National Park Service
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Natural Resource Program Center

Vegetation Classification and Mapping of Homestead National Monument of America

Project Report

Natural Resource Report NPS/HTLN/NRR—2011/345

ON THE COVER
The Homestead Heritage Center is situated next to upland restored prairie.
Photograph by: Kelly Kindscher

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This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Executive Summary

Homestead National Monument (HOME) was created at the to celebrate the significance of the Homestead Act of 1862 which granted 160 acres of free land to claimants and was one of the most significant and enduring events in the westward expansion of the United States. The National Monument encompasses 184 acres in Gage County, west of Beatrice, Nebraska. This unique site also hosts the oldest prairie restoration in the National Park system, and the second-oldest tallgrass prairie restoration known. This park unit also has a small remnant of native tallgrass prairie and remnants of bur-oak forest.

A three-year program was initiated to complete the task of mapping and classifying the vegetation at HOME. The Kansas Biological Survey in conjunction with NatureServe developed a vegetation classification using the National Vegetation Classification System and produced a digital vegetation map. To classify the vegetation, 17 representative plots located throughout the approximately 1,725 acre project area (parks + environs) were sampled during the summer of 2008. Additional data were obtained from vegetation plots sampled by the Inventory & Monitoring program in 2006. Analysis of the plot data by KBS produced six distinct plant associations and alliances and four land-use classes. Two of the communities, encompassing the upland and lowland restored tallgrass prairie area, were unique to HOME. Descriptions and a field key for all plant communities of HOME are included in this report.

Draft maps were printed, field tested, reviewed and revised. Twelve accuracy assessment (AA) data points were collected in 2009 by KBS and used to verify the map's accuracy.

Introduction

Homestead National Monument Vegetation Mapping Project

The Homestead National Monument of America (HOME) Vegetation Mapping Project was organized and coordinated by the Kansas Biological Survey (KBS) at the University of Kansas, in cooperation with NatureServe, in accordance with the standards set forth by the U.S. Geological Survey (USGS) – National Park Service (NPS) Vegetation Mapping Program.

The HOME Vegetation Mapping Project was initiated because a unified objective classification, such as outlined in the National Park Service's Vegetative Mapping Program, can become a valuable aid to the preserve for the use in vegetation management, fire, and monitoring wetlands and wildlife. Since the National Park Service is charged with conserving, protecting, and interpreting the resources of this prairie landscape, an accurate and detailed vegetation map and data layers for a GIS will be very useful for management purposes.

Common to all Vegetation Mapping Progam projects, the three major components of the HOME Vegetation Mapping Project are vegetation classification, vegetation mapping, and map accuracy assessment. In this report we discuss each of these fundamental components in detail.

USGS-NPS Vegetation Mapping Program

The National Vegetation Mapping Program is an interagency initiative established to inventory, classify, describe, and map vegetation in National Park units across the United States. It is administered by the USGS Center for Biological Informatics and the NPS Natural Resources Information Division, and provides baseline vegetation information to the NPS Inventory and Monitoring Program. Vegetation Mapping Program scientists developed procedures for classification, mapping, and accuracy assessment (The Nature Conservancy [TNC] and Environmental Systems Research Institute [ESRI] 1994a).

Use of the NVCS as the standard vegetation classification system is central to fulfilling the goals of this national program. This system:

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

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

The NVCS has primarily been developed and implemented by The Nature Conservancy (TNC) and the network of State Natural Heritage Programs over the past 20 years (TNC and ESRI 1994a; Grossman et al. 1998). The NVCS is currently supported and endorsed by multiple federal agencies, the Federal Geographic Data Committee (FGDC), NatureServe, state natural heritage programs, and the Ecological Society of America. Refinements to the classification occur in the process of application, leading to ongoing proposed revisions that are reviewed both locally and nationally.

