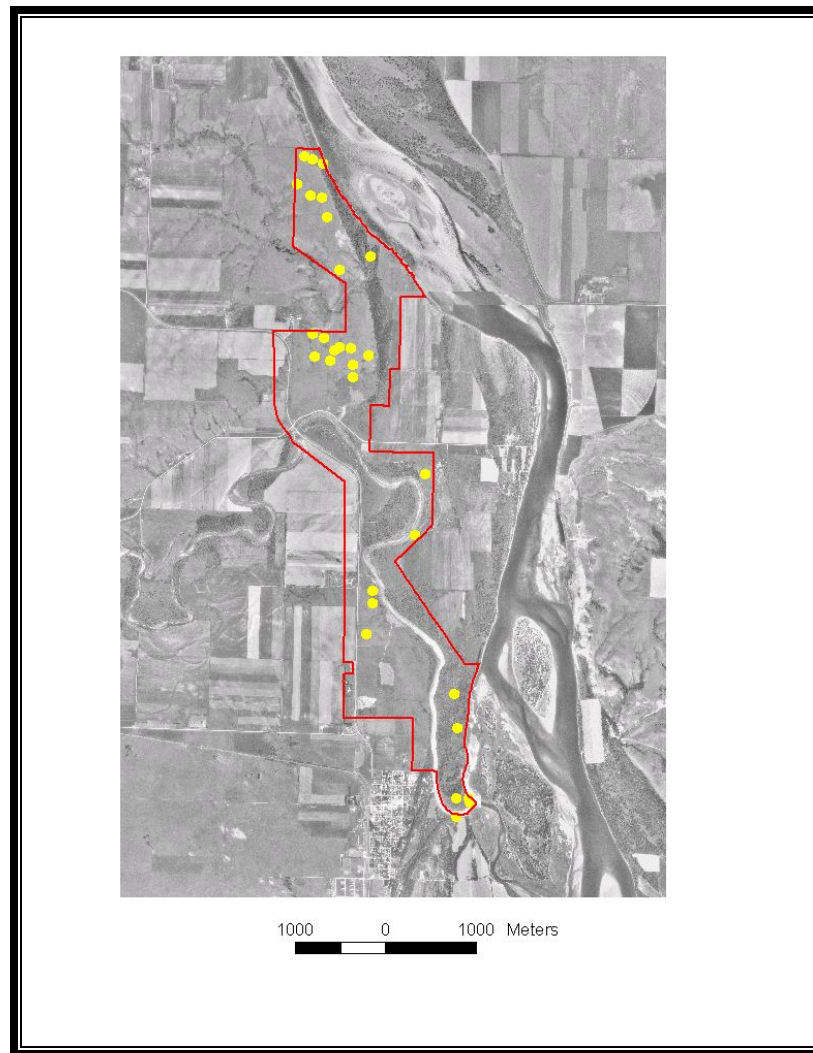


Figure 12. Location of observation points for KNRI.

Vegetation Map Preparation

Vegetation map development for KNRI has somewhat different protocols than for other Parks. Normally photointerpretation is preceded by extensive field work which includes plot selection and vegetation sampling using detailed descriptions which are subsequently analyzed using ordination and other statistical techniques. The data are then summarized and association descriptions are assigned to each plot or, if the association is previously unrecognized, then a new association name is assigned. Subsequently, the plots locations are compared to its photographic signature and a photointerpretive key is developed. Given the very small size of KNRI and the extensive historical impact and alteration of the vegetation a simplified technique was used. NatureServe developed a list of potential vegetation types prior to any field work. This list was referenced during the field visit and modified after comparison of site characteristics and vegetation descriptions. Aerial photographs were viewed prior to the field visit and areas of like signature were

differentiated. There are other subtle differences including map validation assumptions and these are described below.

Map Units

In many parks map units are derived from the vegetation classification and are often, but not always equivalent. In this particular case every polygon within the Park boundaries was visited and assigned its respective vegetation association (Table 2). In addition to classification by vegetation association, tree height and density were included as mapping parameters.

Aerial Photography Interpretation

After receiving the aerial photography from the contractor, all distinguishing ground features were delineated on clear mylar overlays registered to each photograph. Each photograph was then viewed under magnification and a stereoscope so that subtle features could be discerned and mapped.

Map Validation

Given that that the entire Park was visited by the photointerpreters and all polygons were visited, no post mapping validation was conducted. Ground truth was 100%. Few areas outside the Park were visited therefore these areas / polygons have no map validation.

Digital Transfer

Digital products produced specifically for this mapping effort include a digital vegetation polygon coverage and a digital point coverage for observation point locations.

Photo-interpreted polygons and label information were transferred to a digital format by first consolidating all interpreted mylars to a single mylar sheet which overlaid a plot of the DOQ. The DOQ provided geo-reference information. The DOQ was plotted at the same scale as the photos/interpreted mylars therefore the transfer was roughly 1:1. The single sheet of mylar with all the line work was subsequently scanned and vectorized. The vector coverage was edited and transformed into a polygon coverage using ArcInfo software. Finally, data regarding vegetation classes were then linked digitally to each polygon by “joining” a .dbf file created separately.

Digital point coverages were created by creating a .dbf file using GPS point locations collected in the field. The .dbf file was then used to create a point coverage using ArcInfo scripts. The subsequent point file was then attributed with association through formation class descriptions as reference for the attribute. Coordinate system descriptions were added after creation of the digital files.

Classification System

Vegetation Classification and Characterization

Vegetation classification was done using existing descriptions compiled by NatureServe using the International Classification of Ecological Communities: Terrestrial Vegetation (NatureServe 2002). Given the small size of the Park and the history of vegetation alteration and impact no new survey was conducted. However, observation points were collected to qualify field observations.

NatureServe compiled a preliminary list of potential vegetation associations prior to any fieldwork (NatureServe 2002). This list was later reduced to the following descriptions after further literature search and field observations. Each description includes local observations compiled during this and previous surveys (Clambey 1985). NatureServe (2002) provided the following “Introduction to the International Classification of Ecological Communities (ICEC) and global descriptions.”

During the course of the ground survey 17 vegetation alliances and 19 vegetation associations are described (Table 2). Three other map units not listed here are planted or former croplands. These are described later in the report.

The current alliance and association descriptions are compiled using current data. However, the information from this report has yet to be reviewed by NatureServe. Consequently, the information provided by the local descriptions in this report has not been included in the global descriptions. For example, one will not find KNRI listed as a site within “federal lands” where we now know a particular vegetation type exists. The NatureServe database is being continually updated and information from this survey will be included in the future.

The following discussion describes in detail the classification system.

Green Ash – (American Elm) Temporarily Flooded Forest Alliance
• Fraxinus pennsylvanica – (Ulmus americana) / Symphoricarpos occidentalis Forest
Eastern Cottonwood Temporarily Flooded Forest Alliance
• Populus deltoides – Fraxinus pennsylvanica Forest
Green Ash – (American Elm) Woodland Alliance
• Fraxinus pennsylvanica – Ulmus americana / Prunus virginiana Woodland
Eastern Cottonwood Temporarily Flooded Woodland Alliance
• Populus deltoides – (Salix amygdaloides) / Salix (exigua, interior) Woodland
Western Snowberry Temporarily Flooded Shrubland Alliance
• Symphoricarpos occidentalis Shrubland
(Coyote Willow, Sandbar Willow) Temporarily Flooded Shrubland Alliance
• Salix exigua Temporarily Flooded Shrubland
Silver Sagebrush Temporarily Flooded Shrubland Alliance
• Artemisia cana / Pascopyrum smithii Shrubland
Big Bluestem – (Yellow Indiangrass) Herbaceous Alliance
• Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii Herbaceous Vegetation
Needle-and-Thread – Blue Grama Herbaceous Alliance
• Hesperostipa comata – Bouteloua gracilis – Carex filifolia Herbaceous Vegetation
Western Wheatgrass Herbaceous Alliance
• Pascopyrum smithii – Bouteloua gracilis – Carex filifolia Herbaceous Vegetation
• Pascopyrum smithii – Nassella viridula Herbaceous Vegetation
• Pascopyrum smithii Herbaceous Vegetation
Smooth Brome Semi-natural Herbaceous Alliance
• Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation
Crested Wheatgrass Semi-natural Herbaceous Alliance
• Agropyron cristatum - (Pascopyrum smithii, Hesperostipa comata) Semi-natural Herbaceous Vegetation
(Canada Thistle, Leafy Spurge, Sweet Clover species) - Mixed Forbs Herbaceous Alliance
• Cirsium arvense - Weedy Forb Great Plains Herbaceous Vegetation
Prairie Cordgrass Temporarily Flooded Herbaceous Alliance
• Spartina pectinata Western Herbaceous Vegetation
Western Wheatgrass Temporarily Flooded Herbaceous Alliance
Sand Flats Temporarily Flooded Sparse Vegetation Alliance
• Riverine Sand Flats - Bars Sparse Vegetation
Hardstem Bulrush - (River Bulrush) Freshwater Herbaceous Vegetation
• Freshwater Bulrush Marsh

Table 2. Vegetation alliances and associations within KNRI. Vegetation associations are also equivalent to map units.

Introduction to the International Classification of Ecological Communities (ICEC)

PREFACE

This is a subset of communities defined in the International Classification of Ecological Communities (ICEC), presented in a hierarchical arrangement consistent with that of the ICEC system. The ICEC was developed by ecologists at NatureServe (formerly “ABI”) and The Nature Conservancy (TNC)², in conjunction with the network of state Natural Heritage programs and International Conservation Data Centers (CDCs). What follows is a brief introduction to the classification. Considerably more information on the ICEC’s development and its uses has been published by the NatureServe/TNC Ecology Working Group (Grossman et al. 1998, Maybury 1999) and is available at <<http://www.natureserve.org>> under the Biodiversity Information, Ecological Communities link.

The classification presented here is a snapshot of a work in progress. As the classification is applied in various places and for various purposes there will be additions, modifications, and revisions. For this reason, **printed reports have a suggested shelf life of one year from the “data current as of” date** that you should see in the footer of the document. Please request an updated version if the data in your document are more than one year old.

DEVELOPMENT OF THE CLASSIFICATION

The ICEC grew out of a longstanding recognition on the part of The Nature Conservancy and the Natural Heritage network that ecological communities were important elements of conservation. These organizations employ what is often referred to as a “coarse filter/fine filter” approach to preserving biological diversity (Jenkins 1976, Hunter 1991). This approach involves the identification and protection of the best examples of all ecological communities (coarse filter) as well as rare species (fine filter). Identifying and protecting representative examples of ecological communities assures the conservation and maintenance of biotic interactions and ecological processes, in addition to conservation of most species. Certain species, however, usually the rarest ones, may fall through the community filter. Very rare species often have specialized life histories, or are simply so rare and restricted that their conservation requires explicit planning based on species-specific information. Identification and protection of viable occurrences of rare species served as the fine filter for preserving biological diversity. Using both filters for identifying conservation targets ensures that the most complete spectrum of biological diversity is protected.

² In 2000, TNC decided to form a new organization that could focus its energies more tightly on developing and providing Heritage network data to Natural Resources decision makers (including those in TNC). Many of the ecologists and other scientists and data managers formerly in TNC’s Conservation Science Division are now part of this new organization, called NatureServe (but called “Association for Biodiversity Information” (“ABI”) until November 2001). NatureServe and TNC ecologists continue to work together, and to work with Heritage, federal and state agencies, and academic partners, on ICEC development.

In the U.S., state community classifications were developed for many states by the Heritage ecologist(s), with each state using its own classification scheme. This approach works effectively at a state level to assure protection of ecological communities. However, a major obstacle to using communities as conservation units at the regional, national, and global levels was the lack of a consistent classification system developed through analysis of data from a range-wide perspective. To overcome this problem, TNC and the Natural Heritage/CDC network began working to develop a standardized, hierarchical system to classify vegetated terrestrial communities across the U.S.

The first steps taken by TNC regional ecologists were to begin compiling an enormous amount of fine-scale state and local information on vegetation pattern into four regional classifications spanning the U.S. and to decide upon a single, standardized framework for the classifications they were developing. The U.S. regional classifications were of necessity developed somewhat independently. In the western U.S., for example, most of the existing state classifications were based on vegetation and were strongly influenced by the habitat type approach, which allowed a relatively straightforward compilation into a regional classification for the west. In the Midwest, East, and Southeast, there was less of a tradition of floristically-based classifications, and as a result, there was more emphasis on a synthesis of descriptive information on vegetation, often done with close consultation and review by Heritage program ecologists, along with other partner in state and federal agencies, and university scientists.

Synthesis of the four regional classifications into a U.S. National Vegetation Classification was completed and the first iteration of that classification was published (Anderson et al. 1998).

While classification development has so far focused on the United States (and is ongoing there), classification of Canadian vegetation using the ICEC system is proceeding on a relatively fast track, as is classification of the vegetation of portions of northern Mexico. Caribbean vegetation has also been an area of recent classification development.

THE ICEC: FOUNDATIONS AND SCOPE

The following basic tenets underlie the terrestrial portion of the ICEC:

1. The ICEC is based primarily on vegetation, rather than soils, landforms or other non-biologic features.

This was decided upon mainly because plants are easily measured biological expressions of environmental conditions and are directly relevant to biological diversity. Vegetation is complex and continuously variable, with species forming only loosely repeating assemblages in ecologically similar habitats. The ICEC does not solve the problems inherent in any effort to categorize the continuum of vegetation pattern, but it presents a practical set of methods to bring consistency to the description, modeling, and conservation of vegetation.

2. The ICEC system applies to all terrestrial vegetation. In addition to upland vegetation, “terrestrial vegetation” is defined to include all wetland vegetation with rooted vascular

plants. It also includes communities characterized by sparse to nearly absent vegetation cover, such as those found on boulder fields or talus.

3. The ICEC focuses on existing vegetation rather than potential natural or climax vegetation.

The vegetation types described in the classification range from the ephemeral to the stable and persistent. Recognizing and accommodating this variation is fundamental to protecting biodiversity. The manner in which a community occurs is, in part, an intrinsic property of the vegetation itself. A classification that is not restricted to static vegetation types ensures that the units are useful both for inventory/site description, and as the basis for building dynamic ecological models.

The following tenets reflect the current scope of the ICEC:

1. While the ICEC framework can be used to classify all vegetation, emphasis has been given to vegetation types that are natural or near-natural, i.e., those that appear to be unmodified or only marginally impacted by human activities. Where anthropogenic impacts are apparent, the resulting physiognomic and floristic patterns have a clear, naturally-maintained analog.
2. Classification development at the finest levels of the system has so far focused on the contiguous United States and Hawaii. Some classification at finer levels has also been done for southeastern Alaska, parts of Canada, the Caribbean, and a few areas in northern Mexico.

THE ICEC: THE HIERARCHY SYSTEM LEVEL

The top division of the classification hierarchy separates vegetated communities (Terrestrial System) from those of unvegetated deepwater habitats (Aquatic System) and unvegetated subterranean habitats (Subterranean System). The Terrestrial System is broadly defined to include areas with rooted submerged vegetation of lakes, ponds, rivers, and marine shorelines, as well as the vegetation of uplands.

The hierarchy for the Terrestrial System has seven levels: the five highest (coarsest) levels are physiognomic and the two lowest (finest) levels are floristic. The levels of the terrestrial classification system are listed and described below.

VEGETATION CLASSIFICATION SYSTEM

	FORMATION CLASS
	FORMATION SUBCLASS
	FORMATION GROUP
	FORMATION SUBGROUP
physiognomic levels	FORMATION
floristic levels	ALLIANCE
	ASSOCIATION

PHYSIOGNOMIC LEVELS

The physiognomic portion of the ICEC hierarchy is a modification of the UNESCO world physiognomic classification of vegetation (1973) and incorporates some of the revisions made by Driscoll et al. (1984) for the United States.

Formation class

The physiognomic class is based on the structure of the vegetation as defined by the type, height, and relative percentage of cover of the dominant, uppermost life-forms. There are seven mutually exclusive classes:

- Forest: Trees with their crowns overlapping (generally forming 60% - 100% cover).
- Woodland: Open stands of trees with crowns not usually touching (generally forming 25% - 60% cover).
- Shrubland: Shrubs generally greater than 0.5 meter tall with individuals or clumps overlapping to not touching (generally forming greater than 25% cover, with trees generally less than 25% cover). Vegetation dominated by woody vines is generally treated in this class.
- Dwarf-shrubland: Low-growing shrubs, usually less than 0.5 meter tall. Individuals or clumps overlapping to not touching (generally forming greater than 25% cover; with trees and tall shrubs generally less than 25% cover).
- Herbaceous: Herbaceous plants dominant (generally forming at least 25% cover, with trees, shrubs, and dwarf-shrubs generally with less than 25% cover).
- Nonvascular: Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover).
- Sparse Vegetation: Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25%).

Formation subclass

The physiognomic subclass is determined by the predominant leaf phenology of the forest, woodland, shrubland and dwarf-shrubland classes. Subclass is determined by the persistence (perennial or annual) and growth form (graminoid, forb, hydromorphic) of the vegetation for the herbaceous vegetation class. The relative dominance of lichens, mosses, or algae is the determining factor in the nonvascular class, and particle size of the substrate is the determining factor for the sparse vegetation class. Examples include: Evergreen Forest, Deciduous Forest, Deciduous Shrubland, Perennial Graminoid Vegetation, Annual Graminoid or Forb Vegetation, Lichen Vegetation, and Consolidated Rock Sparse Vegetation.

Formation group

The group generally represents vegetation units defined based on leaf characters, such as broad-leaf, needle-leaf, microphyllous, and xeromorphic. These units are identified and named with broadly defined macroclimatic types to provide a structural-geographic orientation, but the ecological climate terms do not define the groups *per se*. Examples

include: Temperate or subpolar needle-leaved evergreen forest, Cold-deciduous forest, Cold-deciduous shrubland, Temperate or subpolar grassland, Sparsely vegetated cliffs.

Formation subgroup

The subgroup (or formation subgroup) represents a distinction between planted/cultivated vegetation and natural/semi-natural vegetation. The latter is broadly defined to include all vegetation not actively planted or maintained through intensive management activities by humans. Examples of subgroups include: Natural temperate and subpolar needle-leaved evergreen forest; Cultural temperate and subpolar needle-leaved evergreen forest (e.g., pine and spruce plantations).

Formation

The formation represents a grouping of community types that share a definite physiognomy or structure and broadly defined environmental factors, such as elevation and hydrologic regime. Structural factors such as crown shape and lifeform of the dominant lower stratum are used in addition to the physiognomic characters already specified at the higher levels. The hydrologic regime modifiers were adapted from Cowardin et al. (1979). Examples include: Rounded-crowned temperate or subpolar needle-leaved evergreen forest, Seasonally flooded cold-deciduous forest, Semipermanently flooded cold-deciduous shrubland, Tall sod temperate grassland, Cliffs with sparse vascular vegetation.

FLORISTIC LEVELS

Alliance

The alliance is a physiognomically uniform group of plant associations (see association below) sharing one or more dominant or diagnostic species, which as a rule are found in the uppermost strata of the vegetation (see Mueller-Dombois and Ellenberg 1974). Dominant species are often emphasized in the absence of detailed floristic information (such as quantitative plot data), whereas diagnostic species (including characteristic species, dominant differential, and other species groupings based on constancy) are used where detailed floristic data are available (Moravec 1993).

For forested communities, the alliance is roughly equivalent to the "cover type" of the Society of American Foresters (Eyre 1980), developed for use primarily by foresters to describe the forest types of North America. The alliance may be finer in detail than a cover type when the dominant tree species extend over large geographic areas and varied environmental conditions (e.g. the *Pinus ponderosa* Forest Alliance, *Pinus ponderosa* Woodland Alliance, and *Pinus ponderosa* Temporarily Flooded Woodland Alliance are all within the *Pinus ponderosa* Cover Type of the SAF). Alliances, of course, have also been developed for non-forested vegetation.

The alliance is similar in concept to the "series," as developed for the Habitat Type System to group habitat types that share the same dominant species under "climax" conditions (Daubenmire 1952, Pfister and Arno 1980). Alliances, however, are described by the dominant or diagnostic species for *all* existing vegetation types, whereas series are

generally restricted to potential "climax" types and are described by the primary dominant species.

Association

The association is the lowest level, as well as the basic unit for vegetation classification, in the ICEC. The association is defined as "a plant community of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (see Flahault and Schroter 1910 in Moravec 1993). This basic concept has been used by most of the schools of floristic classification (Whittaker 1962, Braun-Blanquet 1965, Westhoff and van der Maarel 1973, Moravec 1993).

The plant association is differentiated from the alliance level by additional plant species, found in any stratum, which indicate finer scale environmental patterns and disturbance regimes. This level is derived from analyzing complete floristic composition of the vegetation unit when plot data are available. In the absence of a complete data set, approximation of this level is reached by using available information on the dominant species or environmental modifiers, and their hypothesized indicator species.

Nomenclature for Alliances and Associations

Alliances are named for constant dominants, codominants, or diagnostic species identified from the dominant and/or top strata of the vegetation. Associations are named with one or more species from the alliance name, and have additional species that represent dominants or indicators from any layer of the vegetation. Species occurring in the same stratum are separated by a hyphen (-); those occurring in different strata are separated by a forward slash (/). Parentheses around one or more species in a name indicate that the species may or may not occur within all associations in the alliance, or an all occurrences (stands) of the association are placed within parentheses.

Vascular plant species nomenclature in the alliance names follows the nationally standardized list, Kartesz (1994), with very few exceptions. Nomenclature for nonvascular plants follows Anderson (1990), Anderson et al. (1990), Egan (1987, 1989, 1990), Esslinger and Egan (1995), and Stotler and Crandall-Stotler (1977).

Association and Alliance names include the formation class (Forest, Woodland, etc.) in which they are placed. Alliances also include the word "alliance" to distinguish them from associations (e.g., *Pinus ponderosa* Woodland **Alliance**. For wetland alliances, the hydrologic regime that the alliance is found in is always provided for clarity, e.g. *Populus fremontii* **Temporarily Flooded** Woodland Alliance. All alliances that have no hydrological modifier are upland alliances.

Environmental or geographic descriptors (e.g., serpentine, Interior Plateau) are used sparingly, when species composition for a type is not known well enough to distinguish it using only species in a name. When an environmental/geographic descriptor is used, it is inserted between the floristic nominals and the class descriptor (e.g., *Quercus palustris* - *Quercus bicolor* - *Quercus macrocarpa* - *Acer rubrum* **Sand Flatwoods** Forest).

THREE EXAMPLES OF THE CLASSIFICATION SYSTEM HIERARCHY

CLASS	FOREST	WOODLAND	SHRUBLAND
SUBCLASS	Deciduous Forest	Evergreen Woodland	Deciduous Shrubland
GROUP	Cold-deciduous Forest	Temperate or Subpolar Needle-leaved Evergreen Woodland	Temperate Broad-leaved Evergreen Shrubland
SUBGROUP	Natural/Semi-natural	Natural/Semi-natural	Natural/Semi-natural
FORMATION	Lowland or Submontane Cold-deciduous Forest	Saturated Temperate or Subpolar Needle-leaved Evergreen Woodland	Sclerophyllous Temperate Broad-leaved Evergreen Shrubland
ALLIANCE	<i>Quercus stellata</i> - <i>Quercus marilandica</i> Forest Alliance	<i>Pinus palustris</i> Saturated Woodland Alliance	<i>Quercus havardii</i> Shrubland Alliance
ASSOCIATION	<i>Quercus stellata</i> - <i>Quercus marilandica</i> - <i>Carya (glabra, texana)</i> / <i>Vaccinium arboreum</i> Forest	<i>Pinus palustris</i> / <i>Leiophyllum buxifolium</i> / <i>Aristida stricta</i> Woodland	<i>Quercus havardii</i> - (<i>Penstemon ambiguus</i> , <i>Croton dioicus</i>) / <i>Sporobolus giganteus</i> Shrubland

ECOLOGICAL GROUPS

Ecological groups are separate from the the “standard” ICEC hierarchy. They are aggregations of associations that are being developed by ecologists in the different NatureServe regions. Also known as ecological systems, these aggregations are “mid-scale” units—there are about 225 in 25 southeastern and midwestern states as compared to about 800 alliances and 2000 associations in the same area. Each is unified by similar ecological conditions and processes (e.g., fire, riverine flooding), underlying environmental features (e.g., shallow soils, serpentine geology), and/or environmental gradients (e.g., elevation). Their distributions are bounded by broad biogeographic provinces. For example, low elevation riparian forests of the desert Southwestern United States, the Great Plains, the Southeastern Coastal Plain, and the Chaco would each constitute a different ecological group.

The groups are intended as landscape-scale conservation planning tools and as categories that will be more intuitively understandable and will facilitate communication. They can also be used to develop viability and ranking criteria in a more efficient way. Separate groups have been developed for the midwestern, southeastern, and eastern NatureServe regions. However, eventually, the groups will be crosswalked among NatureServe regions to achieve a single, non-duplicative set.

KNOWN DATA GAPS - GEOGRAPHIC

The ICEC is primarily comprised of a classification of the vegetation of the contiguous U.S. and Hawaii. Most of the vegetation of Alaska has not yet been incorporated into the ICEC.

Even within the contiguous U.S. and Hawaii, regional differences endure in the U.S. National classification due to regional differences in inventory data and in classification history. Some states or regions have focused their efforts on those alliances and associations that are considered to be imperiled (conservation ranks G1 or G2), while others, like the western U.S. Forest Service Districts, focused on more common communities. Also, while the classification system is intended to develop units with consistent scale, associations are more narrowly defined in some areas, resulting in a greater number of associations per alliance than average. On the other hand, limited inventory and classification work in areas such as the Great Basin area of the southwestern United States might lead a casual observer of the classification to believe that it is an area with low ecological diversity. In fact, it is an area about which little is known.

In the near term, significant refinements to the classification are anticipated with further integration of local and state classification work from Alaska, California, and Canadian provinces. Future classification refinement will also focus on underclassified portions of the U.S. interior southwest and adjacent Mexico.

KNOWN DATA GAPS - TAXONOMIC

In general, more information is available for Forest, Woodland, Shrubland, and Herbaceous classes than for Dwarf-Shrubland, Nonvascular, and Sparse Vegetation classes. Shortgrass prairie vegetation and many riparian types have not been consistently classified. In addition, the degree of classification confidence for upland types is generally higher than for wetland types. The classification of communities that occur as vegetation complexes will also require additional research and analysis.

CAVEATS ABOUT DISTRIBUTION DATA

In general: Absence of a state or ecoregion from any list of the distribution of a type cannot be interpreted to be a definitive statement that the type does not occur there.

Federal Lands: Some data may be available listing federal land units (such as National Park Service units, individual National Forests, etc.) within which an association occurs. However, this field is *extremely incompletely populated* and absence of a federal land management unit should not be considered to indicate that the type is absent on that unit.

CONSERVATION STATUS RANKING

Associations are given a conservation status rank based on factors such as present geographic extent, threats, number of distinct occurrences, degree of decline from historic extent, and degree of alteration of natural processes affecting the dynamics, composition, or function of the type. Ranks are customarily assigned by the various members of the Natural Heritage programs and the regional offices of NatureServe.

Associations are ranked on a global (G), national (N), and subnational (S) scale of 1 to 5, with 1 indicating critical imperilment and 5 indicating little or no risk of extirpation or elimination. For example, a rank of G1 indicates critical imperilment on a rangewide basis, i.e., a great risk of “extinction” of the type worldwide; S1 indicates critical imperilment in the specific state, province, or other subnational unit, i.e., a great risk of extirpation of the type from the subnation.

Special attention is generally given to taxa of high endangerment, as opportunities for their conservation may be limited in space and time. However, occurrences of relatively secure communities can also be of critical conservation importance. In eastern North America, for example, a large tract of a common forest type in pristine condition that occurs in an intact landscape and with relatively intact ecological processes would be of high priority for conservation. Though the type itself is common, the opportunity to conserve such a high quality example may be very limited.

Global conservation status ranks for natural/near-natural communities are defined as follows:

- GX ELIMINATED** throughout its range, with no restoration potential due to extinction of dominant or characteristic species.
- GH PRESUMED ELIMINATED (HISTORIC)** throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration (e.g., *Castanea dentata* Forest).
- G1 CRITICALLY IMPERILED** Generally 5 or fewer occurrences and/or very few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).
- G2 IMPERILED** Generally 6-20 occurrences and/or few remaining acres or very vulnerable to elimination throughout its range due to other factor(s).
- G3 VULNERABLE** Generally 21-100 occurrences. Either very rare and local throughout its range or found locally, even abundantly, within a restricted range or vulnerable to elimination throughout its range due to specific factors.
- G4 APPARENTLY SECURE** Uncommon, but not rare (although it may be quite rare in parts of its range, especially at the periphery). Apparently not vulnerable in most of its range.
- G5 SECURE** Common, widespread, and abundant (though it may be quite rare in parts of its range, especially at the periphery). Not vulnerable in most of its range.
- GU UNRANKABLE** Status cannot be determined at this time.
- G? UNRANKED** Status has not yet been assessed.

Modifiers and Rank Ranges

- ?** A question mark added to a rank expresses an uncertainty about the rank in the range of 1 either way on the 1-5 scale. For example a G2? rank indicates that the rank is thought to be a G2, but could be a G1 or a G3.
- G#G#** Greater uncertainty about a rank is expressed by indicating the full range of ranks which may be appropriate. For example, a G1G3 rank indicates the rank could be a G1, G2, or a G3.
- Q** A “Q” added to a rank denotes questionable taxonomy. It modifies the degree of imperilment and is *only* used in cases where the type would have a *less imperiled* rank if it were not recognized as a valid type (i.e., if it were combined with a more common type). A GUQ rank often indicates that the type is unrankable *because of* daunting taxonomic/definitional questions.

ranks indicating semi-natural/altered communities:

- GD RUDERAL** Vegetation resulting from succession following anthropogenic disturbance of an area. Generally characterized by unnatural combinations of species (primarily native species, though often containing slight to substantial numbers and amounts of species alien to the region as well).
- GM MODIFIED/MANAGED** Vegetation resulting from the management or modification of natural/near natural vegetation, but producing a structural and floristic combination not clearly known to have a natural analogue.

GW INVASIVE Vegetation dominated by invasive alien species; the vegetation is spontaneous, self-perpetuating, and is not the (immediate) result of planting, cultivation, or human maintenance.

rank indicating planted/cultivated communities

GC PLANTED/CULTIVATED Areas dominated by vegetation that has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation.

DATA SETS

The primary data set for this project is a digital GIS file of the vegetation in and around KNRI. However, during the course of the study a number of files are generated and collected from various sources that are helpful for further work. All these data are included on the accompanying CD. The GIS data is in ArcGIS Shape format.

Vector

- Vegetation – This coverage contains the following fields:

Veg_Id
Veg_code
Formation Class
Formation Subclass
Formation Group
Formation Subgroup
Formation
Alliance
Density
Height
Area meters
Perimeter meters
Acres

The description of each field with vegetative information (Formation Class through Association) are described in “Vegetation Description and Characterization” in this document. Veg_Id and Veg_code are numeric and string identifiers for each polygon. Area and Acres are calculated using tools within ArcView.

- Burn History - This coverage contains the following fields:

Date
Burn

This coverage was compiled from several shape files produced by KNRI staff that outlines the perimeter of all prescribed burns. The polygons were digitized using a GPS in the field and ArcView software. The date is self explanatory and each burn received a name which is under the “Burn” field.

- KNRI Boundary - This coverage contains the following fields:

Park
Name

Area meters
Perimeter meters
Acres

The original ArcView shapefile provided by the GIS staff at Theodore Roosevelt National Park was replaced by this file that was updated with a GPS in the field and ArcView software. Area and Acres are calculated using tools within ArcView.

- Soils - This coverage contains the following fields:

Soil_code
Soil Description
Soil Texture
Area meters
Perimeter meters
Acres

This coverage was build using SCS Soil reports from two counties. Hence, the soil codes are not equivalent. The Soil Description is the name given to each unit and the soil Texture is the texture of each unit. Area and Acres are calculated using tools within ArcView. There is significantly more information associated with each soil type than one will see in this coverage. This information may be accessed by reference to the soil reports.

- Soil Texture - This coverage contains the following fields:

Texture

This shapefile is derived from the soils shapefile and is a compilation of all soil types of the same soil texture.

- Former Croplands - This coverage contains the following fields:

Veg_code
Vegetation

This coverage was built using a figure in a report by Clambey (1985). The boundaries are estimated. The Veg_code and vegetation are codes and vegetation description for each polygon.

- Land Tracts - This coverage contains the following fields:

Land Tract Name

This coverage was built using a figure in a report by Clambey (1985). The boundaries are estimated.

Point

- Field Data - This coverage contains the following fields:

Veg_Id
Veg_code
Formation Class
Formation Subclass
Formation Group
Formation Subgroup
Formation
Alliance
Association

These data points are informal observation points collected while in the field the last week of August 2002. The Veg_code are the names associated with each observation. All other codes are equivalent to those for the vegetation polygon coverage.

Raster

- DRG Mosaic

Seamless mosaic of four USGS quadrangles for the areas intersecting KNRI. Original data is in Datum NAD27 and reprojected into NAD83

- DRG Individual

Digital Raster Graphics for the four quads intersecting KNRI. Original data is in Datum NAD27 and reprojected into NAD83

- DOQQ

DOQ provided by GIS staff at Theodore Roosevelt National Park

- DEM and TIN

The DEM is a subset of the original provided by the GIS group at Theodore Roosevelt National Park. The TIN was created from this using a z-value tolerance of 1 meter.

RESULTS

Ground survey of all of KNRI shows 17 vegetation associations or vegetation map units. The mapping area is larger and includes several areas that were not visited. These areas have additional associations that could not be confirmed by site visit. These areas are very likely to have other associations given their different photographic signature, soils and topographic location. These unvisited areas have been assigned a tentative classification based on conjecture and descriptions from Park personnel (Rod Skalsky – personal communication). Table 3 shows the vegetation association and acres within KNRI and the mapping boundary.

Vegetation / Map Unit Description	Acres	
	Within KNRI	Within Mapping Boundary
Agricultural	115.2	2882.8
Archaeological Site	34.4	34.4
Undifferentiated Urban	16.8	239.1
Forest - Green Ash / Snowberry	108.6	328.4
Woodland - Green Ash / Chokecherry	259.4	1095.5
Herbaceous - Big Blue Stem / Little Blue Stem	124.3	184.8
Herbaceous - Smooth Brome	314.9	428.5
Herbaceous - Canada Thistle	8.9	35.1
Herbaceous - Needle-and Thread / Blue Grama	115.6	746.8
Herbaceous - Western Wheatgrass / Blue Grama	93.1	237.2
Herbaceous - Crested Wheatgrass	1.3	119.6
Herbaceous - Riverine Sand Flats	4.2	247.3
Planted - Big Blue Stem	62.7	308.8
Planted - Sideoats Grama / Western Wheatgrass	97.4	125.1
Planted - Smooth Brome	52.2	1.5
Planted - Grass Forb Mix	23.6	66.4
Shrub - Dwarf Sagebrush	2.3	97.4
Shrub - Coyote Willow	39.1	52.2
Shrub - Western Snowberry	35.5	23.7
Water	67.2	2.3
Hardstem Bulrush Marsh	2.7	281.2
Total	1579.3	218.5

Table 3. Acreages of plant associations and other mapping units present within KNRI and mapping boundary.

Vegetation Associations: Global and Local Descriptions

The following descriptions are organized and numbered using the original numbering system devised by NatureServe (2002).

I. Forest

I.B.2.N.d. Temporarily flooded cold-deciduous forest

I.B.2.N.d.33. FRAXINUS PENNSYLVANICA - (ULMUS AMERICANA) TEMPORARILY FLOODED FOREST ALLIANCE

Green Ash - (American Elm) Temporarily Flooded Forest Alliance

Concept:

Comments: The single association in this alliance that is reported for the western U.S. (in eastern Montana and Wyoming) is *Fraxinus pennsylvanica* / *Prunus virginiana* Forest (CEGL000642). In Montana, this association is considered synonymous with *Fraxinus pennsylvanica* - *Ulmus americana* / *Prunus virginiana* Woodland (CEGL000643). The relationship between these two associations needs to be reviewed, and they will likely be merged into one association and placed in the *Fraxinus pennsylvanica* - (*Ulmus americana*) Woodland Alliance (A.629). Until this review is completed, the *Fraxinus pennsylvanica* - (*Ulmus americana*) Temporarily Flooded Forest Alliance (A.308) will not be described and may not occur in the West.

Range: This alliance is found in Wyoming, Montana, Minnesota, and North Dakota. It is also found in Manitoba and Ontario, Canada.

States/Provinces: MB MT ND SD SK WY

TNC Ecoregions: 26:C, 34:C, 35:C, 46:C, 47:C

USFS Ecoregions: 251Aa:CCC, 331D:CC, 331F:CC, 331G:CC, 332:P

Federal Lands: NPS (Theodore Roosevelt)

References: Hansen and Hoffman 1988, Hansen et al. 1991, Hansen et al. 1995, Jones 1990

Authors: M.S. REID, WCS **Identifier:** A.308

***Fraxinus pennsylvanica* - (*Ulmus americana*) / *Symphoricarpos occidentalis* Forest**

Green Ash - (American Elm) / Western Snowberry Forest

Great Plains Ash - Elm - Snowberry Forest **G4? (00-02-27)**

Ecological Group (SCS;MCS): Northern and Central Great Plains Wooded Riparian Vegetation (560-05; 1.6.5.1)

Concept: This ash - elm forest type is found in the northeastern Great Plains of the United States and Canada. Stands are found on nearly level floodplains and lower terraces of rivers and streams, generally away from the river on older, stabilized sites. The water table may be relatively deep on higher terraces, allowing drier species to establish. Soils are typically clays or silty clays. The tree layer is variable in structure,

ranging from open (25-50%) to closed (50% or more) canopy. *Fraxinus pennsylvanica* is the leading dominant. In some parts of the range *Juniperus scopulorum* is present in the subcanopy, particularly where the canopy is still open. *Populus deltoides* may be present as an emergent. Emergent *Populus deltoides* may also occur under a canopy of *Fraxinus pennsylvanica*, reflecting a successional shift in some stands. *Fraxinus pennsylvanica* is common in the subcanopy and sapling layer, and, in some stands, *Ulmus americana* may be an associate. *Acer negundo* may only be occasionally present in some parts of the range. The dominant shrub is *Symphoricarpos occidentalis*. Other shrub species may be present, including *Cornus sericea*, *Rosa woodsii*, and *Rhus aromatica*. A variety of herbs may be present, none at high cover values, including *Elymus canadensis*, *Maianthemum stellatum*, *Melilotus officinalis*, *Muhlenbergia racemosa*, *Parthenocissus vitacea*, *Poa pratensis*, *Thalictrum dasycarpum*, and *Toxicodendron rydbergii*.

Comments: Where stands occur on higher terraces and the water table is deep, *Prunus virginiana* may be more common, and stands may resemble *Fraxinus pennsylvanica* - *Ulmus americana* / *Prunus virginiana* Woodland (CEGL000643). This type is placed under a temporarily flooded hydrologic regime, but because of the arid climate, the floodplain may be relatively dry. Type is conceptually equivalent to the *Fraxinus pennsylvanica* / *Symphoricarpos occidentalis* Habitat Type of Hansen et al. (1984) and Girard et al. (1989), at least in the western Dakotas. The relative importance of *Acer negundo* across the range of this type is not clear, nor whether stands with *Acer negundo* have been impacted by human activity to a greater degree.

Range: This ash - elm forest type is found in the northeastern and north-central Great Plains of the United States and Canada, ranging from the Dakotas and northern Ontario to Saskatchewan.

States/Provinces: MB:S3, ND:SU, SD:S3, SK:S?

TNC Ecoregions: 34:C, 35:C

USFS Ecoregions: 251Aa:CCC, 332:P

Federal Lands: NPS (Theodore Roosevelt)

Synonymy: *Fraxinus pennsylvanica* / *Symphoricarpos occidentalis* Habitat Type (Hansen et al. 1984) =, *Fraxinus pennsylvanica* / *Symphoricarpos occidentalis* Habitat Type (Girard et al. 1989) =

References: Girard et al. 1989, Hansen et al. 1984

Authors: D. Faber-Langendoen, MCS **Confidence:** 2 **Identifier:** CEGL002088

Local Description: The only area that fits the forest category is the Russel Floodplain to the northeast of the park. The forest is comprised primarily of Green Ash with a small amount of smaller elms. Boxelder also occurs but typically towards the periphery of the stands and are also smaller than the ash. The taller Green Ash may reach heights up to 70 feet but averages about 50 ft. Canopy cover is 100% in most areas. The understory has few shrubs. The few that appear are mostly Western Snowberry and a fair amount of Poison Ivy. Smooth Brome occurs widely with some Kentucky bluegrass and wild rye. Typical forb species are Dandelion, Tall Meadow Rue and Wild Bergamot. This class occurs on several soil textures. These include Loam (35.1%), Silty Clay Loam (31.8%), Loamy Fine Sand (6.2%), Silt Loam (4.8%) and Silty Clay (6.1%)(See Table 5).

I.B.2.N.d.15. POPULUS DELTOIDES TEMPORARILY FLOODED FOREST ALLIANCE

Eastern Cottonwood Temporarily Flooded Forest Alliance

Concept: This alliance, found throughout the central midwestern and southeastern United States, contains riverfront floodplain forests. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* and *Salix nigra*, although *Fraxinus pennsylvanica*, *Acer negundo*, *Acer rubrum*, *Acer saccharinum*, *Platanus occidentalis*, and *Ulmus americana* are also commonly encountered in various parts of this alliance's range. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The shrub layer is often sparse, but species such as *Salix exigua*, *Carpinus caroliniana*, *Lindera benzoin*, *Cornus drummondii* and, in the Southeast, *Ilex vomitoria*, *Ilex opaca* var. *opaca*, and *Forestiera acuminata* can be found. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Herbaceous species found throughout the range of this alliance are not well known, but in parts of the range, species can include *Carex* spp., *Leersia oryzoides*, *Bidens* spp., *Aster* spp., *Eragrostis hypnoides*, *Lipocarpa micrantha*, *Rumex maritimus*, *Potentilla paradoxa*, and, more commonly in the Southeast, *Leptochloa panicea* ssp. *mucronata* (= *Leptochloa mucronata*) and *Mikania scandens*.

Stands are found primarily along riverfronts, where they develop on bare, moist soil on newly made sand bars, front-land ridges, and well-drained flats. Soils are formed in alluvium, are deep, medium-textured, and with adequate or excessive moisture available for vegetation during the growing season. This alliance can also be found on abandoned fields and well-drained ridges in the first bottoms.

Comments: In the Midwest, this alliance can overlap floristically with the I.B.2.N.d *Acer saccharinum* Temporarily Flooded Forest Alliance (A.279), particularly where historic flooding regimes have been altered, leading to stabilized substrates and suitable conditions for *Acer saccharinum* and other species less tolerant of floods. Where *Acer saccharinum* is either codominant with *Populus deltoides* or has become the dominant subcanopy species and understory composition reflects the new hydrologic regime, the stand should be placed in that alliance. This alliance is known from Kentucky's Mississippi River Alluvial Plain, where it provides nesting habitat for the Mississippi Kite.

Range: This alliance is found in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina (?), Oklahoma, South Carolina, Tennessee, Texas, Virginia, Indiana (?), Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota (?), South Dakota, Wisconsin, Montana, and in Canada, in Saskatchewan. It is likely to occur elsewhere.

States/Provinces: AB AL AR FL GA IA IL IN KS KY LA MB? MN MO MS MT NC? ND NE OH? OK SC SD SK TN TX VA? WI

TNC Ecoregions: 10:C, 25:C, 26:C, 31:C, 32:C, 33:C, 35:C, 36:C, 37:C, 38:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 46:C, 53:C, 56:C, 57:C, 58:?