Vegetation Mapping Program Standards

The NPS Inventory & Monitoring Program established guidance and standards for all vegetation mapping projects in a series of documents:

Protocols

- documenting a National Vegetation Classification System (TNC and ESRI 1994a);
- standards for field methods and mapping procedures (TNC and ESRI 1994b);
- producing rigorous and consistent accuracy assessment procedures (TNC and ESRI 1994c);
- establishing standards for using existing vegetation data (TNC 1996);

Standards

- National Vegetation Classification Standard (FGDC 1997);
- Spatial Data Transfer Standard (FGDC 1998b);
- Content Standard for Digital Geospatial Metadata (FGDC 1998a);
- United States National Map Accuracy Standards (USGS 1999);
- Integrated Taxonomic Information System (http://www.itis.gov/);
- Program-defined standards for map attribute accuracy and minimum mapping unit.

These documents are available at the USGS-NPS Vegetation Program Web site (http://biology.usgs.gov/npsveg/standards.html).

Study Area

Homestead National Monument of America

On March 16, 1936, federal legislation was passed creating a new unit in the National Park System on the site of the Daniel Freeman homestead, recognized as the first homestead in the nation obtained through the Homestead Act of 1862. It is located on 184 acres in Gage County, west of Beatrice, NE.

Homestead National Monument is home to the second-oldest tallgrass prairie restoration in the nation. Prior to acquisition by the NPS, the 100-acre area that is now restored prairie was heavily used for agriculture and grazing. The restoration was accomplished through a combination of seeding a mix of native grasses, installation of native plant plugs, and transplanting sod from local areas of unplowed prairie. Management for exotic species has involved mowing, selective herbicide application, and, beginning in 1970, prescribed burning on a regular basis. The restored prairie reflects the species richness and diversity of its historic source, but has more woody species in some locations (James and Debacker 2007). Approximately 0.75 acres of tallgrass prairie, which had never been plowed, are located next to the Freeman School, which was incorporated into the park in 1970.

Sixty acres of lowland Bur Oak Woodland are also present at HOME along Cub Creek, remnants of a bur oak wooded community that was recorded occurring on the site in the Public Land Office survey of 1857. It reflects the pre-settlement community that occurred here with some very large characteristic bur oak trees and has been studied as a rare natural plant community (Rolfsmeier 2007).

Significant facilities and cultural resources are present at Homestead National Monument. A multipurpose Heritage Center opened in May 2007, containing interactive displays on homesteading, a view of the tallgrass prairie to depict how early pioneers might have seen it, and a parking lot exactly one acre in size to give visitors a sense of scale. Another resource available to visitors is the Education Center, which includes a log cabin built in 1867 and museum displays of tools and farm machinery. The one-room Freeman School House was built in 1872 and holds a long history of use: it was a school until 1967 and was also used as a meeting place for the First Trinity Lutheran Church, the polling place for Blakely Township, and a gathering place for many debates, socials and clubs.