USFS Ecoregions: 212Aa:P??, 212Ab:P??, 212Ba:PPP, 212Bb:PPP, 212Ca:PPP, 212Cb:PPP, 212Da:PPP, 212Dc:PPP, 212Ea:PPP, 212Eb:PPP, 212Ec:PPP, 212Ed:PP?,

212Fa:PPP, 212Fb:PPP, 212Fc:PPP, 212Ga:PPP, 212Gb:PPP, 221Aa:PP?, 221Ad:PPP, 221Ae:PPP, 221Af:PPP, 221Ag:PPP, 221Ah:PP?, 221Ai:PPP, 221Aj:PP?, 221Ak:PPP, 221Al:PPP, 221Ba:PPP, 221Bb:PPP, 221Bc:PPP, 221Bd:PPP, 221Db:PPP, 221Ea:PPP, 221Eb:PPP, 221F:PP, 222Ab:CCC, 222Ad:CC?, 222Ae:CC?, 222C:CP, 222D:CP, 222Ee:CP?, 222Ef:CP?, 222Eg:CP?, 222F:CP, 222G:CP, 222H:CP, 222Ia:CPP, 222Ib:CPP, 222Ic:CPP, 222Id:CPP, 222Ie:CPP, 222If:CPP, 222J:CP, 222K:CP, 222Lf:CCC, 222Mb:CCC, 222Me:CCC, 231Aa:CCP, 231Ae:CCP, 231Af:CCP, 231Ak:CCP, 231Al:CCP, 231An:CCP, 231Ap:CCP, 231Ba:CC?, 231Bb:CC?, 231Bc:CC?, 231Bd:CC?, 231Be:CC?, 231Bf:CCC, 231Bg:CC?, 231Bh:CC?, 231Bi:CC?, 231Bj:CC?, 231Bk:CC?, 231Bl:CC?, 231Ca:CP?, 231Cb:CP?, 231Cc:CP?, 231Cd:CP?, 231Ce:CP?, 231Cf:CP?, 231Cg:CP?, 231Ec:CCP, 231Ed:CCP, 231El:CCP, 231Em:CCP, 231F:CP, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Ad:CPP, 232Bj:CCC, 232Br:CCP, 232Bs:CCC, 232C:CP, 232Fc:CCP, 232Fd:CCP, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Ae:CC?, 234Af:CC?, 234Ag:CCC, 234Ah:CCP, 234Ai:CCP, 234Ak:CC?, 234Al:CCP, 234Am:CCC, 234An:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Cd:CC?, 251Cg:CCC, 251Cq:CCC, 251D:CP, 251Ea:CCC, 251Fa:CCC, 255Aa:CC?, 255Ab:CC?, 255Ac:CC?, 255Ad:CC?, 255Ae:CC?, 255Af:CC?, 255Ag:CCC, 255Ah:CCC, 255Ai:CC?, 255Aj:CCC, 255Ak:CC?, 255Db:CCC, 311A:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 332A:CC, 332B:CP, 332C:CC, 332D:CC, 332E:CC, 342A:??, M212Ac:PPP, M212Ad:PPP, M212Ba:PPP, M212Bb:PPP, M212Ca:PPP, M212Cc:PPP, M212Cd:PPP, M212Da:PPP, M212Db:PPP, M212Dc:PPP, M212Ea:PP?, M212Eb:PPP, M212Fa:PP?, M212Fb:PPP, M221Aa:?PP, M221Ab:?PP, M221Bb:?PP, M221Bd:?PP, M221Be:?PP, M221Bf:?PP, M221Ca:?PP, M221Cb:?PP, M221Cd:?PP, M221Da:???, M331A:CC, M331B:C?, M332D:CC

Federal Lands: COE (Claiborne Lake); NPS (Badlands, Congaree Swamp); USFS (Angelina, Apalachicola, Conecuh, Davy Crockett, De Soto, Delta, Francis Marion?, Holly Springs?, Homochitto?, Kisatchie, Sabine, St. Francis?, Sam Houston, Sumter, Tombigbee?); USFWS (Chickasaw, Hatchie, Holla Bend, Lower Hatchie?)

Synonymy: IIA7c. Eastern Cottonwood - Willow Riverfront Forest, in part (Allard 1990); Riverfront Forest, in part (Foti 1994b); Riparian forest, in part (Evans 1991); *Populus deltoides* forest alliance (Hoagland 1998a); R1B3cI2a. *Populus deltoides* (Foti et al. 1994); R1B3cI2c. *Populus deltoides* - *Salix nigra* - *Celtis laevigata* (Foti et al. 1994); *Populus-Salix* wetland forest (No. 24), in part (Vankat 1990); Cottonwood: 63, in part (Eyre 1980); *Populus deltoides* Dominance Type, in part (Hansen et al. 1988b); No equivalent (Diamond 1993)

References: Allard 1990, Ambrose 1990a, Evans 1991, Eyre 1980, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Klimas 1988b, MTNHP n.d., Oberholster 1993, Smith 1996a, TNC 1996b, Van Auken and Bush 1988, Vankat 1990, Voigt and Mohlenbrock 1964, Wieland 1994b

Authors: D.J. ALLARD, MOD. D. CULV, MP, MCS **Identifier:** A.290

Populus deltoides - Fraxinus pennsylvanica Forest

Eastern Cottonwood - Green Ash Forest

Cottonwood - Green Ash Floodplain Forest **G2G3 (00-02-27)**

Ecological Group (SCS;MCS): Northern and Central Great Plains Wooded Riparian Vegetation (560-05; 1.6.5.1)

Concept: This cottonwood - green ash riparian forest community occurs throughout the northern and central Great Plains of the United States and adjacent Canada. Stands occur along rivers and streams and around ponds and lakes. The alluvial soils are variable, with silty clay loam, clay loam, clay, and loam soils in the northern Plains and sandy soils in the central Plains. It is a riparian open to closed-canopy forest dominated by deciduous trees. *Populus deltoides* and *Fraxinus pennsylvanica* are the most abundant mature trees. *Acer negundo* and *Ulmus americana* may also be present in the tree layer. *Juniperus scopulorum* may occur in the western portion of this community's range, and *Juniperus virginiana* in the eastern part. This community is dynamic and in younger stands *Populus deltoides* is the dominant but as stands age *Fraxinus pennsylvanica* becomes more prominent. The shrub layer is often vigorous. Species such as *Rosa woodsii*, *Symphoricarpos occidentalis*, *Juniperus scopulorum*, *Juniperus communis*, *Prunus virginiana*, *Cornus drummondii*, and *Cornus sericea* ssp. *sericea* can be abundant. *Carex* spp., *Juncus* spp., *Leymus cinereus*, *Lysimachia ciliata*, *Thalictrum venulosum*, and *Elymus canadensis* are common in the northern Plains, and *Amphicarpaea bracteata*, *Carex blanda*, *Geum canadense*, *Parietaria pensylvanica* and others in the central Plains. Weedy species are almost ubiquitous, especially *Poa pratensis*, *Bromus inermis*, *Melilotus officinalis*, *Ambrosia* spp., and *Urtica* spp.

Comments: In North and South Dakota, woodland cottonwood types may only occur in the western half of the state, e.g., *Populus deltoides* / *Juniperus scopulorum* Woodland (CEGL002152), where such species as *Celtis occidentalis* do not occur. Further comparisons are needed between these stands and those in Nebraska, which may contain a different set of species.

Range: This cottonwood - green ash riparian forest community occurs 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.

States/Provinces: MB?, MT:S2Q, ND:S?, NE:S?, SD:S?, SK?

TNC Ecoregions: 25:C, 26:C, 35:C, 36:C

USFS Ecoregions: 251Aa:CCC, 251Bb:CCC, 251Cg:CCC, 331E:CC, 331F:CC, 332A:CC, 332B:CP, 332C:CC, 332D:CP

Federal Lands: NPS (Badlands)

Synonymy: *Populus deltoides* / *Fraxinus pennsylvanica* Community Type (Girard et al. 1989) =, DRISCOLL FORMATION CODE:I.B.3.d. (Driscoll et al. 1984) B, *Fraxinus pennsylvanica* / *Symphoricarpos occidentalis* Habitat Type (Hansen et al. 1984) =, *Populus sargentii* / *Symphoricarpos occidentalis*, Phase 1 Plant Association (Johnston 1987) B, Cottonwood, green ash, boxelder Floodplain Forest (Johnson 1971) =

References: Driscoll et al. 1984, Eyre 1980, Girard 1985, Girard et al. 1989, Hansen et al. 1984, Hansen et al. 1990, Johnson 1971, Johnston 1987, Keammerer 1972, MTNHP n.d., South Dakota Geological Survey n.d., Steinauer and Rolfsmeier 2000

Authors: Faber-Langendoen, D., MCS **Confidence:** 3 **Identifier:** CEGL000658

Local Description: A wooded area within Smith-Russel was reported by Clambey (1985) to have a mixture of cottonwood – green ash. The cottonwood area that he reported was intermediate in size and has a significant component of American elm and boxelder. This whole area was burned in 2001 and few Cottonwoods remain. The area was mapped as Green Ash - American Elm / Choke Cherry Woodland. Few other areas exist within KNRI and in the adjacent areas that were large enough to be mapped. This description is included as there are small patches scattered about that may warrant this classification. This area may have been Eastern Cottonwood - Green Ash Forest or Eastern Cottonwood - (Peachleaf Willow) / (Coyote Willow, Sandbar Willow) Woodland.

II. Woodland

II.B.2.N.a. Cold-deciduous woodland

II.B.2.N.a.29. FRAXINUS PENNSYLVANICA - (ULMUS AMERICANA) WOODLAND ALLIANCE

Green Ash - (American Elm) Woodland Alliance

Concept: This alliance is found along streams and rivers and in draws and canyons across much of the northern Great Plains. Stands often have an overstory that is more dense than typical woodland physiognomy. The canopy can be moderately closed to closed. Most of the canopy trees are 6-10 m tall, and they allow significant light to penetrate to the understory. The shrub layer is usually well-developed while the herbaceous layer is moderately to well-developed. The canopy is dominated by *Fraxinus pennsylvanica* and sometimes *Ulmus americana*. Individuals of *Populus deltoides* and *Acer negundo* are often scattered throughout. The shrub layer is typically dominated by *Prunus virginiana*, *Symphoricarpos occidentalis*, *Symphoricarpos albus*, and *Ribes* spp. The herbaceous layer often contains *Maianthemum stellatum*, *Galium aparine*, and *Elymus canadensis*.

Stands of this alliance are usually on flat to moderately steep slopes near permanent or ephemeral streams. Rarely, it can be found on steep north-facing escarpments. These sites create more mesic microclimates in which the woodland can develop in landscapes otherwise dominated by grasslands. The soils are typically deep and loamy, but in places they can be rocky. Stands are common along riparian areas but are usually distant enough from larger streams that they do not flood or do so for very short periods.

Comments: In places, the elements within the *Populus deltoides* Woodland Alliance (A.1493) border on and succeed to *Fraxinus pennsylvanica* - (*Ulmus americana*) Woodland Alliance (A.629). Sites that are temporal or spatial transition zones can be difficult to classify.

Range: This alliance is found in the central and western parts of Nebraska, South Dakota, and North Dakota, and in southeastern Montana.

States/Provinces: MT ND NE SD

TNC Ecoregions: 26:C

USFS Ecoregions: 331E:CC, 331F:CC, 332A:C?, 332C:CP, 332D:C?

Federal Lands: NPS (Badlands, Theodore Roosevelt)

Synonymy: Northern floodplain forest, # 98, in part (Kuchler 1964)

References: Faber-Langendoen et al. 1996, Girard et al. 1989, Hansen et al. 1984, Kuchler 1964, MTNHP n.d., Steinauer 1989

Authors: MCS, MOD. M.S. REID, MCS **Identifier:** A.629

Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland

Green Ash - American Elm / Choke Cherry Woodland

Green Ash - Elm Woody Draw G2G3 (98-06-22)

Ecological Group (SCS;MCS): Northern Great Plains Ash-Elm Forests and Woodlands (n/a; 2.5.5.3)

Concept: This community type occurs in the northwestern Great Plains of the United States. Stands occur in upland ravines and broad valleys or on moderately steep slopes. They also occurs along small permanent or ephemeral streams, including deep mesic ravines and canyon bottoms that are not flooded or saturated. On these sites, soil and topography permit greater than normal moisture. The soils are clay loams, sandy clay loam, and sandy loam, dry to moist, and moderately well-drained. The parent material is typically colluvium or alluvium. This community is an open- to closed-canopy woodland dominated by *Fraxinus pennsylvanica*. *Ulmus americana* or *Acer negundo* sometimes achieve codominance. In undisturbed stands, the understory is composed of two layers. The taller and more conspicuous layer is a shrub layer 2-3 m tall. This layer is dominated by *Prunus virginiana* with smaller amounts of *Symphoricarpos occidentalis* or more rarely *Ostrya virginiana*. The lower layer is dominated by grasses and sedges such as *Elymus virginicus*, *Elymus villosus*, and *Carex sprengelii*. Common herbaceous species include *Aquilegia canadensis*, *Cerastium arvense*, *Thalictrum dasycarpum*, *Galium boreale*, *Galium aparine*, *Maianthemum stellatum*, and *Thalictrum dasycarpum*. The continuation of the status of *Ulmus americana* as a prominent part of this community is uncertain due to the effects of Dutch elm disease.

Comments: The community described by Girard et al. (1989) in southwestern North Dakota was very dense for a woodland (700 trees/ha); however, the basal area was fairly low (18 m²/ha) and the trees averaged 9 m tall. This appears to be a dense woodland and may overlap with *Fraxinus pennsylvanica* / *Prunus virginiana* Forest (CEGL000642) that occurs in Montana and Wyoming. For example, the *Fraxinus pennsylvanica* - *Prunus virginiana* habitat type in Theodore Roosevelt National Park, western North Dakota (Hansen et al. 1985) was expanded in Hansen et al. (1990) to include this community in eastern Montana. Wali et al. (1980) also described a green ash-American elm forest in western North Dakota. Montana lumps most stands with *Ulmus americana* into *Fraxinus pennsylvanica* / *Prunus virginiana* Forest (CEGL000642).

Range: This community type occurs in the northwestern Great Plains of the United States, from northern and western Nebraska to the Dakotas and Montana.

States/Provinces: MT:S1Q, ND:SU, NE:S2, SD:SU

TNC Ecoregions: 26:C

USFS Ecoregions: 331E:CC, 331F:CC, 332A:P?, 332C:PP, 332D:P?

Federal Lands: NPS (Badlands, Theodore Roosevelt)

Synonymy: DRISCOLL FORMATION CODE:I.B.3.d. (Driscoll et al. 1984) B, *Fraxinus pennsylvanica* - *Zanthoxylum americanum* (USACE 1979). Similar. In south-central South Dakota along the east bank of the Lake Francis Case Reservoir on the Missouri River. This type was trampled heavily as domestic animals and wildlife commonly use it for shade from the mid-day sun., Deciduous woods (Tolstead 1947) B

References: Daubenmire 1970, Daubenmire and Daubenmire 1968, Driscoll et al. 1984, Girard et al. 1989, Godfread 1976, Godfread 1994, Hansen and Hoffman 1988, Hansen et

al. 1984, Hansen et al. 1985, Hansen et al. 1990, MTNHP n.d., Mack 1981, Nixon 1967, Steinauer 1989, Steinauer and Rolfsmeier 2000, Tolstead 1947, USACE 1979, Wali et al. 1980, Williams 1979

Authors: Faber-Langendoen, D., MCS **Confidence:** 2 **Identifier:** CEG000643

Local Description: Most of the woodlands within and around KNRI are made of this class. In some cases the overstory closes but the woodland class predominates. Most of the wooded areas were burned in 2001. The prescribed fires opened up the canopy in many areas and changed the characteristics of the ground cover from that reported by Clambey (1985). In the northern portion of the park in the Big Hidatsa floodplain there is a steep slope that transitions to prairie above. This area is adjacent to the forested class but given the slope it has a much more open canopy and a greater shrub community (Figures 13 and 14). In fact, this area is the only wooded classification that has any significant shrub component. Green ash and American elm make up equivalent portions of the canopy with a smaller component of Boxelder. Snowberry is the common shrub, followed by Common Juniper and Western Wild Rose. Common forbs include *Clematis* sp., *Solidago gigantea*, *Fragaria virginiana*, *Galium triflorum*, and the common graminoid was *Carex filifolia*. In all other areas within this class the shrub component is either minimal or non-existent. The Russel Flood plain in the south east of the park makes up the greatest portion of this class. This area was burned in May 2002. Clambey (1985) reported this area as having a very dense Poison Ivy shrub component. Currently it has no shrub component. Smooth Brome has about 100% coverage throughout the burned area. (Figures 15 and 16). Oddly enough there are several patches of Big Blue stem scattered throughout the area (Figure 17). This class occurs on several soil textures. These include Loam (36.1%), Silty Clay Loam (36.5%), Loamy Fine Sand (6.2%), Silt Loam (4.8%) and Silty Clay (6.1%)(See Table 5).



Figure 13. Green Ash - American Elm / Choke Cherry Woodland –North Big Hidatsa Floodplain.



Figure 14. Green Ash - American Elm / Choke Cherry Woodland –North Big Hidatsa Floodplain.



Figure 15. Green Ash - American Elm / Choke Cherry Woodland Russel Floodplain.

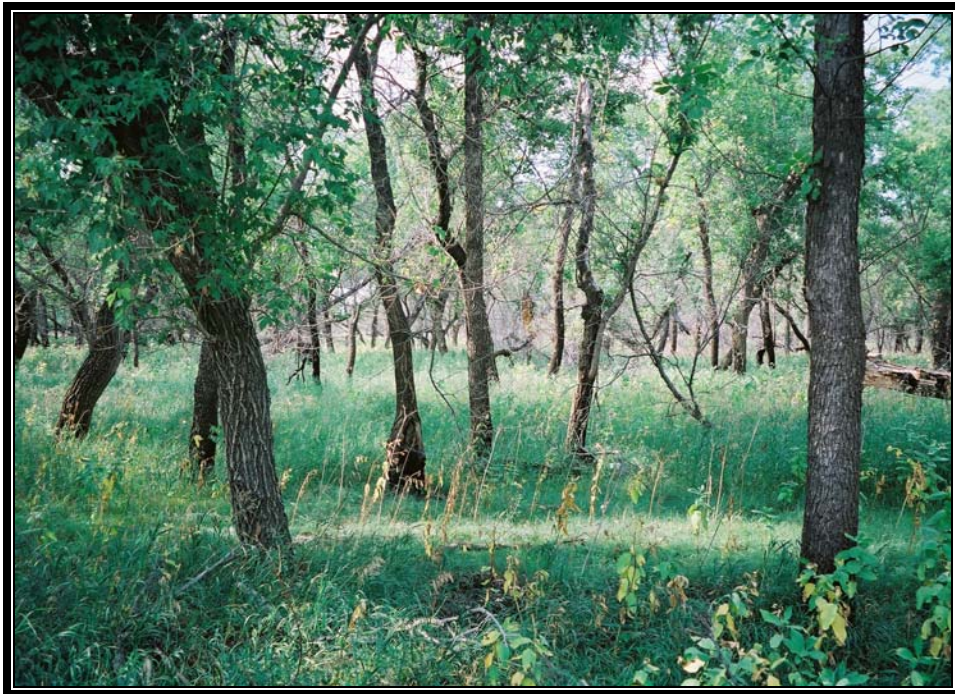


Figure 16. Green Ash - American Elm / Choke Cherry Woodland Russel Floodplain.



Figure 17. Big Bluestem within Green Ash - American Elm / Choke Cherry Woodland Russel Floodplain.

II.B.2.N.b. Temporarily flooded cold-deciduous woodland

II.B.2.N.b.4. POPULUS DELTOIDES TEMPORARILY FLOODED WOODLAND ALLIANCE

Eastern Cottonwood Temporarily Flooded Woodland Alliance

Concept: This alliance occurs throughout the Great Plains near rivers and large streams. It is dominated by *Populus deltoides* throughout its range. Secondary canopy species include *Acer negundo* throughout, *Salix nigra* (in the eastern part of its range), *Fraxinus pennsylvanica* and *Ulmus americana* (central and eastern), and *Salix amygdaloides* (central and western). *Fraxinus pennsylvanica* and *Ulmus americana* often increase in abundance and dominance as stands of this alliance age. *Populus deltoides* does not reproduce well in established stands. The understory composition and structure are variable. A shrub layer may be present, with species such as *Salix* spp., *Symphoricarpos occidentalis*, and *Prunus virginiana* predominating. Sites experience seasonal floods, which, after receding, leave areas available for colonization. This process often favors the establishment of aggressive native and exotic plants. Among the species that are common in this alliance are *Carex* spp., *Juncus* spp., *Spartina pectinata* (in the east), *Pascopyrum smithii* (in the west), *Elymus* spp., *Cenchrus longispinus*, *Melilotus officinalis*, and *Equisetum* spp. Typical exotics found in this alliance are *Poa pratensis* and *Bromus* spp.

Stands of this alliance are found on level to gently sloping topography near rivers, streams, lakes, and ponds. The areas may have been very recently deposited by water action, or they may have been deposited earlier and occupied by other communities. The water table fluctuates with the level of the adjacent water body. This can lead to periods of flooding and soil saturation in the spring and after heavy rains and also to periods of drought when the water level falls in the summer and fall. The soils are silts, loams, and sands, and are derived from alluvial material.

Comments: In many parts of the Great Plains, stands within this alliance border on and succeed to stands belonging to less flood-prone mesic alliances such as II.B.2.N.a *Fraxinus pennsylvanica* - (*Ulmus americana*) Woodland Alliance (A.629), I.B.2.N.a *Fraxinus pennsylvanica* - (*Ulmus americana*) Forest Alliance (A.259), and I.B.2.N.d *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis (occidentalis, laevigata)* Temporarily Flooded Forest Alliance (A.286). Flood control also appears to hasten this successional process (Johnston et al. 1976). Sites that are temporal or spatial transition zones can be difficult to classify. The former *Populus deltoides* Temporarily Flooded Wooded Herbaceous Alliance (A.1507) has been merged with this alliance.

Range: This alliance is found in North Dakota, South Dakota, Nebraska, Kansas, Missouri, Wyoming, Colorado, New Mexico (?), Texas (?), Oklahoma, and in Canada in Manitoba.

States/Provinces: CO IA KS MB? MO? ND NE NM OK SD SK? TX WY

TNC Ecoregions: 10:C, 19:C, 20:C, 25:C, 26:C, 27:C, 32:C, 33:C, 34:C, 37:C, 39:P

USFS Ecoregions: 222Ak:???, 251Cd:C??, 251Eb:CCC, 255:C, 311:C, 313A:CC, 315A:CC, 331B:C?, 331C:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 341B:CC, M313B:CC, M334A:CC, M341B:CC

Federal Lands: NPS (Theodore Roosevelt, Wind Cave)

Synonymy: Northern floodplain forest, # 98, in part (Kuchler 1964); *Populus deltoides* woodland alliance (Hoagland 1998a); Cottonwood: 63, in part (Eyre 1980)

References: Bunin 1985, Christy 1973, Cooper 1988, Crouch 1961a, Crouch 1961b, Crouch 1978, Crouch 1979a, Crouch 1979b, Diamond 1993, Eyre 1980, Faber-Langendoen et al. 1996, Fitzgerald 1978, Hansen et al. 1984, Hansen et al. 1995, Hoagland 1998a, Jackson 1972, Jackson and Lindauer 1978, Johnson et al. 1976, Keammerer 1974a, Keammerer 1974b, Kittel and Lederer 1993, Kittel et al. 1996, Kittel et al. 1997, Kittel et al. 1999, Knopf 1985, Kuchler 1964, Lindauer 1970, Lindauer 1978, Lindauer and Christy 1972, Lindauer and Fitzgerald 1974, Lindauer and Ward 1968, Lindauer et al. 1973, Masek 1979, McEachern 1979, Moulton et al. 1981, TNC 1995a, Thilenius and Smith 1985, Thilenius et al. 1995, U.S. Bureau of Reclamation 1976, Wilson 1970

Authors: GREAT PLAINS PROGRAM 1-95, MP, MCS **Identifier:** A.636

Populus deltoides - (Salix amygdaloides) / Salix (exigua, interior) Woodland

Eastern Cottonwood - (Peachleaf Willow) / (Coyote Willow, Sandbar Willow) Woodland
Cottonwood - Peach-Leaf Willow Floodplain Woodland **G3G4 (98-06-22)**

Ecological Group (SCS;MCS): Northern and Central Great Plains Wooded Riparian
Vegetation (560-05; 1.6.5.1)

Concept: This cottonwood - willow woodland is found widely in the central Great Plains of the United States. Stands occur on recently deposited alluvial material along rivers and streams. The soils are derived from alluvial sand, silt, and clay and are poorly developed. The water table fluctuates with the level of the adjacent river or stream. *Populus deltoides* is the dominant species in this community, although *Salix exigua* and/or *Salix interior* is generally more dominant in the initial stage following a major flood event. *Salix amygdaloides* is rare to codominant. The shrub/sapling layer is conspicuous, especially near the streambank, and consists mainly of *Salix exigua*, *Populus deltoides*, and *Salix amygdaloides*, or occasionally *Salix lutea*. In the more easterly parts of the range, *Salix interior* may replace *Salix exigua*. On the older margins of this community *Fraxinus pennsylvanica* is often found as a sapling or small canopy tree. The herbaceous stratum is variable. Graminoids typical of undisturbed sites include *Carex emoryi*, *Carex pellita* (= *Carex lanuginosa*), *Pascopyrum smithii*, and *Spartina pectinata*. *Equisetum arvense* and *Glycyrrhiza lepidota* are common forbs in these sites. Widely distributed species that are adapted to these sites include *Ambrosia psilostachya*, *Artemisia campestris* ssp. *caudata*, *Artemisia ludoviciana*, *Calamovilfa longifolia*, *Cenchrus longispinus*, *Chamaesyce serpyllifolia* (= *Euphorbia serpyllifolia*), *Euphorbia esula*, *Grindelia squarrosa*, *Helianthus petiolaris*, *Heterotheca villosa*, *Phyla lanceolata* (= *Lippia lanceolata*), *Opuntia macrorhiza*, *Poa pratensis*, and *Sporobolus cryptandrus*. These sites are prone to invasion by exotic grasses and forbs, the most widely established being *Agrostis stolonifera*, *Bromus tectorum*, *Cirsium arvense*, *Bassia scoparia* (= *Kochia scoparia*), *Melilotus* spp., *Taraxacum officinale*, and *Tragopogon dubius*.