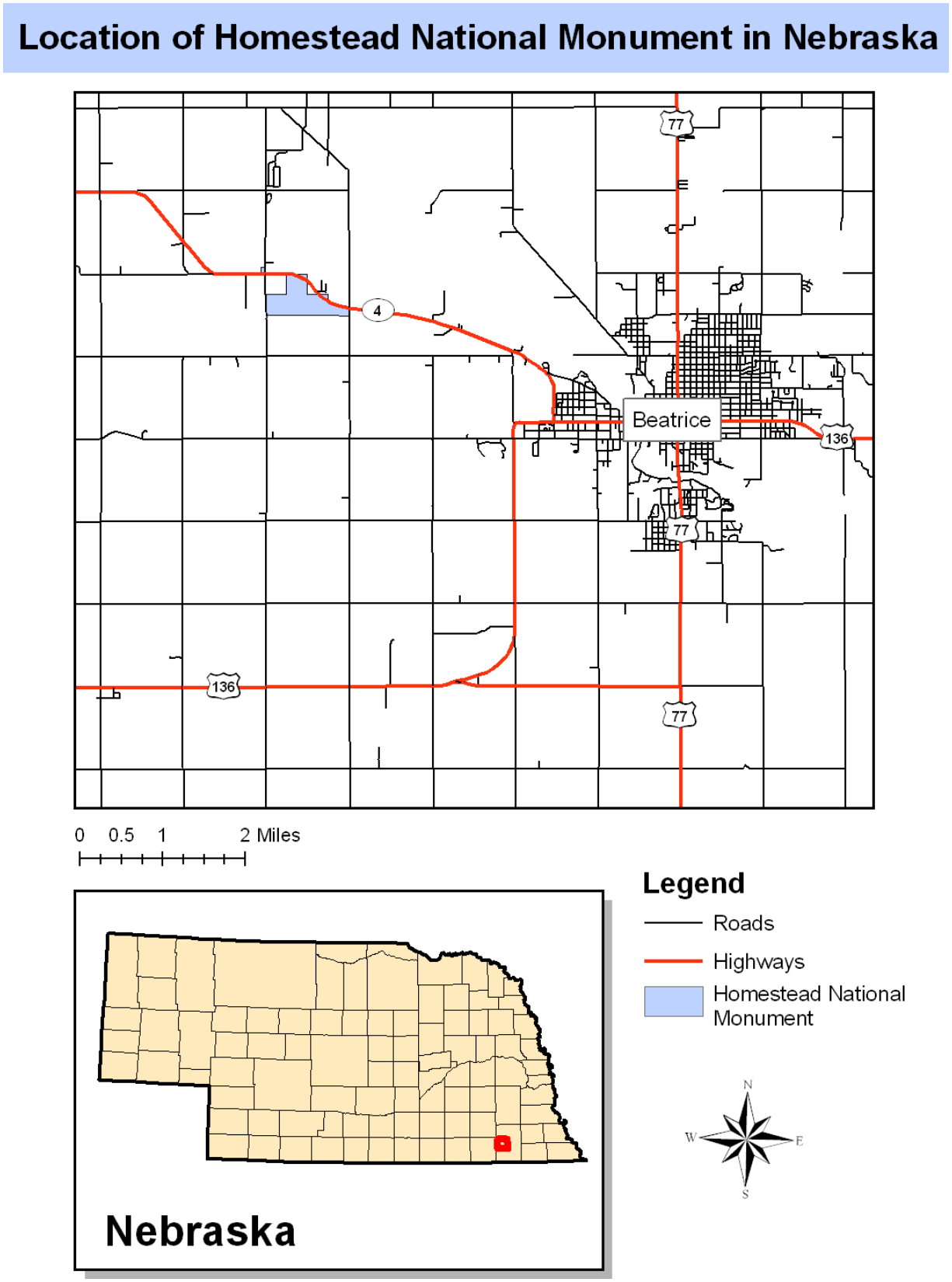

Figure 1. Location of Homestead National Monument in Beatrice, NE.

Project Statistics

Field Work Summers of 2008 and 2009:

Plot Sampling = 17 Plots:
17 Plots Sampled in July 2008 by the Kansas Biological Survey staff

Accuracy Assessment Points = 12
12 Points assessed in July 2009 by the Kansas Biological Survey staff

Classification:

4 NVC Vegetation Classes
2 Park Special Vegetation Classes
4 Non-Vegetated Land-Use Classes

GIS Database 2008-2009:

Project Size = 1,725 acres (698.08 hectares)
Homestead National Monument = 184 acres (74.46 hectares)

Base Imagery acquired from the NPS:
Spring 2001 Ikonos image
1991 USGS Digital Orthophoto Quarter Quads (DOQQs)
1971 and 1937 panchromatic imagery

Ancillary Imagery acquired by the Kansas Applied Remote Sensing Program (KARS), a program of the Kansas Biological Survey:
2003, 2006, 2007, and 2009 USDA Farm Service Administration National Agriculture Imagery Program (NAIP)
2007 Custom CIR and RGB imagery from KARS