Comments: This community's range into North Dakota and Manitoba needs review. It apparently does not occur in South Dakota. Check with other midwestern states regarding woodland status. Species nomenclature is *Populus deltoides* ssp. *monilifera* in Colorado. *Salix interior* and *Salix exigua* are treated as separate species in Kartesz (1999), with *Salix exigua* restricted to western North America.

Range: This cottonwood - willow woodland is found widely in the central Great Plains, especially Colorado, Nebraska, Kansas, and Oklahoma, and possibly both north and south of this region.

States/Provinces: CO:S2S3, KS:SU, MB?, ND:S?, NE:S?, NM?, OK?, SD:S?, SK?, TX?, WY?

TNC Ecoregions: 19:C, 20:C, 25:C, 26:C, 27:C, 33:C, 34:C

USFS Ecoregions: 331H:CC, 331I:CC, M334A:CC

Federal Lands: NPS (Badlands, Theodore Roosevelt)

Synonymy: Willow wetland community (Currier 1982) F, DRISCOLL FORMATION CODE:I.B.3.d. (Driscoll et al. 1984) B, *Populus-Salix* Associates (Hefley 1937) B, *Populus sargentii* / *Ribes americanum* Plant Association (Johnston 1987) =, Plains Cottonwood/Western wheatgrass Community (Jones and Walford 1995) B, Willow-Poplar Community (Ramaley 1939b) =

References: Baalman 1965, Bellah and Hulbert 1974, Blair and Hubbell 1938, Bunin 1985, Burgess et al. 1973, Christy 1973, Cooper 1988, Crouch 1961a, Crouch 1961b, Crouch 1978, Crouch 1979a, Crouch 1979b, Currier 1982, Driscoll et al. 1984, Fitzgerald 1978, Hefley 1937, Hoagland 2000, Jackson 1972, Jackson and Lindauer 1978, Johnson 1994, Johnston 1987, Jones and Walford 1995, Kartesz 1999, Knopf 1985, Lindauer 1970, Lindauer 1978, Lindauer and Christy 1972, Lindauer and Fitzgerald 1974, Lindauer et al. 1973, McAdams et al. 1998, Penfound 1953, Ramaley 1939b, Rogers 1949, Rogers 1953, Steinauer 1989

Authors: J.F. Drake and S.B. Rolfsmeier, MCS **Confidence:** 2 **Identifier:** C EGL000659

Local Description: A wooded area within Smith-Russel was reported by Clambey (1985) to have a mixture of cottonwood – green ash. The cottonwood area that he reported was intermediate in size and has a significant component of American elm and boxelder. This whole area was burned in 2001 and few Cottonwoods remain. The area was mapped as Green Ash - American Elm / Choke Cherry Woodland. Few other areas exist within KNRI and in the adjacent areas that were large enough to be mapped. This description is included as there are small patches scattered about that may warrant this classification. This area may have been Eastern Cottonwood - Green Ash Forest or Eastern Cottonwood - (Peachleaf Willow) / (Coyote Willow, Sandbar Willow) Woodland.

III. Shrubland

III.A.4.N.c. Temporarily flooded microphyllous shrubland

III.A.4.N.c.2. ARTEMISIA CANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

Silver Sagebrush Temporarily Flooded Shrubland Alliance

Concept: This alliance is found in the northwestern Great Plains and interior northwestern United States. This description is based largely on the type within this alliance that occurs in North and South Dakota. Stands of this alliance are found predominantly on floodplains or flat terraces near watercourses. The soils are derived from alluvial deposits and are often not well-developed. They are almost always loams, either sandy loams, silt loams, or clay loams. Flooding may occur periodically. Stands within this alliance are dominated by shrubs and graminoids approximately 1 m tall. Total vegetation cover is moderate. Graminoids make up the majority of the canopy, but the shrub layer is taller and thus more noticeable. *Artemisia cana* is the dominant, and often only, shrub in this stratum. *Symphoricarpos occidentalis* is present to common in some stands. There are also shorter shrubs such as *Artemisia frigida*, *Krascheninnikovia lanata*, *Rosa woodsii*, and *Gutierrezia sarothrae*. These rarely exceed 0.5 m. The most abundant midgrass in the Midwest is *Pascopyrum smithii*, with smaller amounts of *Nassella viridula*, *Hesperostipa comata* (= *Stipa comata*), *Koeleria macrantha*, and *Poa pratensis*. The shortgrass *Bouteloua gracilis* is usually present and may be very common. Forbs are present but do not contribute much of the vegetation cover in this alliance. Among the forbs that are typically found in this alliance are *Achillea millefolium*, *Gaura coccinea*, *Sphaeralcea coccinea*, *Lactuca tatarica* var. *pulchella*, and *Taraxacum officinale*.

Comments: The relationship of this alliance to others dominated by *Artemisia cana* is unclear. The hydrological divisions in the *Artemisia cana* group are poorly distinguished, particularly in the literature. In montane and subalpine meadows and along riparian stringers of western mountain ranges, *Artemisia cana* communities are often the driest of the recognizable riparian habitats. This transitional position and the broad floodplains where these shrublands typically occur blur wetland/upland distinctions. Most of these riparian stands have been placed in the temporarily flooded alliance. Although these sites generally have seasonally saturated soils and shallow water tables, the frequency of flooding is probably highly variable.

Range: This alliance is found in the western United States in Oregon, possibly Nevada, and Montana. One community extends into the northwestern Great Plains in the western portions of Nebraska, and North and South Dakota. The alliance probably also occurs in Alberta and Saskatchewan, Canada.

States/Provinces: CA? MT ND NE NV? OR SD

TNC Ecoregions: 25:C, 26:C, 35:C, 6:C

USFS Ecoregions: 251Aa:CCC, 331D:CC, 331F:CC, 331G:CC, 342B:CC, 342C:CC, M331A:CC, M332B:C?, M332D:CC, M332E:CC, M332G:CC, M334A:CC

Federal Lands: NPS (Theodore Roosevelt)

References: Chappell et al. 1997, Faber-Langendoen et al. 1996, Hansen et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Hanson and Whitman 1938, Johnston 1987, Manning and Padgett 1991, Manning and Padgett 1995, ORNHP unpubl. data n.d., Sarr 1995, USFS 1992

Authors: D. SARR, WCS **Identifier:** A.843

Artemisia cana / Pascopyrum smithii Shrubland

Silver Sagebrush / Western Wheatgrass Shrubland

Silver Sagebrush / Western Wheatgrass Shrubland **G4 (96-02-01)**

Ecological Group (SCS;MCS): Northern and Central Great Plains Mesic Shrublands (510-55; 2.6.3.2)

Concept: This silver or coaltown sagebrush shrubland is found in the northwestern Great Plains and Rocky Mountains of the western United States. Stands occur on flat alluvial deposits on floodplains, terraces or benches, or alluvial fans. The soils are moderately deep to deep and either silt loam, clay loam, or sandy loam. Flooding may occur periodically and this tends to retard soil development. This community is dominated by a combination of shrubs and graminoids. The total vegetation cover is moderate. The tallest and most conspicuous stratum in this community is a shrub layer that is usually 0.6-1.2 m. *Artemisia cana* is the dominant in this layer and may be accompanied by *Symphoricarpos occidentalis*. Also present are 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 community are *Achillea millefolium*, *Gaura coccinea*, *Sphaeralcea coccinea*, and *Lactuca tatarica* var. *pulchella*.

Comments: See Steinauer and Rolfsmeier (2000) for a description of the stands in Nebraska.

Range: 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.

States/Provinces: MT:S4, ND:S2S3?, NE:S?, SD:SU

TNC Ecoregions: 25:C, 26:C, 35:C

USFS Ecoregions: 251Aa:CCC, 331D:CC, 331F:CC, 331G:CC, M331A:CC, M332B:C?, M332D:CC, M332E:CC, M334A:CC

Federal Lands: NPS (Badlands, Theodore Roosevelt)

Synonymy: DRISCOLL FORMATION CODE:III.B.3.a. (Driscoll et al. 1984) B, *Artemisia cana/Pascopyrum smithii* (Bourgeron and Engelking 1994) =, *Artemisa cana* / *Agropyron smithii* Habitat Type (Hansen et al. 1984) =, *Artemisia cana* Habitat Type (Hirsch 1985) =, Sagebrush Type (Hanson and Whitman 1938) =, *Artemisa cana* / *Elytrigia smithii* Plant Association (Johnston 1987) B, *Artemisa cana* - *Symphoricarpos occidentalis* / *Elytrigia smithii* Plant Association (Johnston 1987) =, *Artemisa cana* / *Agropyron smithii* Habitat Type (USFS 1992) =

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Hanson and Whitman 1938, Hirsch 1985, Johnston 1987, Nelson 1961, Steinauer and Rolfsmeier 2000, USFS 1992

Authors: Drake, J. F., WCS **Confidence:** 1 **Identifier:** CEG001072

Local Description: Only one area within the mapping boundary was found to contain this type. This area was partially burned in 1997. The stand is almost entirely *Artemisia cana* with a few other species such as *Pascopyrum smithii* and *Bromus inermis*. This class occurs soils with undescribed texture (See Table 5).

III.B.2.N.d. Temporarily flooded cold-deciduous shrubland

III.B.2.N.d.6. SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE

(Coyote Willow, Sandbar Willow) Temporarily Flooded Shrubland Alliance

Concept: Plant associations within this temporarily flooded shrubland alliance are located on floodplains and gravel bars between 780-1760 m in the western U.S., and at lower elevations (to below 100 m) in the midwestern and southeastern U.S. Stands may be dominated either by *Salix exigua* (in the West) or *Salix interior* (in the Midwest and East). Both species or intermediates may occur in stands in the region where the range of the two species overlap. These shrublands are found on open sandbars without canopy shading on larger, well-developed drainages and along larger sandy rivers, or on coarser-textured substrates. They are associated with annual flooding and inundation and will grow well into the channel, where it is flooded, even in drier years. Even though flooding is frequent, surface water is not present for much of the growing season, and the water table is well below the surface. Some stands form large, wide stands on mid-channel islands on larger rivers, or narrow stringer bands on small, rocky tributaries. Stream reaches range widely from moderately sinuous and moderate-gradient reaches to broad, meandering rivers with wide floodplains or broad, braided channels. Many stands also occur within highly entrenched or eroding gullies. Soils of this alliance are typically coarse alluvial deposits of sand, silt and cobbles that are highly stratified with depth from flooding scour and deposition. The stratified profiles consist of alternating layers of clay loam and organic material with coarser sand or thin layers of sandy loam over very coarse alluvium. Occasionally, stands may occur on deep pockets of sand. The pH of the substrate ranges from 6.0-6.8. The canopy is dominated by a tall, 2- to 5-m, broad-leaved deciduous shrub that is typically many-branched with continuous cover of 60-100%. The herbaceous stratum has sparse to moderate cover including a variety of pioneering species. Plant associations within this alliance are characterized as temporarily flooded, cold-deciduous shrubland dominated by *Salix exigua* or *Salix interior*. The tall-shrub layer has 15-90% cover, ranging in height between 2-5 m. Other willows can occur in the canopy including *Salix eriocephala*, *Salix lutea*, *Salix ligulifolia*, and/or *Salix monticola*. Occasionally taller *Salix amygdaloides* or *Populus deltoides* occur within the tree subcanopy. The herbaceous layer varies greatly over the broad range of the alliance. It

typically has at least 20-35% cover of various graminoid species including *Carex nebrascensis*, *Carex pellita* (= *Carex lanuginosa*), *Spartina pectinata*, *Phalaris arundinacea*, *Equisetum arvense*, *Panicum bulbosum*, and *Muhlenbergia rigens*. The forb cover is usually sparse. The understory can be dominated by barren ground or gravel bar. This alliance represents an early seral, primary successional stage on newly deposited sediments that may persist under a regime of repeated fluvial disturbance. *Salix exigua* and *Salix interior* are highly adapted to most forms of disturbance. Both species are prolific sprouters and will reestablish themselves on sites dominated by other disturbance-associated species, e.g., *Glycyrrhiza lepidota* and *Pascopyrum smithii* (= *Agropyron smithii*). Associations in this shrubland alliance are common and widespread.

Shrublands dominated solely by *Salix exigua* (*sensu stricto*) extend from the Pacific Northwest and California east into the Rocky Mountains and onto the Great Plains. Stands of possibly mixed or ambiguous composition may occur from the northern Great Plains south to the Colorado plains, possibly extending into northeastern New Mexico and the western portions of the Dakotas, Nebraska, Kansas, and Oklahoma. Examples dominated by *Salix interior* occur in the Midwest in Iowa, Illinois, Indiana, Ohio, and the eastern portions of North Dakota, South Dakota, Nebraska, and Kansas. They also extend into Arkansas, Tennessee, Kentucky, Texas, and eastern Oklahoma, and possibly in Pennsylvania and West Virginia, as well as in Manitoba and other provinces of Canada. In western Oklahoma and throughout the Ozarks the associations are local along major streams. In the West, adjacent upland plains communities include agricultural fields and rolling hills of *Artemisia filifolia*, xeric tallgrass prairies, and *Bouteloua gracilis* shortgrass prairies. In the steep canyons of the foothills, upslope vegetation includes *Pseudotsuga menziesii* and *Pinus ponderosa* forests, *Pinus edulis* and *Juniperus* spp. woodlands, oak, sagebrush, and greasewood scrub. In the lower montane, upslope vegetation includes *Pinus contorta* and *Populus tremuloides* forests.

Comments: In the West, *Salix exigua* alliances differ due to the structure of the vegetation and hydrologic regimes. The woodland alliances contain open stands of trees with crowns not touching (generally forming 25-60% cover). The hydrologic regimes differ due to the length of time that the surface water is present and depth to the water table. The surface water in the seasonally flooded alliance is present for extended periods during the growing season, and the water table is typically near the surface. It occurs in interdune depressions. On the other hand, the surface water in the temporarily flooded alliance is only present for brief periods during the growing season, and the water table is well below the surface. Its habitat is strictly riverine. In contrast, *Salix interior* does not develop stands which would be considered to have a woodland physiognomy, and all examples are considered to be temporarily flooded (e.g., riverine).

Range: Associations in this alliance are common and widespread. Their range extends from the Pacific Northwest and California, east to the Rocky Mountains (these dominated solely by *Salix exigua sensu stricto*); in the northern Great Plains and south to the Colorado plains and New Mexico (these associations possibly of mixed or ambiguous composition). The western portions of the Dakotas, Nebraska, Kansas, and Oklahoma are also in this apparent zone of ambiguity or intermediacy. Stands dominated by *Salix interior* occur in the Midwest in Iowa, Illinois, Indiana, Ohio, and the eastern portions of North Dakota, South Dakota, Nebraska, and Kansas. They also extend into Arkansas, Tennessee, Kentucky, Texas, and eastern Oklahoma, and possibly in Pennsylvania and

West Virginia, as well as in Manitoba and other provinces of Canada. The alliance is also found in the Mexican state of Tamaulipas.

States/Provinces: AR CA? CO IA ID IL IN KS KY? MB MT MXTM ND NE NM OH? OK ON OR PA? SD TN? TX UT WA WY

TNC Ecoregions: 10:C, 17:C, 18:C, 19:C, 20:C, 25:C, 26:C, 27:C, 30:C, 32:?, 33:?, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 42:C, 44:?, 48:C, 49:?, 6:C

USFS Ecoregions: 221Ec:PPP, 221Ed:PPP, 221Ef:PPP, 222A:CC, 222Df:C??, 222Ek:C??, 222Fc:C??, 231G:CC, 234Aa:CCP, 234Ai:CC?, 251Aa:CCC, 251B:CP, 251C:CC, 251D:CC, 251E:CC, 311A:C?, 313A:CC, 313B:CC, 313E:CC, 315C:C?, 315E:CC, 321A:CC, 322A:CC, 331B:CP, 331C:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 332C:CC, 332E:CP, 341B:CC, 341C:CC, 342A:CC, 342B:CC, 342C:CC, 342D:CC, 342E:CC, 342F:CC, 342G:CC, 342H:C?, 342I:CC, M222A:CC, M231A:CC, M313B:CC, M331A:CC, M331B:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M332E:CC, M332G:CC, M333C:CC, M334A:CC, M341B:CC, M341C:CC

Federal Lands: NPS (Buffalo, Theodore Roosevelt, Zion); USFWS (Lower Rio Grande Valley, Ouray, Santa Ana)

Synonymy: *Salix* spp. Series (Johnston 1987); Plains and Great Basin Riparian Wetlands (Brown 1982); *Salix exigua* shrubland alliance (Hoagland 1998a); R4B3cI2a. *Salix exigua* (Foti et al. 1994); No equivalent (Allard 1990)

References: Brown 1982, Brown et al. 1979, Christy 1973, Cooper and Cottrell 1990, Dick-Peddie et al. 1984, Dorn 1997, Evenden 1990, Faber-Langendoen et al. 1996, Foti et al. 1994, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Johnston 1987, Jones and Walford 1995, Kagan 1997, Kittel 1994, Kittel and Lederer 1993, Kittel et al. 1994, Kittel et al. 1995, Kittel et al. 1996, Kittel et al. 1999, Kovalchik 1987, Muldavin et al. 1993a, Muldavin et al. 1994a, Muldavin et al. 2000a, Myhre and Clements 1972, Padgett et al. 1988b, Padgett et al. 1989, Phillips 1977, Sawyer and Keeler-Wolf 1995, Shelford 1954, Tuhy and Jensen 1982, Youngblood et al. 1985a

Authors: GREAT PLAINS PROGRAM 1-95, JT, WCS **Identifier:** A.947

***Salix exigua* Temporarily Flooded Shrubland**

Coyote Willow Temporarily Flooded Shrubland

Sandbar Willow Shrubland **G5 (99-05-06)**

Ecological Group (SCS;MCS): Northern and Central Great Plains Wooded Riparian Vegetation (560-05; 1.6.5.1) Montane Riparian Shrublands (n/a; n/a)

Concept: This willow shrubland community is found along rivers and streams at lower elevations throughout the northwestern United States and Great Plains. This type is an early successional stage that occurs on recently flooded riparian areas. Stands occur most commonly on alluvial sand, but silt, clay, or gravel may also be present. *Salix exigua* is the dominant canopy species (*Salix interior* or intermediates of the two willow species may be present in the eastern part of the range). It can form dense stands up to 4 m tall, but there are often patches where the shrub layer is absent. Seedlings and small saplings of *Populus deltoides* and *Salix amygdaloides* may be present. The herbaceous cover is sparse to moderate, but rarely exceeds 30%. Species present include *Cenchrus longispinus*, *Polygonum lapathifolium*, *Schoenoplectus americanus* (= *Scirpus*

americanus), *Triglochin maritima*, and *Xanthium strumarium*. The composition of this community, especially the herbaceous layer, varies from year to year with succession or renewed disturbance.

Comments: This type may be an early successional shrubland that develops into *Salix exigua* / Mesic Graminoids Shrubland (CEGL001203), or the two types may be essentially synonymous. This plant association occupies a wide geographic range. The range of this type was reviewed and it was split into eastern, *Salix interior* Temporarily Flooded Shrubland (CEGL008562), and western components. The western stands may all be composed of *Salix exigua* (*sensu stricto*) and Great Plains stands may contain either *Salix exigua*, *Salix interior*, or intermediates of the two willow species, the *Salix exigua* being an entirely Great Plains and eastwardly distributed species (Kartesz 1999).

Range: This sandbar willow shrubland community is found along rivers and streams at lower elevations throughout the northwestern United States and Great Plains, ranging sporadically from Oklahoma northwest to the Dakotas and Manitoba, and west to Washington. 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)].

States/Provinces: ID:S3?, MB:S?, MT:S5, ND:S?, NE:S4S5, OK:S?, OR:S1, SD:S2, WA:S?, WY:S3Q

TNC Ecoregions: 10:C, 20:C, 25:C, 26:C, 27:C, 6:C

USFS Ecoregions: 251Aa:CCC, 251C:CC, 331C:C?, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 331J:CC, 332C:PP, 332E:PP, 342A:CC, 342B:CC, 342F:CC, 342G:CC, M331A:CC, M331B:CC, M331C:CC, M331D:CC, M331E:CC, M331F:CC, M331G:CC, M331H:CC, M331I:CC, M331J:CC, M332A:CC, M333C:CC, M334A:CC

Federal Lands: NPS (Badlands, Theodore Roosevelt)

Synonymy: DRISCOLL FORMATION CODE:III.B.3.c. (Driscoll et al. 1984) B, *Salix exigua* (Bourgeron and Engelking 1994) =, R4B3cI2a. *Salix exigua* (Foti et al. 1994)

References: Bellah and Hulbert 1974, Bourgeron and Engelking 1994, Driscoll et al. 1984, Evenden 1990, Foti et al. 1994, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998c, Hoagland 2000, Kartesz 1999, Kittel and Lederer 1993, Kovalchik 1987, Phillips 1977, Steinauer 1989, Steinauer and Rolfsmeier 2000, Wilson 1970

Authors: J.F. Drake, WCS **Confidence:** 1 **Identifier:** CEGL001197

Local Description: This class occurs along both the Knife River and the Missouri River. The stands along the Knife River had considerably more mesic graminoid elements such as Smooth Brome, Leafy Spurge and Canada Thistle (Figure 18). Communities scattered along the Missouri River had Cockerbur, Common Milkweed, Canada Thistle, Field Horsetail and Cottonwood seedlings (1 – 2 feet tall). The Coyote Willow density varied from 100% to 10 – 15% in all areas. There is also an area mapped as Coyote Willow Temporarily Flooded Shrubland on the large island to the south east of the KNRI boundary in the Missouri River. This area was not visited and remains questionable. This class occurs primarily on Silty Clay Loam (62.3%) and Loam (33.6%) (See Table 5).