Minimum Mapping Unit = ½ hectare

Total Size = 60 Polygons

Average Polygon Size = 28.8 acres (11.65 hectares)

Overall Thematic Accuracy = 100%

Project Completion Date: 06/30/10

Methods

The vegetation mapping project at HOME was considered to be in the "small park" category based on the overall size of the project area (TNC and ESRI 1994b). As such, the standard methodology for sampling and mapping is to visit every vegetation polygon in the park. It is assumed that these sites will sufficiently characterize the vegetation types and explain their distribution across the park without having to survey each stand of vegetation. Based on this approach the assignment of responsibilities was divided into five major tasks, including the following:

1. Plan, gather data, and coordinate tasks;

2. Survey HOME to understand and sample the vegetation;

3. Classify the vegetation using the field data to NVC standard associations and alliances and crosswalk these to recognizable map units;

4. Acquire current digital imagery and interpret the vegetation from these using the classification scheme and a map unit crosswalk;

5. Assess the accuracy of the final map product.

All protocols for this project as outlined in the following sections can be found in documents produced by TNC and ESRI (1994a, 1994b, 1994c) for the USGS-NPS Vegetation Mapping Program. These documents can be found at: http://biology.usgs.gov/npsveg.

Planning, Data Gathering and Coordination

A scoping meeting was held in June 2007 with all project participants (Kansas Biological Survey, NatureServe, Nebraska Natural Heritage Program, NPS Heartland Network staff, Homestead National Monument staff, Kansas Park Trust, National Park Service National Vegetation Mapping staff, and the Nature Conservancy). KBS was responsible for plot sampling and reconnaissance visits of potential community types of HOME. KBS was also responsible for entering these data into a digital database, classifying the data, and providing a list and global descriptions for the HOME plant associations. KBS was responsible for the imagery interpretation and creating a digital vegetation map and spatial database. NatureServe reviewed and evaluated the draft classification and wrote vegetation descriptions for all associations. KBS created a vegetation key, and conducted accuracy assessment of the vegetation map. NatureServe and HOME staff provided logistical and technical support, and helped coordinate activities.

The project boundary included the area within HOME as well as a 0.5 mile environs (Figure 2).

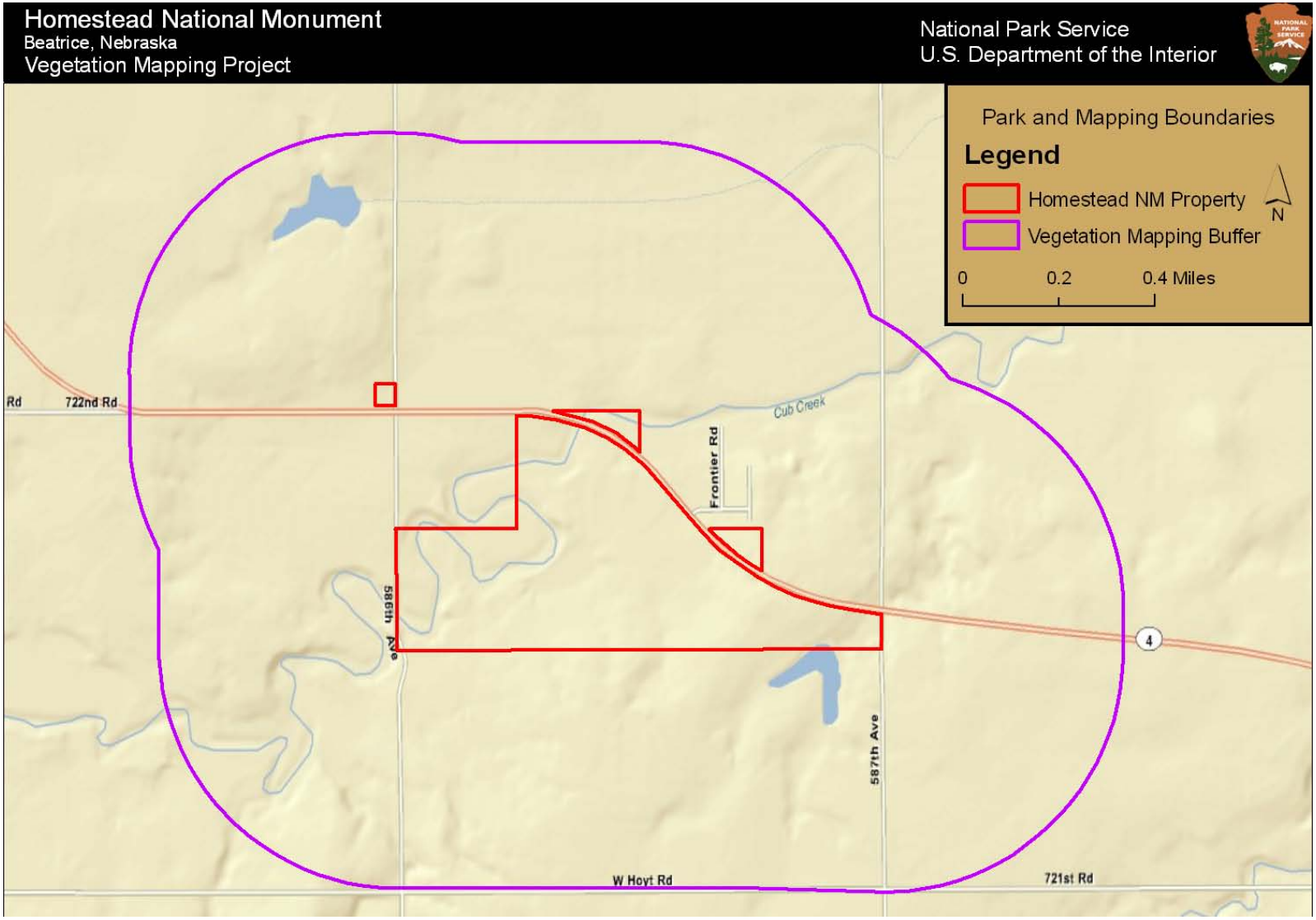

Figure 2. Map of the vegetation project boundary and park boundary.

Field Survey

Overall, the field methods used by the Kansas Natural Heritage Inventory in sampling and classifying the vegetation followed the methodology outlined by the USGS-BRD/NPS Vegetation Mapping Program and the NVC (Grossman et al. 1994, Grossman et al. 1998).

Vegetation data were collected in characteristic plots by KBS in July 2008 and additional plot information was acquired from the HTLN (Figure 3). Characteristic plots were located in areas that were visually representative of the preliminary vegetation categories. Plots were 100 m^2 in area, and GPS coordinates were recorded with a Garmin receiver. To maintain consistency with other projects, plots were square. The accuracy for all of the recorded points ranged from 1-7 meters in horizontal accuracy, as recorded by the GPS receiver. Thirteen plots were sampled in the preliminary vegetation type "Restored Prairie," and three plots were sampled in the preliminary vegetation type "Central Tallgrass Prairie."

The survey form used for characteristic plot data is located in Appendix B. All plants found within the characteristic plots were identified to species level where possible. In some cases, identification was only possible to the genus level (i.e., non-reproductive *Muhlenbergia* and *Carex* species). Visual estimates of percent cover were made for all species, including live material and the current year's standing dead. To maintain consistency with local vegetation surveys and other work of KBS, a continuous range of possible cover estimates was used, rather than cover classes. Plants that covered less than one half of one percent of the plot were classified as a "trace" (T). Also to maintain consistency with published accounts and similar projects in the region, species were assigned names following the Flora of the Great Plains (McGregor and Barkley 1986). An updated synonymy was completed when data were entered into the PLOTS database. Noteworthy surrounding vegetation, slopes, unusual soil features, and noticeable use by animals were also noted at each plot. Most of HOME had been previously plowed for agriculture but has been restored to prairie, and many of the plots were on a gentle slope with an A horizon of silt or silty clay loam soils.