Figure 18. Coyote Willow Temporarily Flooded Shrubland.

III.B.2.N.d.20. SYMPHORICARPOS OCCIDENTALIS TEMPORARILY FLOODED SHRUBLAND ALLIANCE

Western Snowberry Temporarily Flooded Shrubland Alliance

Concept: This alliance is found in the northern Great Plains in mesic swales, depressions, ravines and floodplains. Some sites experience intermittent and brief flooding. 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. This alliance 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. *Rhus aromatica* and *Prunus virginiana* can be locally abundant, and both can grow to 2-3 m in places. Rarely, scattered small trees are present. These are most often *Fraxinus americana* or *Populus deltoides*. Herbaceous species and smaller shrubs are most abundant at the edge of stands of this alliance and in gaps between the taller shrubs where the shading is less complete. *Rosa woodsii* is a typical smaller shrub. *Achillea millefolium*, *Artemisia ludoviciana*, *Galium boreale*, and *Pascopyrum smithii* are common herbaceous species. Woody vines sometimes occur, most commonly *Parthenocissus vitacea*. *Symphoricarpos occidentalis* shrublands often have a significant component of exotic species, especially where grazing has been intense. *Bromus inermis*, *Cirsium arvense*, and *Poa pratensis* are the most abundant of these

exotics. Overgrazing of prairies can lead to the expansion of degraded forms of this alliance.

Comments: This alliance may grade into *Fraxinus pennsylvanica* - (*Ulmus americana*) Woodland Alliance (A.629) or *Populus deltoides* Temporarily Flooded Woodland Alliance (A.636). Some communities within the latter woodland alliances contain significant amounts of *Symphoricarpos occidentalis* and may be difficult to distinguish from the shrubland where the two meet. This alliance includes grassland areas that are near or between shrub-covered areas. Establishing the boundaries between this alliance and surrounding grasslands is problematic and may be somewhat arbitrary.

Range: This alliance occurs in riparian areas in the northern Great Plains and the foothills of the Rocky Mountains. The alliance is found from southern Saskatchewan, Canada, south through Montana and the Dakotas, and into eastern Wyoming and Colorado.

States/Provinces: CO IA? MB? MT ND NE SD SK WY

TNC Ecoregions: 10:C, 20:C, 25:C, 26:C, 27:C, 35:C

USFS Ecoregions: 251Bb:CPP, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 332A:CP, 332B:CP, 332C:CP, 332D:CP, 342A:CC, M331B:??, M332B:CC, M332D:CC, M332E:CC, M334A:CC

Federal Lands: NPS (Theodore Roosevelt, Wind Cave); USFS (Pawnee)

Synonymy: *Symphoricarpos occidentalis* Community (Hansen et al. 1984); *Symphoricarpos occidentalis* Community (Hansen and Hoffman 1988); *Symphoricarpos occidentalis/Elytrigia smithii* Shrubland (Johnston 1987); Western Snowberry Dominance Type (Jones and Walford 1995)

References: Christy 1973, Clark 1977b, Clark et al. 1980, Faber-Langendoen et al. 1996, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1988b, Hansen et al. 1991, Hansen et al. 1995, Johnston 1987, Jones and Walford 1995, Kittel et al. 1994, Kittel et al. 1996, Kittel et al. 1999, Meyer 1985, Welsh et al. 1987

Authors: M.S. REID, WCS **Identifier:** A.961

Symphoricarpos occidentalis Shrubland

Western Snowberry Shrubland

Western Snowberry Shrubland **G4G5 (96-02-01)**

Ecological Group (SCS;MCS): Northern and Central Great Plains Mesic Shrublands (510-55; 2.6.3.2)

Concept: This western snowberry shrubland is found in the western tallgrass and northern Great Plains of the United States and Canada. Stands occur in mesic depressions and swales, typically surrounded by upland grassland communities. The soils are silts and loams. This type has three distinct vegetation layers, a shrub layer (approximately 80 cm tall), a graminoid-dominated layer (approximately 30 cm tall), and a forb-dominated layer (<20 cm tall). *Symphoricarpos occidentalis* is the predominant species in the shrub layer and at times forms almost monospecific stands. *Rosa woodsii* commonly occurs interspersed with the *Symphoricarpos occidentalis*. Other shrubs, such as *Rhus aromatica* and *Prunus virginiana*, often occur as thickets on the fringe of this community. *Rhus aromatica* and *Prunus virginiana* can reach 2 m or more. The herbaceous layer is poorly

represented where the shrubs are dense, although *Poa pratensis* occurs in many stands. Common forbs include *Artemisia ludoviciana*, *Solidago* spp., and *Achillea millefolium*. Vines, such as *Parthenocissus vitacea*, are often found climbing through the shrubs. This type is frequently observed in heavily grazed meadows and prairies.

Comments: This type often occurs in heavily disturbed areas in conjunction with exotic species such as *Poa pratensis* and *Cirsium arvense*. Because it occurs in mesic swales, depressions, ravine bottoms and floodplains, some stands are occasionally flooded whereas others are just very moist. Thus it tends to fall on both sides of the upland/wetland division.

Range: This western snowberry shrubland is found in the western tallgrass and northern Great Plains of the United States and Canada.

States/Provinces: CO:S3, IA?, MB?, MT:S4S5, ND:S4?, NE:S4, SD:SU, SK:S?, WY:SR

TNC Ecoregions: 10:C, 20:C, 25:C, 26:C, 27:C, 35:C

USFS Ecoregions: 251Bb:CPP, 331C:CC, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 332A:CP, 332B:CP, 332C:CP, 332D:CP, 342A:CC, M331B:??, M332B:CC, M332D:CC, M332E:CC, M334A:CC

Federal Lands: NPS (Badlands, Theodore Roosevelt, Wind Cave)

Synonymy: DRISCOLL FORMATION CODE:III.B.3.a. (Driscoll et al. 1984) B, *Symphoricarpos occidentalis* (Bourgeron and Engelking 1994) =, *Symphoricarpos occidentalis* Community (Hansen et al. 1984) =, Low Shrub (Meyer 1985) =, *Symphoricarpos occidentalis* / *Elytrigia smithii* Plant Association (Johnston 1987) =, *Symphoricarpos occidentalis* Community (Hansen et al. 1984) =, *Symphoricarpos occidentalis* Community (Jones and Walford 1995) =, *Symphoricarpos occidentalis* Series (Jones 1992b)

References: Bourgeron and Engelking 1994, Christy 1973, Clark 1977b, Clark et al. 1980, Driscoll et al. 1984, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1991, Hansen et al. 1995, Johnston 1987, Jones 1992b, Jones and Walford 1995, Kittel et al. 1994, Kittel et al. 1999, McAdams et al. 1998, Meyer 1985, Steinauer and Rolfsmeier 2000

Authors: Drake, J. F., WCS **Confidence:** 3 **Identifier:** CEGl001131

Local Description: This classification is by far the most common shrubland within the mapping boundary. Snowberry is typically found within swales and moist but not wet areas (Figure 19). In addition, it can be found on flat to rolling topography and often makes up some portion of most grassland types (Figure 20). In some cases, Snowberry was often the only species within some patches that may get as large as 10 to 20 meters in diameter. It is often a significant species within Western Wheatgrass communities. Common associated shrubs include *Artemisia ludoviciana*, *Artemisia dracunculus*, *Pediomelum argophyllum* and *Rosa woodsii*. Forbs and graminoids include *Bromus inermis*, *Carex filifolia*, *Pascopyrum smithii*, *Andropogon gerardi*, *Solidago canadensis*, *Liatris punctata*, *Aster* sp. On one occasion *Elaeagnus angustifolia* was found with this association (Figure 21). This class occurs on several soil textures. These include Loam (32.5%), Silty Clay Loam (33.0%), Loamy Fine Sand (2.9%), Silt Loam (6.6%) and Fine Sandy Loam (7.8%)(See Table 5).



Figure 19. Western Snowberry in swales. Surrounding area is Big Blue Stem – Little Bluestem Association.



Figure 20. Western Snowberry within Needle-and-Thread – Blue Grama – Threadleaf Sedge association.



Figure 21. Western Snowberry and Russian Olive. Light colored shrub in foreground is *Artemisia ludoviciana*.

V. Herbaceous Vegetation

V.A.5.N.a. Tall sod temperate grassland

V.A.5.N.a.2. ANDROPOGON GERARDII - (SORGHASTRUM NUTANS) HERBACEOUS ALLIANCE

Big Bluestem - (Yellow Indiangrass) Herbaceous Alliance

Concept: This alliance is a very widespread mesic tallgrass prairie, which occurs in central North America. Most communities have moderately dense to dense vegetation dominated by graminoids 1-2 m tall. *Andropogon gerardii* is dominant across this alliance's range. Other abundant species include *Bouteloua curtipendula*, *Pascopyrum smithii* (in the western portions of this alliance's range), *Schizachyrium scoparium*, *Sorghastrum nutans* (in the center and east), *Sporobolus heterolepis* (in the Great Plains), and *Hesperostipa spartea* (= *Stipa spartea*) (in the northern Great Plains). In Montana, *Festuca idahoensis* (at its eastern range limits) is codominant in an association in this alliance. Forbs are abundant in stands of this alliance, especially in the more humid East. Among these are *Aletris farinosa* (in the East), *Aster* spp., *Echinacea pallida*, *Helianthus grosseserratus*, *Liatris pycnostachya*, *Phlox pilosa*, *Ratibida pinnata*, *Silphium laciniatum* (in the center), and *Solidago* spp. *Galium boreale* and *Oxalis* sp. are more common in northern tallgrass prairies than in southern. Trees and tall shrubs are infrequent in high-quality stands, especially in the Great Plains. Among those that may be found are scattered *Symphoricarpos occidentalis* (in the northern Great Plains), *Rhus* spp., and *Quercus macrocarpa* (in the central and eastern portions of this alliance's range).

Stands of this alliance occur on flat to rolling topography. In the West and South, stands are found on lower slopes and valleys that receive extra moisture. On the western plains, the alliance can be found in areas with gravelly soil where water infiltrates below the surface but is held by an impermeable subsurface layer. Floodplain and toe-slope soils are deep and fine-textured, whereas the foothills soils are coarse-textured, often with cobble-sized rocks. In the northwestern plains, this alliance is found on lower slopes of hills, creeks and creek terraces. Soils are generally finer-textured (clay loams). In other parts of this alliance's range, stands can be found on many topographic positions. Soils are generally fertile, deep, slightly acidic, and moderately to well-drained. In glacial lakeplains near the Great Lakes, soils tend to be more poorly drained. Soils moisture is generally mesic, although it can vary from dry-mesic to wet-mesic. Soil texture can range from clay loams to sands.

In the far western extent, vegetation in this alliance is a relict true prairie found along the eastern foothills and floodplains of the Front Range of the Rocky Mountains. *Andropogon gerardii* is the major diagnostic species, as well as *Sorghastrum nutans*, *Panicum virgatum*, *Schizachyrium scoparium*, *Sporobolus heterolepis*, the other common tallgrass prairie species. *Bouteloua curtipendula* and *Pascopyrum smithii* are also

common grasses. The alliance is found in mesic areas along the Colorado Front Range. Landform position and soil texture dictate potential sites, as precipitation is generally not adequate to support stands of this alliance. In localized areas, hydrological processes of the site enhance the soil moisture. Along the Front Range, 'relict' true prairie is found along the foothills in parks and on slopes below *Pinus ponderosa* woodlands. Soils are coarse-textured, and runoff and seeps enhance soil moisture. The alliance is also found in floodplains adjacent to streams where the water table is within reach for plant roots.

Comments: Texas types are probably limited because *Andropogon gerardii* declines in the southern part of the prairie. In the Daniel Boone National Forest (and many other areas in the eastern North America), this alliance is apparently represented on powerline rights-of-way and other mowed or maintained areas; resolution is needed as to how to deal with natural prairies vs. powerline vegetation common eastward. In Kentucky, associations are known from the Big Barrens, the eastern Knobs, and from the Upper West Gulf Coastal Plain. These unglaciated associations (of Tennessee and Kentucky) are species-poor compared to the typical midwestern tallgrass prairies.

Range: This alliance is most common in tallgrass prairies of the Great Plains. Stands occur from Texas and Arkansas north into Montana, and east into Michigan, Ohio, Virginia and Tennessee. In Canada it is found in southern Saskatchewan, southern Manitoba, and southern and northwestern Ontario.

States/Provinces: AR CO IA IL IN KS KY MB MI MN MO MT ND NE OH OK ON SD SK TN VA WI WY

TNC Ecoregions: 20:C, 25:C, 26:C, 27:C, 28:C, 30:C, 32:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 39:C, 40:C, 42:C, 43:C, 44:C, 45:C, 46:C, 48:C, 50:C, 51:C, 59:C

USFS Ecoregions: 212Hx:CCC, 212Hy:CCC, 221Hc:CPP, 221Ja:CCC, 222Ab:CCC, 222Ae:CC?, 222Ag:CCP, 222Ah:CCP, 222Am:CCC, 222An:CCC, 222Ao:CCC, 222Cb:CCC, 222Cc:CCP, 222Cd:CCP, 222Ce:CCP, 222Cf:CCP, 222Cg:CCP, 222Da:C??, 222Dc:C??, 222Dd:C??, 222Dg:C??, 222Dj:C??, 222Ea:CC?, 222Eb:CCC, 222Ec:CCP, 222Ed:CCP, 222Ee:CC?, 222Ef:CC?, 222Eg:CCC, 222Eh:CCC, 222Ei:CC?, 222Ej:CCC, 222Ek:CCC, 222En:CCC, 222Eo:CCC, 222Fa:CC?, 222Fb:CC?, 222Fc:CC?, 222Fd:CCC, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222He:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kc:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Kj:CCC, 222Lc:CCC, 222Le:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 222Qb:CCC, 231Ba:CPP, 231Bg:CP?, 231Bh:CP?, 231Bj:CP?, 231Bk:CP?, 231Cd:CP?, 231Ce:CPP, 231Da:CP?, 231Eh:CCC, 231Em:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 234Ae:CCC, 234Aj:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bc:CCC, 251Bd:CCC, 251Be:CCC, 251Bf:CCC, 251Ca:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CCP, 251Ce:CCP, 251Cf:CCC, 251Cg:CCC, 251Ch:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCP, 251Cm:CCC, 251Cn:CCC, 251Co:CCP, 251Cp:CCC, 251Cq:CCC, 251Da:CCC, 251Db:CCP, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCP, 251Dg:CCC, 251Dh:CCC, 251Ea:CCC, 251Eb:CCC, 251Ec:CCC, 251Ed:CCC, 251Fb:CCC, 251Fc:CCP, 251Fd:CCC, 255Aa:CCC, 255Ag:CCC, 255Ah:CCC, 255Ai:CCC, 255Aj:CCC, 255Ba:CCC, 255Ca:CCC, 255Cd:CCC, 255Cf:CCC, 331C:CC, 331D:C?, 331E:CP, 331F:CC, 331G:CC, 331H:CC, 331I:CC,

332A:CP, 332D:CP, 332E:CC, 411:C, M221C:C?, M221Db:CCC, M231Aa:CCC, M231Ab:CC?, M231Ac:CC?, M231Ad:CC?, M331H:CC, M331I:CC, M334A:CC

Federal Lands: DOD (Arnold, Fort Chaffee); DOE (Oak Ridge); NPS (Wind Cave); USFS (Daniel Boone)

Synonymy: ID4a. Bluestem Tallgrass Prairie, in part (Allard 1990); Bluestem Tallgrass Prairie, in part (Pyne 1994); Mesic Prairie, in part (Foti 1994b); Tallgrass prairie, in part (Evans 1991); *Andropogon gerardii* herbaceous alliance, in part (Hoagland 1998a); Little Bluestem-Indiangrass Series, in part (Diamond 1993); T5A1aI1c. *Andropogon gerardii* - *Sorghastrum avenaceum* (Foti et al. 1994); Mesic Prairie (Curtis 1959); Big Bluestem (Hanson and Whitman 1938)

References: Allard 1990, Bichel 1959, Branson et al. 1961, Branson et al. 1964, Branson et al. 1965, Bunin 1985, Clements 1904, Comer et al. 1995b, Culwell and Scow 1981, Culwell and Scow 1982, Curtis 1959, Diamond 1993, Diamond and Smeins 1988, Evans 1991, Faber-Langendoen et al. 1996, Foti 1994b, Foti et al. 1994, Hadley and Branson 1965, Hansen et al. 1984, Hanson 1957, Hanson and Dahl 1956, Hanson and Whitman 1938, Hoagland 1998a, James 1930, Johnston 1987, Kettler pers. comm., Kittel et al. 1996, Kuchler 1964, Livingston 1947, Livingston 1952, Marr 1964b, Moir 1969b, Moir 1972, Moulton et al. 1980, Mutel 1976, Pyne 1994, Ramaley and Kelso 1931, Robbins 1917, Soil Conservation Service 1978, Tatina 1987, Taylor and Holst 1976, Tolstead 1942, Vestal 1914, Wasser and Hess 1982

Authors: MCS, MOD. K. SCHULZ, JT, MCS **Identifier:** A.1192

Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii Herbaceous Vegetation

Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass Herbaceous Vegetation

Northern Plains Transition Bluestem Prairie

Ecological Group (SCS;MCS): Great Plains Tallgrass Prairies (521-20; 2.9.3.1)

ELEMENT CONCEPT

Summary: This bluestem tallgrass prairie community is found in the glaciated regions of the northern Great Plains of the United States and possibly adjacent Canada. Stands occur on the crests and upper slopes of knolls in areas of gently rolling topography. It can also occur on north- and south-facing slopes with inclinations ranging from 10 to 20 degrees. Soils are deep, well-drained loams. This community is a grassland dominated by mid and tall grasses. Abundant species include *Andropogon gerardii*, *Poa pratensis*, *Carex duriuscula*, *Lactuca tatarica* var. *pulchella*, *Bouteloua curtipendula*, and *Schizachyrium scoparium*.

Environment: This community occurs in glaciated terrain on the crests and upper slopes of knolls in areas of gently rolling topography. It can also occur on north-facing and south-facing slopes with inclinations ranging from 10 to 20 degrees.

Vegetation: This community is a grassland dominated by mid and tall grasses. Abundant species include *Andropogon gerardii*, *Poa pratensis*, *Carex duriuscula* (= *Carex eleocharis*), *Lactuca tatarica*, *Bouteloua curtipendula*, and *Schizachyrium scoparium*.

Dynamics:

Similar Associations:

- *Andropogon gerardii* - *Schizachyrium scoparium* Northern Plains Herbaceous Vegetation (CEGL002205)--is similar but is found on unglaciated landscapes in the Northern Great Plains.
- *Andropogon gerardii* - *Sorghastrum nutans* Western Great Plains Herbaceous Vegetation (CEGL001464)
- *Andropogon gerardii* - *Hesperostipa spartea* - *Sporobolus heterolepis* Herbaceous Vegetation (CEGL002202)--does not occur in the Great Plains; restricted to the northern tallgrass region.

Synonymy:

- Crests (Tatina 1987) F
- Slopes (Tatina 1987) F

GRank & Reasons: G2 (00-03-23). There are probably fewer than 50 occurrences of this community rangewide. Currently 24 occurrences have been documented from Manitoba, North Dakota, and South Dakota; it is also reported from Saskatchewan. S-ranks have not been assigned in any of these states or provinces. There are probably fewer than 10,000 acres rangewide. Currently over 3275 acres have been documented rangewide, with sizes ranging from 2 to 1033 acres. There has been some decline in high-quality sites due to heavy grazing and loss from conversion to agriculture.

High-ranked species:

Comments: This type represents glaciated tallgrass stands in the mixedgrass prairie region, whereas *Andropogon gerardii* - *Schizachyrium scoparium* Northern Plains Herbaceous Vegetation (CEGL002205) and *Andropogon gerardii* - *Sorghastrum nutans* Western Great Plains Herbaceous Vegetation (CEGL001464) are unglaciated types. Eastward this type extends somewhat into the northern tallgrass prairie region in the Dakotas only, but *Andropogon gerardii* - *Hesperostipa spartea* - *Sporobolus heterolepis* Herbaceous Vegetation (CEGL002202) is the more common type in that region.

ELEMENT DISTRIBUTION

Range: This bluestem tallgrass prairie community is found in glaciated terrain of the northern Great Plains of the United States and possibly adjacent Canada, extending from the Dakotas into Saskatchewan and Manitoba.

Nations: CA US

States/Provinces: MB?, ND:S?, SD:S?, SK:S?

TNC Ecoregions: 26:C, 34:C, 35:C

USFS Ecoregions: 222Na:CCC, 251Aa:CCC, 251Ab:CCC, 331E:CP, 332A:CP, 332D:CP

Federal Lands:

ELEMENT SOURCES

Authors: Faber-Langendoen, D., MCS **Confidence:** 3 **Identifier:** CEGL002376

References: Tatina 1987, USACE 1979

Local Description: This association occurs primarily on slopes and within swales, often associated with Western Snowberry. The principal area that this association occurs in is a hill and swale transition area also known as the Big Hidatsa Pasture. This area was burned in 1999. Prior to the burn, Big Bluestem was common however after the burn its presence increased greatly (Rod Skalskey – Pers. Comm.) Other species occurrence is

patchy and variable. Nonetheless, Big Bluestem usually dominates the cover. Other common species include *Carex filifolia*, *Glycyrrhiza lepidota* and *Schizachyrium scoparium*. In some areas *Schizachyrium scoparium* is the dominant grass. Less common but present include the following in varying abundances throughout the landscape; *Pascopyrum smithii*, *Liatris punctata*, *Artemisia dracunculus*, *A. ludoviciana*, *A. frigida*, *Ratibida columnifera*, *Symphoricarpos occidentalis*, *Pedimelum argophyllum* and *Rosa woodsii* (Figures 22 and 23). Some portions of this mapped area include a fair amount of *Bromus inermis* and *Poa pratensis*. In the North Prairie is another small area that is similar to the Big Hidatsa Prairie yet this one is less mesic and has a higher proportion of *Rosa woodsii* and *Artemisia ludoviciana* (Figure 24). This class occurs on several soil textures. These include Loam (45.9%), Loamy Fine Sand (25.1%), Silty Clay Loam (6.7%), Silt Loam (9.6%) and Fine Sandy Loam (9.9%) (See Table 5).



Figure 22. Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass
Herbaceous Vegetation – Big Hidatsa Prairie.



Figure 23. Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass Herbaceous Vegetation – Big Hidatsa Prairie.



Figure 24. Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass Herbaceous Vegetation - North Prairie.