Additional plot data were obtained from the HTLN, which had sampling data from 2005 and 2006 on ten permanent plots. Each plot was comprised of two transects 50 m in length, with ten sets of nested subplots systematically arranged. Working from the smallest to the largest plot, all herbaceous, woody shrub and tree seedling and sapling species were identified. Foliar cover was estimated in the 10 m^2 subplot using a modified Daubenmire (1959) scale. Trees less than 5.0 cm diameter at breast height (dbh) were tallied by species in each 10 m^2 subplot. In woodland communities, stem density was used to estimate abundance of tree species. Seedlings and saplings were counted and assigned to one of three size classes (<0.5 m dbh, 0.5–2.5 m dbh, or 2.5–5.0 m dbh). The 0.1 ha area between the two transects was used to collect data on the woody species greater than 5.0 cm dbh in the understory and overstory canopy layers. Diameter at breast height was measured for each individual tree greater than or equal to 5.0 cm.

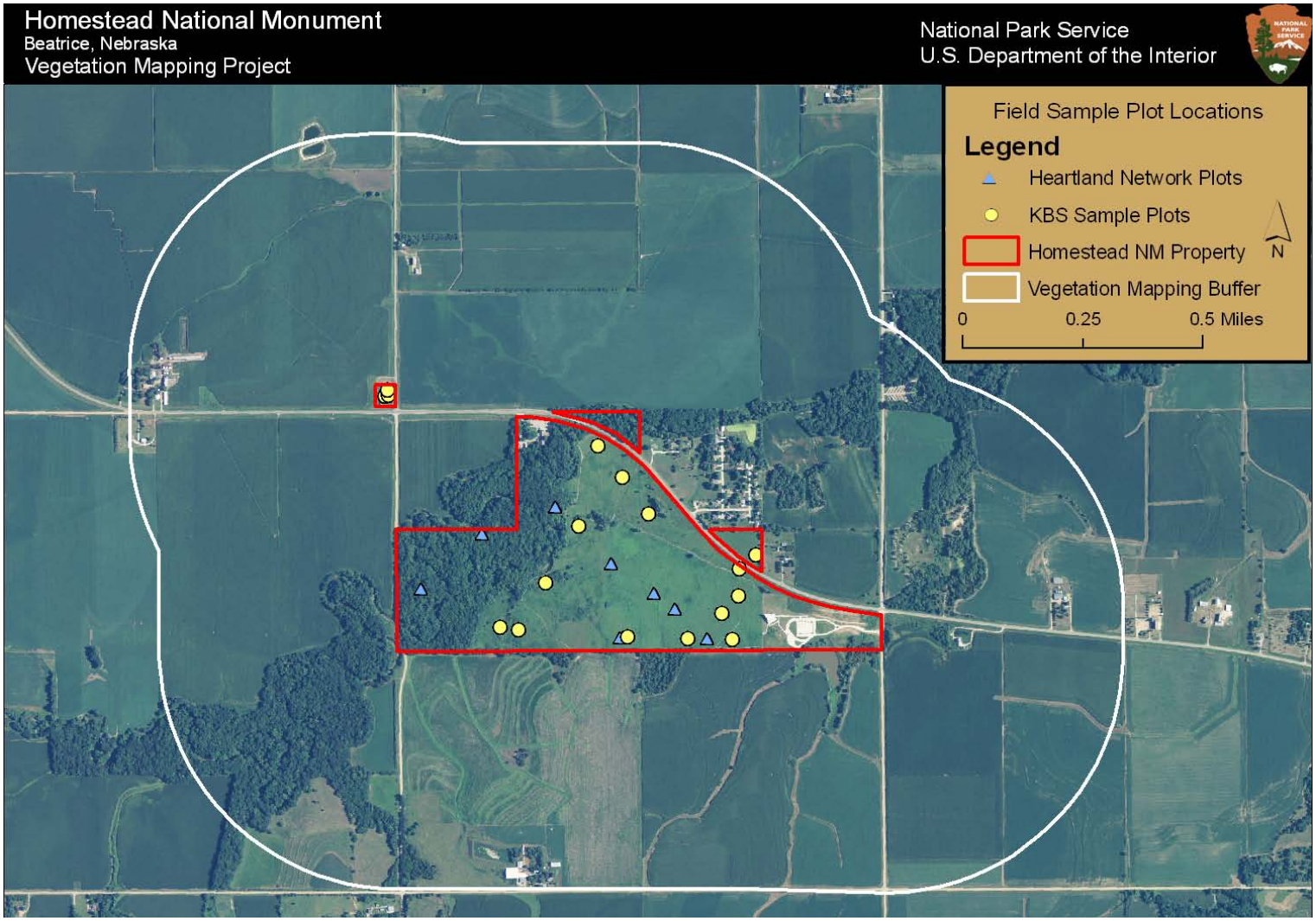

Figure 3. Locations of all vegetation plots collected at Homestead National Monument of America in 2008.

Vegetation Classification

Upon completion of field surveys, all recorded data were entered into the NPS PLOTS database (TNC 1997), a Microsoft Access-derived program. The PLOTS database was developed specifically for the NPS vegetation and mapping program so that the electronic data entry fields mirror the standard field form. Data entry was facilitated by assigning each plant taxon a unique, standardized code and name based on the PLANTS database developed by Natural Resources Conservation Service in cooperation with the Biota of North America Program (USDA and NRCS 2009). Data was thoroughly proofed after entry to minimize errors.

Plots were assigned to categories based on similarity of vegetation. These categories were assigned names following descriptions in Lauver et al. (1999) and NatureServe Explorer (NatureServe 2006). Where the observed HOME vegetation did not fit descriptions of natural associations described for Nebraska, semi-natural and disturbed associations or alliances described for other parks were considered. Most of the vegetation at HOME had been planted with native species following years of agricultural use. These areas were assigned to the alliances of the dominant native species planted, with the addition of the term "Restored." In this manner, HOME vegetation was assigned to one of six plant associations and alliances.