V.A.5.N.c. Medium-tall sod temperate or subpolar grassland

V.A.5.N.c.27. PASCOPYRUM SMITHII HERBACEOUS ALLIANCE

Western Wheatgrass Herbaceous Alliance

Concept: This alliance is common and widespread in the Great Plains, especially the northern portions, and parts of the intermountain western U.S. and possibly Canada. The communities in it range from dry or dry-mesic to wet-mesic. Mid grasses are the dominant vegetation in most communities, although short grasses and sedges can be codominant. The vegetation tends to be denser where the mid grasses are predominant and more open where shorter graminoids are abundant. The mid grasses grow to 0.5-1.0 m on favorable sites, while the short grasses and sedges are less than 0.5 m tall. The most abundant midgrass is *Pascopyrum smithii*. Common associates include *Hesperostipa comata* (= *Stipa comata*), *Nassella viridula*, *Koeleria macrantha*, *Schizachyrium scoparium*, *Hesperostipa spartea* (= *Stipa spartea*), and *Poa* spp. In the drier communities of this alliance *Bouteloua gracilis* is the most common shortgrass. Other short graminoids typically found in the drier communities include *Carex inops* ssp. *heliophila*, *Carex duriuscula* (= *Carex eleocharis*), *Carex filifolia*, and *Bouteloua curtipendula* (in the northern portion of this alliance's range), *Aristida purpurea*, and *Buchloe dactyloides* (in the southern half of this alliance's range). In the wetter communities within this alliance, *Distichlis spicata*, *Hordeum jubatum*, *Elymus trachycaulus*, and *Iva annua* are common. Forbs and shrubs are generally minor components of communities within this alliance. If shrubs are present they are rarely taller than 1 m. Some forbs that are usually scattered about are *Gaura coccinea*, *Sphaeralcea coccinea*, *Amorpha canescens*, *Astragalus* spp., and *Tragopogon dubius*. Shrubs include *Symphoricarpos occidentalis*, *Artemisia cana*, *Artemisia frigida*, and *Opuntia* spp.

Communities within this alliance occur on several different soil types. The soil is most often clay or clay loam, however. it can be loam or sandy loam. In the east and central part of this alliance's range, these communities can be found on flat or rolling uplands, hillslopes, or along streams or depressions. In the western part of this alliance's range, its communities are found where local conditions are wetter than the average. This includes such areas as the base of slopes or along rivers or streams.

Comments: *Pascopyrum smithii* is a common constituent in many communities in the Great Plains. Its presence in so many communities can make it difficult to distinguish communities within this alliance from other dry-mesic midgrass communities in other alliances. The dominance of *Pascopyrum smithii* is typically a good diagnostic feature. Stands that have other species as codominants or even dominants may be difficult to classify. These stands will most likely be similar to stands within the *Bouteloua gracilis* Herbaceous Alliance (A.1282), *Hesperostipa comata* Bunch Herbaceous Alliance (A.1270), *Distichlis spicata* - (*Hordeum jubatum*) Temporarily Flooded Herbaceous Alliance (A.1341), or *Distichlis spicata* Intermittently Flooded Herbaceous Alliance (A.1332). Associations in this alliance differ from those in the *Hesperostipa comata* -

Bouteloua gracilis Herbaceous Alliance (A.1234) in having cover of *Pascopyrum smithii* exceeding that of *Hesperostipa comata*. In some stands of this association, *Distichlis spicata* may dominate, but contribution of at least 25% of the canopy cover by *Pascopyrum smithii* is diagnostic; stands with <25% of the cover contributed by *Pascopyrum smithii* belong to the *Distichlis spicata* alliance. In general a stand must have at least 25% cover of *Pascopyrum smithii* to be included in this alliance.

Range: Grasslands included in this alliance are found in the western Great Plains, from New Mexico north into Colorado, Wyoming and Montana, as well as Kansas north into Saskatchewan and Manitoba. It is also found in scattered locations in Idaho and Utah, and possibly Alberta, Canada.

States/Provinces: AB AZ CO ID KS MB MT ND NE NM SD SK UT WY

TNC Ecoregions: 10:C, 11:C, 20:C, 21:C, 25:C, 26:C, 27:C, 34:C, 35:C, 6:C, 9:C

USFS Ecoregions: 251Aa:CCC, 313D:CC, 315A:CC, 321A:PP, 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 332A:CC, 332B:CC, 332D:CC, 341A:CC, 341C:CC, 342F:CC, M313A:CC, M313B:CC, M331A:CC, M331F:CC, M332D:C?, M332E:CC, M334A:CC

Federal Lands: NPS (Jewel Cave, Sunset Crater, Theodore Roosevelt, Wind Cave); USFWS (Ouray)

Synonymy: *Elytrigia smithii* Series, in part (Johnston 1987)

References: Baker 1983c, Baker and Kennedy 1985, Bear Creek Uranium Mine Application n.d., Boutton et al. 1980, Branson et al. 1961, Branson et al. 1964, Branson et al. 1965, Bujakiewicz 1975, Bunin 1985, Cacek 1973, Christensen and Welsh 1963, Costello 1944b, Culwell and Scow 1982, DeVelice et al. 1991, Dick-Peddie 1986, Donart et al. 1978a, Faber-Langendoen et al. 1996, Hadley and Branson 1965, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hansen et al. 1991, Hanson 1957, Hanson and Ball 1928, Hanson and Dahl 1956, Hanson and Whitman 1938, Hanson et al. 1931, Hyder et al. 1966, Johnston 1987, Jones 1992b, Kahler 1973, Keammerer and Stoecker 1975, Marr and Buckner 1974, Moir 1969b, Muldavin and Mehlhop 1992, Mutel 1976, Ramaley 1916b, Ramaley 1919b, Ramaley 1927, Ramaley 1942, Rogers 1953, Shanks 1977, Shantz 1906, Shantz 1911, Shantz 1923, Soil Conservation Service 1978, Stoecker-Keammerer Consultants n.d.(b), USFS 1992, Vestal 1913, Vestal 1914, Vestal 1919, Weaver and Albertson 1956, Western Resources Development Corporation n.d. (a), Wooten 1980

Authors: MCS, MOD. M.S. REID, MOD., MCS **Identifier:** A.1232

Pascopyrum smithii - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation

Western Wheatgrass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation

Western Wheatgrass - Blue Grama - Threadleaf Sedge Prairie **G4 (96-02-01)**

Ecological Group (SCS;MCS): Great Plains Mixedgrass Prairies (521-10; 2.9.3.2)

Concept: This western wheatgrass prairie community occurs throughout much of the northwestern Great Plains of the United States and Canada, on flat or gently sloping terrain. Many stands are on floodplains or gentle valley slopes. Some are on uplands. The soils are clay loam, silt loam, or loam and usually deep and fertile. This community is dominated by medium and short graminoids. The midgrass stratum is dominated by *Pascopyrum smithii* or *Elymus lanceolatus*. Common associates include *Koeleria*

macrantha, *Hesperostipa comata* (= *Stipa comata*), and *Nassella viridula*. *Hesperostipa comata* is more common on the upper slopes and drier upland sites with sandier soils, whereas *Nassella viridula* is more common on the lower slopes and floodplains with finer-textured soils. The most common short graminoid is *Bouteloua gracilis*. Other common graminoids include *Carex filifolia*, *Carex inops* ssp. *heliophila*, *Carex duriuscula* (= *Carex eleocharis*), and *Carex pensylvanica*. Forbs do not contribute much of the canopy cover but they are scattered throughout this community. Typical forbs are *Tragopogon dubius*, *Gaura coccinea*, *Hedeoma hispida*, *Phlox hoodii* and *Sphaeralcea coccinea*.

Comments: Almost any combination of *Pascopyrum smithii*, *Bouteloua gracilis*, *Carex filifolia*, and *Hesperostipa comata* (= *Stipa comata*) can be found in the northern and northwestern Great Plains, and the relative amounts of these species apparently depend at least in part on soil texture and grazing history. Moreover, drought or wet weather can cause the relative amounts of these species in one stand to change markedly in a few years (Ellison and Woolfolk 1937, Weaver and Albertson 1956). Consequently, differentiating between plant associations based solely on the relative amounts of these species is extremely difficult. This *Pascopyrum smithii* - *Bouteloua gracilis* - *Carex filifolia* association is found on soils in textural classes finer than loam in which *Pascopyrum smithii* and/or *Elymus lanceolatus* (which is similar morphologically and ecologically) contribute at least as much cover as does *Hesperostipa comata*. *Bouteloua gracilis*, *Elymus lanceolatus* and *Carex filifolia* may be patchily distributed, so areas of several acres should be examined to determine whether the vegetation belongs to this association. This association shares major graminoid species with *Hesperostipa comata* - *Bouteloua gracilis* - *Carex filifolia* Herbaceous Vegetation (CEGL002037) but in the latter association, *Hesperostipa comata* contributes more cover than do *Pascopyrum smithii* or *Elymus lanceolatus*, and the latter association grows on soils of loam or coarser textural classes.

Range: This western wheatgrass prairie community occurs throughout much of the northwestern Great Plains of the United States and Canada on flat or gently sloping terrain, ranging from Alberta and Saskatchewan in Canada south to Nebraska and possibly Colorado.

States/Provinces: AB:S?, CO?, MT:S4, ND:S3?, NE:S3S4, SD:S4, SK:S?, WY?

TNC Ecoregions: 10:C, 26:C, 27:C

USFS Ecoregions: 331D:CC, 331E:CC, 331F:CC, 331G:CC, 331H:CC

Federal Lands: NPS (Badlands, Jewel Cave, Theodore Roosevelt)

Synonymy: DRISCOLL FORMATION CODE:V.B.4.a. (Driscoll et al. 1984), *Pascopyrum smithii*-*Bouteloua gracilis*-*Carex filifolia* (Bourgeron and Engelking 1994) =, Western Wheatgrass - Grama - Sedge Type (Hanson and Whitman 1938) =. Types previously separated as *Pascopyrum smithii* / *Bouteloua gracilis* or *Pascopyrum smithii* / *Carex filifolia* in the literature are now lumped together as *Pascopyrum smithii* / *Bouteloua gracilis* - *Carex filifolia* Herbaceous Vegetation (CEGL001579)., *Bromus tectorum* - *Agropyron smithii* - *Bouteloua gracilis* Association (Hanson and Dahl 1956) =, *Agropyron smithii* / *Carex filifolia* Habitat Type (Hansen et al. 1984) =, *Elytrigia smithii* / *Bouteloua gracilis* Plant Association (Johnston 1987) B, *Elytrigia smithii* / *Carex filifolia* Plant Association (Johnston 1987) =, *Agropyron smithii* / *Bouteloua*

gracilis Community (Jones 1992b) F, *Agropyron smithii* / *Carex filifolia* Community (Jones 1992b) F

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Ellison and Woolfolk 1937, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hanson and Dahl 1956, Hanson and Whitman 1938, Johnston 1987, Jones 1992b, Ode pers. comm., Steinauer and Rolfsmeier 2000, Weaver and Albertson 1956

Authors: H.C. Hanson and W. Whitman, mod. J. Drake and D. Faber-Langendoen, WCS **Confidence:** 2 **Identifier:** CEGLO01579

Local Description: This association occurs primarily in the north and north west of the mapping area within and around the Big Hidatsa Pasture. The terrain is sloping and brackets the drainage coming in from the northwest. The dominant grass is *Pascopyrum smithii* followed by *Bromus inermis* and *Carex filifolia*. Other species present include *Andropogon gerardii*, *Liatris punctata*, *Artemisia dracunculus*, *A. frigida*, *Salsola tragus*, *Bouteloua curtipendula*, *Schizachyrium scoparium* and *Symphoricarpos occidentalis* (Figure 25). *Bouteloua gracilis* was present but rare. This area was assigned to this class given the dominance of *Pascopyrum smithii* and sub-dominance of *Carex filifolia*. With the exception of a small area within the Big Hidatsa Pasture, most of this class has not been burned. This class was also noted in Buchfink pasture (Clambey 1985). His observations included western wheatgrass (11.4%), blue grama (15.2%), plains muhly (5.0%), needle-and-thread (14.2%), and Kentucky bluegrass (12.8%). This area still contains some of the noted species but is largely overrun with *Bromus inermis*. It still has some of its original character and is mapped as Western Wheatgrass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation. However, it is unlikely to remain as such given the aggressive colonization by *Bromus inermis*. This class occurs on several soil textures. These include Loam (51.2%), Silt Loam (13.6%), Channeled (5.5%) and Loamy Fine Sand (9.0%) (See Table 5).



Figure 25. Western Wheatgrass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation.

***Pascopyrum smithii* Herbaceous Vegetation**

Western Wheatgrass Herbaceous Vegetation

Western Wheatgrass Mixedgrass Prairie **G3G5Q (96-02-01)**

Ecological Group (SCS;MCS):Great Plains Mixedgrass Prairies (521-10; 2.9.3.2)

Concept: This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, and the interior western United States and possibly Canada. Stands occur on level to gently sloping terrain. They are found on alluvial fans, swales, river terraces, floodplains, valley floors and basins. The soils are clay, clay loam, and silt loam. *Pascopyrum smithii* strongly dominates the moderate to dense (40-100% cover) mixedgrass herbaceous canopy that grows 0.5-1 m tall. Other graminoids that co-occur and may achieve local dominance are *Koeleria macrantha*, *Eleocharis palustris*, and *Poa* spp. Many other species common in midgrass prairies are also found in this community. These include *Artemisia ludoviciana*, *Eriogonum* spp., *Bouteloua gracilis*, *Nassella viridula*, and *Hesperostipa comata* (= *Stipa comata*). Shrubs and dwarf-shrubs are rare in this community, but occasional woody plants such as *Artemisia tridentata*, *Symphoricarpos* spp., *Ericameria nauseosa*, or *Krascheninnikovia lanata* may be present. Introduced species, such as *Bromus tectorum*, *Bromus inermis*, *Poa pratensis*, *Melilotus* spp. or *Cirsium arvense*, are common in some stands, especially where disturbed.

Comments: This community is similar to several others that are dominated or codominated by *Pascopyrum smithii*. As currently defined, it represents a western Great Plains and foothills version of the western wheatgrass types in the central Great Plains.

Further work needs to be done to refine the differences in composition and environmental characteristics. See recent descriptions by Thilenius et al. (1995) (*Pascopyrum smithii* sodgrass steppe, a more playa-like wheatgrass type) and by Steinauer and Rolfsmeier (2000). In Nebraska, Steinauer and Rolfsmeier (2000) suggest that their stands may resemble *Pascopyrum smithii* - *Nassella viridula* Herbaceous Vegetation (CEGL001583).

Range: This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, intermountain western United States and possibly Canada, ranging from North Dakota and possibly Saskatchewan, south to Nebraska and Colorado, west to northern Arizona, Utah and Idaho.

States/Provinces: AZ:S?, CO:S1?, ID:S1Q, MT:S4, NE:S?, SD:S?, SK:S?, UT:S3S5, WY:S4Q

TNC Ecoregions: 10:C, 11:C, 21:C, 26:C, 27:C, 6:C, 9:C

USFS Ecoregions: 313D:CC, 331D:CC, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 341C:CC, 342F:CC, M313A:CC, M331A:CC, M332E:CC

Federal Lands: NPS (Sunset Crater); USFWS (Ouray)

Synonymy: DRISCOLL FORMATION CODE:V.B.4.a. (Driscoll et al. 1984), *Pascopyrum smithii* (Bourgeron and Engelking 1994), Wheatgrass (Aldous and Shantz 1924) =, *Agropyron smithii* Great Basin Grassland (Baker and Kennedy 1985) =, *Agropyron smithii* Natural Vegetation (Baker 1984a) =, Brown's Meadow grassland (Christensen and Welsh 1963) =. included in Wasatch Mountain meadow., *Agropyron smithii* Habitat Type (Hansen et al. 1995) =, *Agropyron smithii* Habitat Type (Hall and Hansen 1997) =, Western Wheatgrass (*Elymus smithii*) Dominance Type (Jones and Walford 1995) =, *Agropyron* association (Ramaley 1916b) =, Wheat Grass Association (Ramaley 1919b) =, Grassland and Sedgeland (Ramaley 1942) B, *Agropyron smithii* Sodgrass steppe (Thilenius et al. 1995) =. a more playa-like wheatgrass type.

References: Aldous and Shantz 1924, Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Bourgeron and Engelking 1994, Bunin 1985, Christensen and Welsh 1963, Driscoll et al. 1984, Godfread 1994, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, Jones and Walford 1995, Marr and Buckner 1974, Ramaley 1916b, Ramaley 1919b, Ramaley 1942, Shanks 1977, Soil Conservation Service 1978, Steinauer and Rolfsmeier 2000, Thilenius et al. 1995, Von Loh 2000

Authors: J.F. Drake, mod. K. Schulz, WCS **Confidence:** 3 **Identifier:** CEGL001577

Local Description: There are no occurrences of this class within the KNRI boundaries, however there are areas outside the park that are probably this class. These sites were not visited therefore without confirmation this remains purely conjectural. The sites mapped as Western Wheatgrass Herbaceous Vegetation are on flood plains or low terraces. This class occurs on several soil textures. These include Loam (20.9%), Silty Clay Loam (26.2%) Silty Clay (13.3%), and Fine Sandy Loam (23.4%) (See Table 5).

V.A.5.N.c.29. HESPEROSTIPA COMATA - BOUTELOUA GRACILIS HERBACEOUS ALLIANCE

Needle-and-Thread - Blue Grama Herbaceous Alliance

Concept: This alliance is widespread across upland sites in the northern Great Plains. Its communities tend to be the climax communities on fertile dry-mesic sites across much of its range. It is dominated by mid and short grass species; woody species do not regularly achieve prominence. Few of the species exceed 1 m while many, including *Bouteloua gracilis*, do not exceed 50 cm. The most abundant species are *Hesperostipa comata* (= *Stipa comata*) and *Bouteloua gracilis*. On more mesic sites *Hesperostipa comata* is predominant, while on areas that are drier or subject to light grazing *Bouteloua gracilis* takes precedence. Other graminoid species that are commonly found in communities of this alliance are *Aristida purpurea* var. *longiseta* (= *Aristida longiseta*), *Carex duriuscula* (= *Carex eleocharis*), *Carex filifolia*, *Koeleria macrantha*, *Nassella viridula*, and *Pascopyrum smithii*. Sites in the southern half of the range of this alliance may have significant amounts of *Bouteloua curtipendula*. Forbs are common but not usually abundant. Forb species that are regularly found are *Artemisia frigida*, *Gaura coccinea*, *Gutierrezia sarothrae* (= *Gutierrezia diversifolia*), *Liatris punctata*, *Sphaeralcea coccinea* (= *Malvastrum coccineum*), *Phlox hoodii*, and *Sphaeralcea coccinea*. The clubmoss *Selaginella densa* is present in many stands in this alliance. Scattered shrubs are sometimes present. These include *Prunus virginiana*, *Rhus aromatica*, and *Symphoricarpos occidentalis*. In the western and southwestern portions of its range, *Cercocarpus montanus* may be found where this alliance occurs on slopes.

Communities in this alliance are found on flat to moderately steep topography. The soils are sandy loam, loam, or sometimes clay loam. They are often well-developed and derived from either glacial deposits or sometimes limestone or sandstone (Hanson and Whitman 1938, Coupland 1950, Hanson 1955).

Comments: Communities in this alliance can be confused with communities of the *Bouteloua gracilis* Herbaceous Alliance (A.1282), especially in Wyoming. More classification work is needed to clarify the concept boundaries between stands in this alliances.

Range: This alliance is found in the western Great Plains, from western Kansas to North Dakota, west into Colorado, Wyoming and Montana. The alliance also extends north into Canada in Saskatchewan, Manitoba, and probably Alberta.

States/Provinces: AB CO KS MB MT ND NE SD SK WY

TNC Ecoregions: 10:C, 20:C, 25:C, 26:C, 27:C, 33:C, 34:C, 35:C

USFS Ecoregions: 251Ab:CCC, 251Ba:CCC, 331C:CC, 331D:CC, 331E:C?, 331F:CC, 331G:CC, 331H:CC, 331I:CC, 332C:CC, M331A:CC, M331H:CC, M331I:CC, M332B:CC, M332C:CC, M332D:CC, M332E:CC, M334A:CC

Federal Lands: NPS (Theodore Roosevelt, Wind Cave)

Synonymy: *Stipa-Bouteloua* Faciation, in part (Coupland 1950); *Bouteloua-Stipa* Faciation, in part (Coupland 1950); Western Needlegrass, Sedge, Blue Grama community (Tolstead 1941); Mixed Prairie climax, in part (Tolstead 1942); *Bouteloua-Stipa-Agropyron* Type, in part (Kuchler 1964); *Agropyron-Stipa* Type, in part (Kuchler 1964)

References: Aldous and Shantz 1924, Badaracco 1971, Bear Creek Uranium Mine Application n.d., Clements and Goldsmith 1924, Comer et al. 1999, Cooper et al. 1995, Cotter-Ferguson Project n.d., Coupland 1950, Coupland 1992a, Davis 1959, DeVelice et al. 1995, FEIS 1998, Faber-Langendoen et al. 1996, Hansen 1985, Hansen and Hoffman 1988, Hansen et al. 1984, Hanson 1955, Hanson 1957, Hanson and Dahl 1956, Hanson and Whitman 1938, Hardy Ranch Mine Application n.d., Hess 1981, Hubbard 1950, Johnston 1987, Kuchler 1964, Laurenroth et al. 1994, Livingston 1947, Moir 1969b, Mueggler and Stewart 1980, Ramaley 1916b, Smoliak 1965, Smoliak et al. 1972, Soil Conservation Service 1978, Stearns-Roger Inc. 1978, Stoecker-Keammerer Consultants n.d.(a), Tolstead 1941, Trammell and Trammell 1977, Vestal 1914, Weaver and Albertson 1956

Authors: MCS, MOD. M.S. REID, MCS **Identifier:** A.1234

Hesperostipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation

Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation

Needle-and-Thread - Blue Grama Mixedgrass Prairie **G5 (99-02-25)**

Ecological Group (SCS;MCS):Great Plains Mixedgrass Prairies (521-10; 2.9.3.2)

Concept: This needlegrass - grama grass prairie community is common in the northern and central Great Plains of the United States. Stands occur on flat to rolling topography with deep (40-100 cm), sandy loam to loam, coarser-textured soils. They are typically associated with uplands, though they may also occur lower in the landscape, such as coulee and draw bottoms, if soils are sufficiently coarse (usually sandstone-derived). The type is found at elevations ranging from 600-1700 m (2000-5500 feet); average annual precipitation associated with these elevation param ranges from slightly less than 25 cm to over 50 cm (10-20 inches). The vegetation is dominated by moderate to moderately dense medium-tall grasses. *Hesperostipa comata* (= *Stipa comata*) is the tallest of the dominant species, sending seed heads to a maximum height of approximately 1 m. The rhizomatous graminoids *Bouteloua gracilis* and *Carex filifolia*, the other two dominant/codominant species, do not usually exceed 0.5 m. *Calamovilfa longifolia* is often found with high cover values on sandier soils, and *Koeleria macrantha* cover increases on degraded sites. There are regionalized expressions of variability with *Carex inops* ssp. *heliophila* surpassing *Carex filifolia* in Colorado and *Calamagrostis montanensis* being at least as important as the diagnostic species in north-central Montana. *Pascopyrum smithii* is consistently present. For woody species, subshrub forms (*Artemisia frigida*, *Gutierrezia sarothrae*, *Rosa arkansana*) have the highest cover and constancy, but their total cover does not sum to more than 5%, except on overgrazed sites. Cover values for forbs are low (the exception being *Selaginella densa*). Geographic setting influences forb composition to some degree, with *Sphaeralcea coccinea*, *Phlox hoodii*, *Heterotheca villosa*, *Gaura coccinea*, and *Liatris punctata* common in the northern areas, and *Lygodesmia juncea*, *Opuntia polyacantha*, *Artemisia dracunculus*, and *Ratibida columnifera* seeming to increase to the eastern and southern areas.

Comments: *Carex filifolia* is lacking or highly reduced in importance southward. Southern stands were once classified separately (CEGL001699), and further review of their characteristics compared to more northern stands is needed. Weaver and Albertson (1956) also remark on the fact that low sedges are present as far south as Texas but are

important only north of Colorado. However, a phase of the *Stipa comata* - *Bouteloua gracilis* type of Mueggler and Stewart (1980) in western Montana is apparently quite similar to communities of the southern and southeastern portions or the Northern Great Plains, and both lack *Carex filifolia*. There are a welter of named community types, mostly seral representations of grazing or fire impacts, that vary by having one or another of the defining species (or even other graminoids, e.g., *Carex inops* ssp. *heliophila*) dominant. This assemblage of types is also defined by having relatively low cover of both *Pascopyrum smithii* and *Elymus lanceolatus* (= *Agropyron dasystachyum*). To accommodate these permutations within the concept of the type (as lesser-ranked occurrences) or to recognize them as independent vegetation types recognized by existing vegetation composition is one question. Another is, what cover value or degree of dominance of *Pascopyrum smithii* or *Elymus lanceolatus* will serve to establish the distinction between *Pascopyrum smithii* - *Stipa comata* - *Carex filifolia* (and allied *Pascopyrum smithii*-dominated communities) from the community under consideration.

Range: This needlegrass - grama grass prairie community is common in the northern and central Great Plains of the United States and Canada, ranging from Manitoba west to Alberta, south to Kansas and possibly Colorado.

States/Provinces: AB:S?, CO?, KS:S?, MB:S3, MT:S?, ND:S3?, NE:S?, SD:S?, SK:S?, WY:S3

TNC Ecoregions: 10:C, 20:C, 25:C, 26:C, 27:C, 34:C, 35:C

USFS Ecoregions: 251Ab:CCC, 251Ba:CCC, 331C:CC, 331E:C?, 331F:CC, 331G:CC, 331H:CC, 332C:CC, M334A:CC

Federal Lands: NPS (Badlands?, Theodore Roosevelt, Wind Cave)

Synonymy: *Stipa comata* - *Carex filifolia* Habitat Type (Hansen et al. 1984) =, Gramagrass - Needlegrass - Sedge (Hanson and Whitman 1938) =, *Stipa-Bouteloua* (Hubbard 1950) =, *Bouteloua-Stipa* (Hubbard 1950) =, *Stipa comata* / *Bouteloua gracilis* Plant Association (Johnston 1987) B, *Stipa comata* / *Carex filifolia* Plant Association (Johnston 1987) =, Association *Rumicetum venosi*, subassoc. *Boutelouetsum* (Looman 1980) =, Mixed prairie (Tolstead 1941) B

References: Hansen et al. 1984, Hanson and Whitman 1938, Hubbard 1950, Johnston 1987, Looman 1980, Mueggler and Stewart 1980, Steinauer and Rolfsmeier 2000, Thilenius et al. 1995, Tolstead 1941, Tolstead 1942, Weaver and Albertson 1956

Authors: J. Drake, MCS **Confidence:** 1 **Identifier:** CEGLO02037

Local Description: This class is mapped on high upland terraces in the northern part of the park and mapping boundary. A separate area to the southwest was also mapped as Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation. This area, however, is well outside the KNRI boundary and was not visited. The areas visited were characterized by a high amount of *Pascopyrum smithii* which confused the designation. The *Pascopyrum smithii* cover value in all areas visited was about 80%. However, *Hesperostipa comata* ranged in cover from 10 to 25%. In addition, *Carex filifolia* and *Bouteloua gracilis* were present with up to 10% cover in some places. Given that these areas are high terraces and the alternate classification as Western Wheatgrass Herbaceous Vegetation typically occur on lower terraces and floodplains, these areas were classified as Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation (Figures 26 and 27). Shrubs had a significant presence (cover values ~ 10%) and included *Symphoricarpos occidentalis*, *Artemisia frigida* and *A. dracunculus* (Figure

28). Other forbs and graminoids included *Nassella viridula*, *Ratibida columnifera*, *Achillea millefolium*, *Conyza canadensis*, *Chenopodium album* and *Bromus inermis*. The high values for Western Wheatgrass are perhaps due to the North Prairie burn in 1997. Western Wheatgrass often increases in abundance and density after spring fire (Alexander et. al. 1983, Blackburn et. al. 1971, Day and Ludeke 1986, Dittberner and Olson 1983, Enevoldsen and Lewis 1978, Great Plains Flora Association 1986, Hafenrichter et. al. 1968, Kamstra 1973, Kartesz 1994, Klein et al. 1989). This trend is not entirely clear as Kruse and Higgins (1990) report that spring burn affects on Western Wheatgrass are ambiguous with increases, decreases or no change. The North Prairie is scheduled for another burn in the Fall of 2002. This class occurs on several soil textures. These include Loam (26.8%), Silt Loam (14.7%) and Loamy Fine Sand (47.7%) (See Table 5).



Figure 26. Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation.



Figure 27. Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation.



Figure 28. Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation with shrub component.

V.A.5.N.d.400. BROMUS INERMIS SEMI-NATURAL HERBACEOUS ALLIANCE

Smooth Brome Semi-natural Herbaceous Alliance

Concept:

Range: This alliance is found in Montana, Wyoming, and North and South Dakota.

States/Provinces: MT ND SD UT WY

USFS Ecoregions: 313A:CC, M341C:CC

Federal Lands: NPS (Theodore Roosevelt, Zion)

References:

Authors: D. FABER-LANGENDOEN, MCS **Identifier:** A.3561

Bromus inermis - (*Pascopyrum smithii*) Semi-natural Herbaceous Vegetation

Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation

Smooth Brome Semi-natural Grassland **GW (99-06-17)**

Ecological Group (SCS;MCS): Exotic Species-Dominated Herbaceous Upland Vegetation (900-60; 8.0.0.4)

Concept: This smooth brome grassland type occurs widely throughout the northern Great Plains and on relatively mesic sites in the semi-arid interior western United States, and perhaps more widely in the midwestern U.S. and Canada. Stands can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, jeep trails, etc. The type is also widely planted for revegetating disturbed land, pasture, and hay fields, and has escaped into a variety of habitats including prairie, riparian grasslands, and mesic mountain meadows. In Montana, this community types occurs on elevation ranges from 1100-2050 m (3590-6700 feet) with best examples on mesic alluvial terraces. This grass grows best on moist, well-drained, finer-textured loam and clay loams and does not tolerate prolonged flooding. The vegetation is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Bromus inermis*, a naturalized species from Eurasia, that forms moderately dense to dense stands that often develop into monocultures. Other weedy species such as *Cirsium arvense* may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie and montane meadow grasses, such as *Pascopyrum smithii*, *Deschampsia caespitosa*, and *Hesperostipa comata* (= *Stipa comata*) and sparse, scattered mesic shrubs such as *Symphoricarpos* spp. as well as many others. However, the native species are not conspicuous enough to identify the native plant association that could occupy the site or the stand would be typed as such.

Comments: Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such. *Bromus inermis* occurs widely throughout the midwestern and western U.S., and perhaps this association should be broadened to include almost any stand dominated almost exclusively by *Bromus inermis*.

Range: This type occurs widely throughout the northern Great Plains and in relatively mesic sites in the semi-arid interior western United States, and perhaps more widely in the midwestern U.S. and Canada, depending on how the type is defined.

States/Provinces: MT:S?, ND:S?, SD:S?, UT:S?, WY:S?

TNC Ecoregions: 18:C, 19:C

USFS Ecoregions: 313A:CC, M341C:CC

Federal Lands: NPS (Badlands, Theodore Roosevelt, Zion)

Synonymy: *Bromus inermis* Community Type (Hansen et al. 1995) =

References: Cronquist et al. 1977, Hansen et al. 1995

Authors: D. Faber-Langendoen, mod. K.A. Schulz, MCS **Confidence:** 3 **Identifier:** CEGLO05264

Local description: *Bromus inermis* is widespread throughout the park and is a significant component of almost all vegetation communities. The largest concentration of *Bromus inermis* is in the lower lying floodplains and occurs both in prairie and woodland/forest. The associated species vary considerably and include the following; *Bouteloua curtipendula*, *Artemisia dracunculoides*, *A. ludoviciana*, *A. campestris*, *Liatris punctata*, *Cirsium canadensis*, *Epilobium* sp. *Lactuca serriola*, *Medicago sativa* and *Agropyron cristatum* (Figures 29 and 30). This class occurs on several soil textures. These include Loam (26.5%) and Silty Clay Loam (52.6%) (See Table 5).



Figure 29. Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation – Russel Floodplain.



Figure 30. Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation – Russel Floodplain.

V.A.5.N.d.402. AGROPYRON CRISTATUM SEMI-NATURAL HERBACEOUS ALLIANCE

Crested Wheatgrass Semi-natural Herbaceous Alliance

Concept:

Range: This alliance is found in Montana, Wyoming, and North and South Dakota, and in Canada in Manitoba and Saskatchewan.

States/Provinces: MB MT ND SD SK WY

Federal Lands: NPS (Theodore Roosevelt)

References:

Authors: D. FABER-LANGENDOEN, MCS **Identifier:** A.3563

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

Crested Wheatgrass - (Western Wheatgrass, Needle-and-Thread) Semi-natural Herbaceous Vegetation

Crested Wheatgrass Semi-natural Grassland **GW (99-06-17)**

Ecological Group (SCS;MCS): Exotic Species-Dominated Herbaceous Upland Vegetation 900-60; 8.0.0.4)

Concept: This crested wheatgrass type occurs most commonly in the northern Great Plains of the United States and Canada. Stands 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. 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* (= *Stipa comata*), as well as others. Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such.

Comments: Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such.

Range: This type occurs most commonly in the northern Great Plains of the United States and Canada.

States/Provinces: MB:S?, MT:S?, ND:S?, SD:S?, SK:S?, WY:S?

Federal Lands: NPS (Badlands, Theodore Roosevelt)

References: Hansen et al. 1984

Authors: D. Faber-Langendoen, MCS **Confidence:** 3 **Identifier:** CEGLO05266

Local Description: This class is somewhat amorphous. It typically occurs along roadsides or in previously planted areas. It often occurs with *Bromus inermis* and when it does it is mapped as *Bromus inermis* – (*Pascopyrum smithii*) Semi Natural Herbaceous Vegetation. Native species may occur but this is not typical. Only one area was found that was almost pure Crested Wheatgrass. This class occurs on two soil textures. These include Silty Clay (47.1%) and Silty Clay Loam (52.9%) (See Table 5).

V.A.5.N.j.11. SPARTINA PECTINATA TEMPORARILY FLOODED HERBACEOUS ALLIANCE

Prairie Cordgrass Temporarily Flooded Herbaceous Alliance

Concept: This alliance is found primarily in central North America. This description is based on this alliance as it occurs in the Midwest. The vegetation of this alliance is characterized by dense stands of graminoids 1-2 m tall with scattered to very infrequent woody plants. The most abundant species are *Calamagrostis canadensis*, *Carex aquatilis*, *Carex atherodes*, *Carex pellita* (= *Carex lanuginosa*), *Carex sartwellii*, and *Spartina pectinata*. In some stands, *Spartina pectinata* can form virtual monocultures. Other common graminoids include *Andropogon gerardii*, *Muhlenbergia richardsonis*, *Panicum virgatum*, *Poa palustris* (in the western part of this alliance's range), and *Sorghastrum nutans*. Forbs are abundant and include *Symphyotrichum ericoides* (= *Aster ericoides*), *Symphyotrichum novae-angliae* (= *Aster novae-angliae*), *Helianthus grosseserratus*, *Lythrum alatum*, *Pycnanthemum virginianum*, and *Thalictrum dasycarpum*. Shrubs and small trees are infrequent in the south and west but are often present in the north and east. Among these *Cornus* spp., *Fraxinus pennsylvanica*, and *Salix* spp. are typical.

This alliance occurs in the Southeast only as small disjunct occurrences in Oklahoma, the Upper West Gulf Coastal Plain of Kentucky, and possibly extending a short distance into adjacent Tennessee. Associates in Kentucky and Tennessee occurrences may include *Helianthus angustifolius*, *Viola sagittata*, *Cephalanthus occidentalis*, *Andropogon gerardii*, *Dichanthelium scoparium*, *Schizachyrium scoparium*, *Sorghastrum nutans*, *Tripsacum dactyloides*, *Asclepias tuberosa*, *Baptisia alba* var. *macrophylla* (= *Baptisia leucantha*), *Crotalaria sagittalis*, *Dichanthelium clandestinum*, *Agalinis fasciculata*, *Helianthus grosseserratus*, *Helianthus mollis*, *Heterotheca villosa* (= *Chrysopsis villosa*), *Spiranthes cernua*, *Rhexia mariana*, *Rudbeckia hirta*, *Rudbeckia subtomentosa*, and *Viola sagittata*. In Kentucky, this vegetation is at present probably seasonally saturated; it was presumably formerly seasonally flooded. In Oklahoma, this alliance contains *Spartina pectinata* with *Eleocharis montevidensis* and *Carex* spp.

Stands of this wide-ranging alliance are found on level to gently sloping sites with sand, loam, or clay soils. They occur near lakes or rivers or in depressions. All sites are typically flooded for part of the winter and spring. In the east, stands can experience droughty conditions in the summer and fall (Comer et al. 1995) while in the south and central portion of this alliance's range they can remain saturated for much of the growing season.

Range: This is a wide-ranging alliance, found from the central and northern Great Plains west into Washington and south into Oklahoma. It is also reported from Vermont. It has not been reported from the southwestern states and its distribution is limited in the Southeast, but it may occur throughout the rest of the conterminous United States.

In the Midwest this alliance is found in North Dakota, South Dakota, Nebraska, Kansas, Missouri, Iowa, Minnesota, Wisconsin, Illinois, Ohio, Michigan, and Indiana. It is in the West in Montana, Wyoming, Colorado, and Washington, in the Southeast in Oklahoma, Arkansas, Texas (?), Louisiana (?), Mississippi (?), Kentucky, and Tennessee (where possibly extirpated), and in the East in Vermont.

States/Provinces: CO IA IL IN KS KY MA? MB MI MN MO MT ND NE NY? OH OK ON SD SK? TN? VT WA WI WY

TNC Ecoregions: 10:C, 25:C, 26:C, 27:C, 32:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 61:C, 62:C, 64:C, 6:C

USFS Ecoregions: 212E:CC, 212Hu:CCC, 212Hv:CCC, 212Je:C??, 212Jf:C??, 212Kb:CCC, 221A:CC, 222Ab:CCC, 222Cb:CCC, 222Ch:CCC, 222Eb:CP?, 222Ge:CPP, 222Ha:CCC, 222Hb:CCP, 222If:CCC, 222Jb:CCC, 222Jc:CCC, 222Jd:CCC, 222Je:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222Jj:CCC, 222Kc:CCC, 222Kd:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Ki:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 222Qb:CCC, 234Ac:CCC, 234Ae:CCC, 251Aa:CCC, 251Ab:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cg:CCC, 251Cp:CCC, 251Cq:CCC, 251Dd:CCC, 251Dg:CCC, 251Dh:CCC, 251Ea:CCC, 251Eb:CCC, 251Ec:CC?, 251Ed:CC?, 255Aa:CCC, 311A:PP, 331C:CC, 331D:CC, 331E:C?, 331F:CC, 331G:CC, 331H:CC, 332C:CC, 332E:CP, 342I:CC, M333C:CC, M334A:CC

Federal Lands: NPS (Badlands, Theodore Roosevelt, Wind Cave); USFS (Sheyenne?)

Synonymy: Wet prairie. equivalent (Evans 1991); *Spartina pectinata* herbaceous alliance. equivalent (Hoagland 1998a); *Spartina pectinata* Dominance Type. equivalent

(Jones and Walford 1995); *Spartina pectinata* Habitat Type, in part (Hansen et al. 1995); Cordgrass Series, in part (Sawyer and Keeler-Wolf 1995); *Spartina pectinata* Series (Johnston 1987)

References: Chapman 1984, Comer et al. 1995b, Cooper 1988, Culwell and Scow 1982, DeSelm 1989, Evans 1989a, Evans 1989b, Evans 1991, Faber-Langendoen et al. 1996, Hansen and Hoffman 1988, Hansen et al. 1988a, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Hoagland 1998a, Johnson and Knapp 1995, Johnston 1987, Jones and Walford 1995, Kittel et al. 1996, Kittel et al. 1999, Kuchler 1974, MNNHP 1993, Sawyer and Keeler-Wolf 1995, Steinauer 1989, Ungar 1974c, Weaver 1960, Weaver 1965

Authors: D.J. ALLARD 94, MOD. M.S., JT, MCS **Identifier:** A.1347

***Spartina pectinata* Western Herbaceous Vegetation**

Prairie Cordgrass Western Herbaceous Vegetation

G3? (96-02-01)

Ecological Group (SCS;MCS):Marshes (n/a; n/a)

Concept: In Colorado, this is a tallgrass meadow comprised entirely of *Spartina pectinata*. Stands occurs in small swales on the plains as well as on floodplains of larger rivers. Stands of this grass have been included in other tallgrass prairie plant associations. On large river floodplains, this type occurs as distinct patches and is distinguished from adjacent riparian types by micro-topography and degree of soil saturation. Weaver (1965) reports that historically, large stands of *Spartina pectinata* occurred on mud flats of the Missouri River. Large stands have been observed south of Denver, now threatened by housing and golf course developments (Steve Kettler pers. comm.).

Additional information on stands outside of Colorado will be included later.

Comments: Compare this association with *Spartina pectinata* - *Carex* spp. Herbaceous Vegetation (CEGL001477).

States/Provinces: CO:S1, MT:S3?, WA:S1, WY:S?

TNC Ecoregions: 26:C, 27:C, 6:C

USFS Ecoregions: 331C:CC, 331D:CC, 331E:C?, 331F:CC, 331G:CC, 331H:CC, 342I:CC, M333C:CC

Synonymy: DRISCOLL FORMATION CODE:V.A.4.a. (Driscoll et al. 1984), *Spartina pectinata* (Bourgeron and Engelking 1994), *Spartina pectinata* Dominance Type (Evans 1989a) = . (p.32)

References: Bourgeron and Engelking 1994, Driscoll et al. 1984, Evans 1989a, Hansen and Hoffman 1988, Hansen et al. 1989, Hansen et al. 1991, Hansen et al. 1995, Kittel et al. 1996, Weaver 1965

Authors: WCS **Confidence:** 2 **Identifier:** CEGL001476

Local description: The only occurrence of this class is west of Stanton outside the KNRI boundary. This area was not visited and is classified as such from local information (Rod Skalskey – Pers. Comm.). This class occurs on several soil textures. These include Loam (33.4%), Silty Clay (23.5%), Loamy Fine Sand (15.1%) and Silt Loam (13.6%) (See Table 5).

V.A.5.N.j.18. PASCOPYRUM SMITHII TEMPORARILY FLOODED HERBACEOUS ALLIANCE

Western Wheatgrass Temporarily Flooded Herbaceous Alliance

Concept: This alliance is found in the northern Great Plains. Stands are dominated by graminoids, the tallest of which may rarely reach 1 m. Most of the vegetation is 0.6 m or less. The depth to the clay layer affects the height and amount of vegetation. The deeper the clay layer is buried, the more dense the vegetation. The dominants are *Distichlis spicata*, *Hordeum jubatum*, and *Pascopyrum smithii*. Other common graminoids include *Bouteloua gracilis*, *Koeleria macrantha*, *Hesperostipa comata* (= *Stipa comata*), and *Carex duriuscula* (= *Carex eleocharis*). Forbs that may be present include *Iva annua*, *Helianthus petiolaris*, *Plantago patagonica*, *Gutierrezia sarothrae*, and *Aster* spp. Woody plants are rare. Some stands may have scattered *Artemisia frigida*, *Artemisia cana*, or *Symphoricarpos occidentalis*.

This alliance is found in depressions and on stream terraces on moderately saline silt loam and sandy loam soils, sometimes with a clay subsoil. The soils are wet for part of the year and may flood periodically.

Comments: This alliance is closely related to the V.A.5.N.j *Distichlis spicata* - (*Hordeum jubatum*) Temporarily Flooded Herbaceous Alliance (A.1341), and stands of this alliance may be found on the less saline edges of that one. More work needs to be done to better define differences between these two alliances. Some stands of this alliance may be similar to stands in the V.A.5.N.c *Pascopyrum smithii* Herbaceous Alliance (A.1232). Most of the latter alliance is found on drier and much less saline soils. Some associations currently placed in this alliance, those in playas or along intermittent streams that are dependent on unpredictable summer rain events for moisture, may be better classified in the V.A.5.N.i *Pascopyrum smithii* Intermittently Flooded Herbaceous Alliance (A.1328).

In some stands of this alliance, *Distichlis spicata* may dominate, but contribution of at least 25% of the canopy cover by *Pascopyrum smithii* is diagnostic; stands with <25% of the cover contributed by *Pascopyrum smithii* belong to the *Distichlis spicata* Intermittently Flooded Herbaceous Alliance (A.1332). In general, a stand must have at least 25% cover of *Pascopyrum smithii* to be included in this alliance.

Range: Grasslands included in this alliance occur mostly in the northern Great Plains, from Wyoming and Nebraska to North Dakota and into Saskatchewan, Canada. Stands also likely occur in the southern Great Plains states of Oklahoma, Texas, New Mexico, Colorado and Kansas, but association-level descriptions are needed to determine whether vegetation types there belong to this alliance.

States/Provinces: CO? MT ND NE SD SK? WY

TNC Ecoregions: 10:C, 26:C

USFS Ecoregions: 331F:CC, 331G:CC, 342A:C?, 342F:CC, 342G:C?