Once the associations were finalized, a dichotomous key was developed by KBS for use during the Accuracy Assessment (Appendix C). The full NVC hierarchical classification and global descriptions are available in the results section. In addition, the final associations were linked to map classes for use in the photo-interpretation and mapping portions of the project.

In the future, HOME classification plot data will be used by NatureServe and KBS to update and improve world-wide (i.e., global) descriptions of the NVC plant associations. HOME specific (i.e., local) descriptions were written based on HOME plot and AA data. The final HOME classification contains four NVC vegetation classes and two Park Special vegetation classes.

Digital Imagery and Interpretation

The mapping component was initiated by photo interpretation and digitization of 3-band 2001 color infrared (CIR) IKONOS imagery for the vegetation and land use classes determined through the field visit and expert knowledge of project team members. The heads-up digitization was performed at a display scale of 1:1000 to 1:1500. The digitization, evaluation, and modifications were iterative and collaborative processes involving the GIS analysts and the rest of the team. Preliminary maps were checked, corrected, and rechecked for boundary delineations. Final edits were made using the 2009 NAIP imagery, which captured the changes made along the eastern end of the property with the construction of the visitor's center.

Because vegetation phenology, and moisture conditions, and land management practices such as grazing and burning reveal or mask target map features in the imagery, multiple image sources were used during the mapping project in an attempt to extract the most accurate and comprehensive feature classifications possible. There was no one image that captured all vegetation communities and features at their peak differentiability. As noted above, a spring 2001 IKONOS image provided by the NPS served as the general basemap, with additional images used to check mapped features and make adjustments as needed. These image sources included 2003, 2006, 2007, and 2009 (3-band, R,G,B) USDA FSA NAIP, 1993 USGS DOQQs,

and 1971 and 1937 panchromatic imagery. Additionally, in the fall of 2007, custom 0.7 m and 1 m CIR and RGB imagery was acquired using the Kansas Applied Remote Sensing Program's aerial imaging system. Although the individual images were georeferenced, they were not orthorectified. Because they lacked the documented positional accuracy of the other imagery they were used to identify areas of interest but not used for digitization of polygons.