Federal Lands: NPS (Badlands); USFS (Comanche, Pawnee)

Synonymy: *Pascopyrum smithii* herbaceous alliance (Hoagland 1998a); Saltgrass - Western Wheatgrass Type. equivalent (Hanson and Whitman 1938); *Pascopyrum smithii* - *Bouteloua gracilis* - *Distichlis spicata* Habitat Type. slightly more inclusive than A.1354 (Hirsch 1985); *Elytrigia smithii*/*Distichlis spicata* Plant Association. may be

equivalent (Johnston 1987); Western Wheatgrass (*Elymus smithii*) Community, in part (Jones and Walford 1995); No equivalent (Diamond 1993)

References: BLM 1979b, Britton 1979, Caballo Rojo Mine Application n.d., Culver et al. 1996, Diamond 1993, Dodd and Coupland 1966, Faber-Langendoen et al. 1996, Hanson and Whitman 1938, Harner-White Consultants n.d., Hirsch 1985, Hoagland 1998a, Holpp 1977, Johnston 1987, Jones and Walford 1995, Medicine Bow Mine Application n.d., Mine Reclamation Consultants 1977, NVS Corporation n.d., Stoecker-Keammerer Consultants n.d.(a), Stoecker-Keammerer Consultants n.d.(c), Ungar 1967, Ungar 1970, Western Resources Development Corporation n.d. (b), Western Resources Development Corporation n.d. (c)

Authors: MCS, MOD. M.S. REID/K. SC, WCS **Identifier:** A.1354

Local Description: This class lies outside the mapped area and was not visited. The area was assigned to this class due to a combination of photographic signature and topographic position. Until this area is visited it remains questionable. This class occurs on several soil textures. These include Loam (12.3%), Loamy Fine Sand (32.8%), Riverwash (13.8%), Silty Clay (14.6%) and Silty Clay Loam (22.3%) (See Table 5).

V.A.5.N.I. Semipermanently flooded temperate or subpolar grassland

Schoenoplectus acutus - (Schoenoplectus fluviatilis) Freshwater Herbaceous Vegetation

Hardstem Bulrush - (River Bulrush) Freshwater Herbaceous Vegetation

Freshwater Bulrush Marsh CEG002225

DESCRIPTION: Tall hydrophytic graminoids, particularly *Schoenoplectus acutus* (= *Scirpus acutus*) and, less frequently, *Schoenoplectus fluviatilis* (= *Scirpus fluviatilis*), dominate the vegetation. These two species may grow taller than 2 m (Weaver 1960) and sometimes nearly exclude other species. Other species that can be present include *Carex atherodes* (especially in the shallower parts of the community), *Lemna* spp., *Schoenoplectus Tabernaemontani* (= *Scirpus tabernaemontani*), *Typha latifolia*, and *Utricularia macrorhiza*. *Schoenoplectus tabernaemontani* can be a codominant in places. Floating-leaved and submergent plants have low cover (Harris et al. 1996). This community often occurs as dense stands with interspersed channels or pools of open water. This community is found on wetland sites that are flooded for most or all of the growing season. Weaver (1960) found abundant *Schoenoplectus acutus* (= *Scirpus acutus*) in water 0.3-1.6 m deep. Soils are mostly mineral but can contain significant organic matter (Harris et al. 1996). Dix and Smeins (1967) found the soils to be humic gleys and mucks in North Dakota, while in northwestern Ontario this community is favored on sandy substrates (Harris et al. 1996).

COMMENTS: 2, MCS. Separation of pure bulrush marsh types from mixed emergent marsh types may be difficult. Iowa shallow marsh may better fit with *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation

(CEGL002026). In many places, including at Voyageurs National Park, Minnesota, *Schoenoplectus tabernaemontani* is dominant.

CONSERVATION RANK: G4G5.

DISTRIBUTION: This hardstem bulrush - mixed bulrush community type is found mainly in the northeastern Great Plains and northern tallgrass prairie region of the United States and Canada, from Minnesota and Ontario west to Manitoba and south to Iowa.

USFS ECOREGIONS: 212La:CPP, 222Lc:CCC, 251Aa:CCC, 251Bb:CCC, 251Be:CCC

CONSERVATION REGIONS: 26:C, 34:C, 35:C, 46:C, 47:P

STATES: IA MN ND SD **PROVINCES:** MB ON

MIDWEST HERITAGE SYNONYMY: MN mixed emergent marsh (prairie section) +

OTHER SYNONYMY: Swamps (Weaver 1960) B, Marshes (Dix and Smeins 1967) B, Sedge zone, pothole and drainage community (Brotherson 1969) =. uncertain if equivalent, Semipermanent ponds and lakes, slightly brackish, central deep-marsh zone (Stewart and Kantrud 1971) B, Bulrush marsh =., Marsh: Bulrush: Mineral substrate (W7) (Harris et al. 1996) =

USNVC HIERARCHY: SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE (V.A.5.N.I)

Local Description: There are only a few areas mapped as this class within the mapping boundary. Most of these are within KNRI boundary. Most of the species present are either *Schoenoplectus acutus* and *S. americanus* in fairly homogenous stands (Figure 31). These occur in loamy (49%) and silty clay (22%) soils. The soils description may be erroneous as the Soil Surveys typically do not map to a resolution fine enough to split out wetland soils. This type is at the eastern most part of its range and may overlap with *Schoenoplectus acutus* – (*Schoenoplectus tabernaemontani*) Semipermanently Flooded Herbaceous Alliance.



Figure 31. Hardstem Bulrush - (River Bulrush) Freshwater Herbaceous Vegetation

V.B.2.N.a. Tall temperate or subpolar perennial forb vegetation

**V.B.2.N.a.400. (CIRSIIUM ARVENSE, EUPHORBIA ESULA, MELILOTUS SPP.)
- MIXED FORBS HERBACEOUS ALLIANCE**

(Canada Thistle, Leafy Spurge, Sweet Clover species) - Mixed Forbs Herbaceous Alliance

Concept:

Range: This alliance is found in Montana, Wyoming, and North and South Dakota, and in Canada in Alberta, Manitoba and Saskatchewan.

States/Provinces: AB MB MT ND SD SK WY

USFS Ecoregions: M334A:CC

Federal Lands: NPS (Theodore Roosevelt, Wind Cave)

References:

Authors: D. FABER-LANGENDOEN, MCS **Identifier:** A.3564

Cirsium arvense - Weedy Forb Great Plains Herbaceous Vegetation

Canada Thistle - Weedy Forb Great Plains Herbaceous Vegetation

Great Plains Weedy Forb Meadows **GW (99-04-13)**

Ecological Group (SCS;MCS):Exotic Species-Dominated Herbaceous Upland Vegetation (900-60; 8.0.0.4)

Concept: This Canada thistle type is widely naturalized in the northern United States and Canada. Stands occur on a variety of open disturbed habitats, including pastures, ditches, bottomlands, and waste areas. The vegetation is dominated by medium-tall (0.5-1 m) forbs. The dominant forb is *Cirsium arvense*, a naturalized species from Eurasia. 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* (= *Stipa comata*), as well as others. Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such.

Range: This type is widely naturalized in the northern United States and Canada.

States/Provinces: ND:S?, SD:S?

TNC Ecoregions: 25:C

USFS Ecoregions: M334A:CC

Federal Lands: NPS (Theodore Roosevelt, Wind Cave)

References: Great Plains Flora Association 1986

Authors: D. Faber-Langendoen, MCS **Confidence:** 3 **Identifier:** CEG005260

Local Description: This class occurs in various locations within KNRI boundaries – all of which are moist habitats. These include locations on both the Knife and Missouri Rivers and adjacent to wetlands. Species composition varies widely by site but usually include the following in a wide range of cover values; *Cirsium canadensis*, *Bromus inermis*, *Xanthium strumarium*, *Artemisia ludoviciana*, *Asclepias syriaca*, *Potentilla anserina*, *Equisetum arvense*, *E. hyemale* and occasionally seedlings of both *Salix* sp. and *Populus angustifolia* (Figures 32 and 33). This class occurs primarily on two soil textures. These include Loam (20.6%), Silty Clay Loam (61.2%) (See Table 5).



Figure 32. Canada Thistle - Weedy Forb Great Plains Herbaceous Vegetation
Russel Floodplain.



Figure 33. Canada Thistle - Weedy Forb Great Plains Herbaceous Vegetation
– Russel Floodplain.

VII. Sparse Vegetation

VII.C.2.N.c. Temporarily flooded sand flats

VII.C.2.N.c.1. SAND FLATS TEMPORARILY FLOODED SPARSE VEGETATION ALLIANCE

Sand Flats Temporarily Flooded Sparse Vegetation Alliance

Concept: This is technically not an alliance. It is a placeholder for a group of sparsely vegetated associations that do not have adequate vegetation descriptions, but do share certain substrate characteristics.

Range: This alliance is found in Illinois (?), Indiana, Kansas (?), Minnesota, Missouri, Nebraska, Wyoming (?), Wisconsin (?), and Michigan. It is also found in Manitoba, Saskatchewan, and Ontario, Canada.

States/Provinces: IL IN KS MB MN MO NE ON SK? WY?

TNC Ecoregions: 36:C, 37:C, 38:C, 46:C, 47:C, 48:C

USFS Ecoregions: 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hq:CPP, 212Hw:CPP, 212Hx:CPP, 212Ia:CCC, 212Ja:CCC, 212Jb:CCP, 212Jc:CCP, 212Jk:CCP, 212Jl:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCP, 212La:CPP, 212Lb:CPP, 212Mb:CPP, 212Na:CCP, 212Nb:CCP, 212Nc:CCC, 222Ad:CC?, 222Ae:CC?, 222Af:CC?, 222Ak:CC?, 222Ap:CCC, 222Jj:CCC, 222Lc:CCC, 222Mc:CCC, 222Md:CCC, 251Cg:CCC, 251D:CC, 331:C, 332C:CC, 332E:CC

Federal Lands: NPS (Theodore Roosevelt)

References:

Authors: MCS **Identifier:** A.1864

Riverine Sand Flats - Bars Sparse Vegetation

Riverine Sand Flats - Bars Sparse Vegetation

Riverine Sand Flats **G4G5 (98-06-22)**

Ecological Group (SCS;MCS):Midwestern Sand and Gravel Strands (n/a; 2.1.2.1)

Concept: This community ranges from the western Great Plains to the eastern parts of the midwestern United States and Canada. It is a sparsely vegetated community that occurs along river shorelines, islands, pointbars, and flats. These sandbars form when receding floodwaters deposit sand and lesser amounts of clay, silt, and cobbles in the stream bed. Soils are often undeveloped due to the ephemeral nature of the stands. Drainage depends on depth above the water level. Herbaceous species shared in Missouri and Nebraska include *Cyperus* spp. (*Cyperus erythrorhizos*, *Cyperus odoratus*, *Cyperus squarrosus*), *Eragrostis hypnoides*, *Eragrostis trichodes*, *Leptochloa fusca* ssp. *fascicularis* (= *Leptochloa fascicularis*), *Polygonum* spp. (including *Polygonum lapathifolium*), *Rorippa sinuata*, *Sporobolus cryptandrus*, and *Xanthium strumarium*.

Comments: This type will need to be separated into at least a Great Plains versus a Midwest type. The current description is based primarily on work available in Missouri (Nelson 1985) and Nebraska (Steinauer and Rolfsmeier 2000). See also the Riverine Gravel Flats Great Plains Sparse Vegetation (CEGL005223).

Range: This community is found from the western Great Plains to the eastern parts of the midwestern United States and Canada, ranging from Indiana northwest to Saskatchewan, and south to Kansas.

States/Provinces: IL:S?, IN:S?, KS:S?, MB?, MN:SU, MO:S1, NE:S5, ON:S?, SK?, WY?

TNC Ecoregions: 36:C, 37:C, 38:C, 46:C, 47:P, 48:C

USFS Ecoregions: 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 222Ad:CC?, 222Ae:CC?, 222Af:CC?, 222Ak:CC?, 222Ap:CCC, 222Md:CCC, 251Cg:CCC, 251D:CC, 331:C, 332C:CC, 332E:CC

Federal Lands: NPS (Theodore Roosevelt)

References: Nelson 1985, Steinauer and Rolfsmeier 2000

Authors: D. Faber-Langendoen, MCS **Confidence:** 3 **Identifier:** CEGL002049

Local Description: No sites were visited. Most occurrences of this class lie outside the KNRI boundary. This class occurs on several soil textures. These include Loam (14.5%), Loamy Fine Sand (16.3%) and Riverwash (65.1%) (See Table 5).

Vegetation Relation to Soil Texture

Soils and vegetation tend to occur in certain types and this relationship can be seen in Table 4. Vegetation and Soils texture shape coverages were intersected. The resulting

table was then manipulated such that the relationship between vegetation and soil texture becomes clear. Each of these relationships is discussed in the local description for each type.

Vegetation Description	Channeled	Complex	Fine Sandy Loam	Loam	Loamy Fine Sand	No Descrip.	Riverwash	Silt Loam	Silty Clay	Silty Clay Loam	Very Fine Sandy Loam	Grand Total
Agriculture	-	-	7.6%	23.8%	2.0%	0.2%	0.4%	32.7%	3.8%	29.5%	-	100.0%
Andropogon gerardii - Sporobolus heterolepis - Schizachyrium scoparium - Pascopyrum smithii Herbaceous Vegetation	-	1.1%	9.9%	45.9%	25.1%	1.7%	-	9.6%	-	6.7%	-	100.0%
Artemesia cana/ Pascopyrum smithii Shrubland	-	-	-	1.7%	-	98.3%	-	-	-	-	-	100.0%
Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	-	-	6.7%	26.5%	3.2%	0.4%	1.3%	4.4%	4.9%	52.6%	-	100.0%
Cirsium arvense - Weedy Forb Great Plains Herbaceous Vegetation	-	-	-	20.6%	9.0%	-	-	-	9.2%	61.2%	-	100.0%
Fraxinus pennsylvanica - (Ulmus americana) / Symphoricarpos occidentalis Forest	-	-	4.9%	35.1%	0.7%	1.5%	-	4.1%	19.3%	31.8%	2.7%	100.0%
Fraxinus pennsylvanica - Ulmus americana / Prunus virginiana Woodland	0.5%	-	4.8%	36.1%	6.2%	3.2%	0.8%	4.8%	6.1%	36.5%	1.2%	100.0%
Hesperostipa comata - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation	3.5%	-	1.9%	26.8%	47.7%	2.0%	-	14.7%	-	3.5%	-	100.0%
Pascopyrum smithii - Bouteloua gracilis - Carex filifolia Herbaceous Vegetation	5.5%	1.3%	1.6%	51.2%	9.0%	17.4%	-	13.6%	-	0.3%	-	100.0%
Pascopyrum smithii Herbaceous Vegetation	-	-	23.4%	20.9%	0.4%	-	-	1.5%	13.3%	26.2%	14.4%	100.0%
Pascopyrum smithii Temporarily Flooded Herbaceous Alliance	-	-	4.2%	12.3%	32.8%	-	13.8%	-	14.6%	22.3%	-	100.0%
Agropyron cristatum Semi-Natural Herbaceous Alliance	-	-	-	-	-	-	-	-	47.1%	52.9%	-	100.0%
Planted - Agropyron gerardii	-	-	-	85.5%	-	-	-	-	14.5%	-	-	100.0%
Planted - Bouteloua curtipendula - Pascopyrum smithii	-	-	-	29.6%	-	-	-	48.5%	-	21.8%	-	100.0%
Planted - Bromus inermis	-	7.7%	-	23.6%	22.2%	-	-	2.1%	-	44.4%	-	100.0%
Planted - Grass Forb Mix	-	-	-	50.1%	-	-	-	45.0%	-	5.0%	-	100.0%
Riverine Sand Flats - Bars Sparse Vegetation	-	-	1.5%	14.5%	16.3%	-	65.1%	-	-	0.6%	1.9%	100.0%
Salix exigua Temporarily Flooded Shrubland	-	-	-	33.6%	4.0%	-	-	-	0.1%	62.3%	-	100.0%
Spartina pectinata Temporarily Flooded Herbaceous Alliance	-	-	11.8%	33.4%	15.1%	0.4%	-	13.6%	23.5%	2.3%	-	100.0%
Symphoricarpos occidentalis Shrubland	6.4%	-	7.8%	32.5%	2.9%	2.6%	-	6.6%	5.5%	33.0%	2.7%	100.0%
Schoenoplectus acutus - (Schoenoplectus fluviatilis) Freshwater Herbaceous Vegetation	-	-	-	43.9%	-	30.5%	-	-	22.0%	3.6%	-	100.0%
Grand Total	0.8%	0.1%	6.1%	28.9%	9.7%	1.6%	1.4%	18.8%	5.2%	26.7%	0.6%	100.0%

Table 4. Percent of soil textures within vegetation class.

Former Croplands

Manipulation of the soils by agriculture in and around KNRI has continued, more or less, unabated since they were occupied by its original inhabitants, the Mandans and Hidatsas. During the acquisition process, landowners were required to plant some form of perennial grass cover. These efforts resulted in a mixed bag of species and success (Clambey 1985). Figure 34 shows plant cover on former cropland (from Clambey 1985). The current situation shows little resemblance to this figure. In fact Clambey (1985) also noted the little resemblance to these descriptions. In most cases Smooth Brome has taken over most of these areas and in some cases forms a monoculture. In other areas weedy species form some of the total cover. These include *Cirsium arvense*, *Sonchus arvensis*, *Conyza canadensis*, and in some areas that have been disturbed by animals, *Salsola tragus*. Most of these weedy species are also noted by Clambey (1985). In some cases Smooth Brome has usurped the species previously planted and the current vegetation map reflects this change. In other cases, primarily in the lower Hidatsa, some elements of the planting exist. These areas have been mapped as former croplands and labeled with the species originally planted. This situation is not likely to persist as Smooth Brome continues to colonize these areas. The Grass – Forb mixture in the lower Hidatsa is reported as only partially successful or reseeding was not done (Clambey 1985). The other smaller areas of Grass – Forb include *Bromus inermis*, *Poa pratensis*, *Rosa woodsii*, *Melilotus* sp. and others.

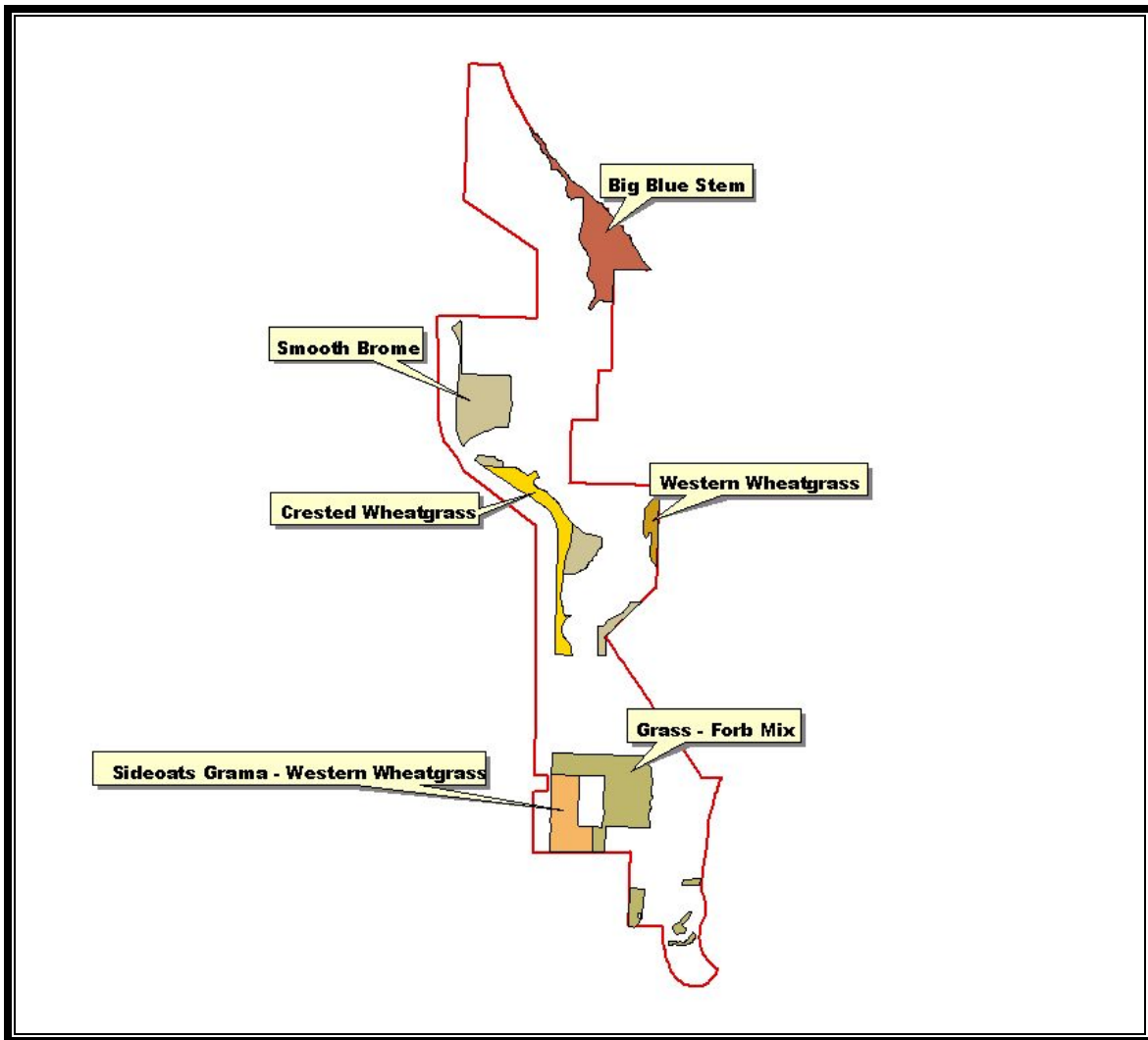


Figure 34. Former croplands and replacement plant cover.

DISCUSSION

Knife River Indian Villages National Historic Site has been impacted in some form or another for centuries and most recently heavily impacted by agriculture. Hence, the vegetation in and around the area is not likely to mirror native communities. This was reflected by field observations. The only areas that bear some resemblance to native populations are the Big Hidatsa Pasture and the North Prairie. Smooth Brome is omnipresent in almost the entire park and, given the current trend, will probably continue to invade other areas. The current practice of prescribed burns should keep Smooth Brome from impacting too heavily the Big Hidatsa Pasture and the North Prairie.

The vegetation assemblage at Knife River Indian Villages National Historic Site has two important components of typical and rare types for North Dakota. The typical vegetation includes prairie types such as Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass Herbaceous Vegetation and Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation. The more rare types include the Green Ash - American woodland and forest elements. North Dakota has little of this type as they are confined to river bottoms and woody draws and form less than 1% of the total vegetation cover for the state (Jakes and Smith 1983). The proportion of these elements within KNRI is 30%. That said, the wooded element bears little resemblance to a non-impacted or native woodland or forest. The shrub component is within the wooded and forest areas are almost entirely missing. Smooth Brome makes up almost the entire understory within the Russel Floodplain.

The vegetation map includes three atypical classes for planted or revegetated areas. These areas are difficult to characterize as their history, management and invasive species all combine to form a complicated mosaic of native and non-native species. The remaining areas are, to some degree or another, different from the global descriptions, again reflecting the history of the Park. The global descriptions are useful for management as they describe what the types should look like in a native setting.

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