Color infrared imagery is often called false-color because the objects that are normally red appear green, green objects (except vegetation) appear blue, and "infrared" objects appear red. Because healthy green vegetation is a very strong reflector of infrared radiation, and appears bright red in color infrared imagery, it helps tremendously in vegetation mapping efforts. Through the use of color infrared imagery subtle differences between cool and warm season grasses, wetland vegetation and deciduous trees are apparent and can be accurately delineated.

Polygons were assigned map class number and name. The vegetation community polygons and other related and supporting data were then incorporated into a geodatabase format.

Accuracy Assessment

Once the vegetation layer was finalized, the accuracy assessment (AA) was conducted. Typically in mapping exercises both thematic or attribute map accuracy and the positional or polygon line accuracy are considered. In the case of the USGS-NPS National Vegetation Mapping Program, however, the positional accuracy is usually omitted since vegetation rarely splits on discrete edges that can be positively located in the field. The subjectivity involved in this effort plus the high resolution and accuracy of the NAIP basemaps usually allows for the assumption that all products derived from them are well within National Map Accuracy Standards for 1:12,000-scale maps (±30 feet).

The thematic accuracy of the vegetation map was assessed following the standards provided by the USGS-NPS National Vegetation Mapping Program's Accuracy Assessment Procedures manual (TNC and ESRI 1994c). Assessment included a four step process consisting of a sample design, sample site selection, data collection and data analysis. The design of the AA process followed the five possible scenarios provided in the field manual with stratified random targets placed in each map class based on their respective frequency and abundance (Table 1).

These parameters were loaded into a GIS program along with the vegetation layer. Hawth's Analysis Tools for ArcGIS (Beyer 2004) was used to pick the random target locations and to buffer them 10 meters away from any polygon boundary and 50 meters from any other point. Being able to choose minimum distance to polygon boundaries helped to minimize confusion and accounted for the horizontal error typically encountered in common GPS receivers (±5 m). The resulting target locations were restricted to the authorized boundaries of HOME due to private land access constraints.

Once the target locations were selected they were downloaded to Garmin or Trimble GPS receivers and investigators walked to the AA points to complete the assessment. During the course of the field work, the estimated position error readings on GPS receivers ranged from 1-7 meters. KBS botanists were also provided with draft field maps, map unit definitions, and a key to the associations and alliances (Appendix C). In July 2009, KBS botanists traveled to 12 AA

target sites and determined the vegetation association using the field key. At each target they recorded vegetation data on an AA form. They also recorded height and cover of vegetative strata, environmental data, and percent canopy cover of the major species (see AA point form in Appendix D). A rationale for the choice of dominant association was noted when the decision was not clear-cut.

Table 1. Target number of AA samples per map class based on number of polygons and area.

Scenario	Description	Polygons in class	Area occupied by class	Recommended number of samples in class
Scenario A:	The class is abundant. It covers more than 50 hectares of the total area and consists of at least 30 polygons. In this case, the recommended sample size is 30.	>30	>50 ha	30
Scenario B:	The class is relatively abundant. It covers more than 50 hectares of the total area but consists of fewer than 30 polygons. In this case, the recommended sample size is 20. The rationale for reducing the sample size for this type of class is that sample sites are more difficult to find because of the lower frequency of the class.	<30	>50 ha	20
Scenario C:	The class is relatively rare. It covers less than 50 hectares of the total area but consists of more than 30 polygons. In this case, the recommended sample size is 20. The rationale for reducing the sample size is that the class occupies a small area. At the same time, however, the class consists of a considerable number of distinct polygons that are possibly widely distributed. The number of samples therefore remains relatively high because of the high frequency of the class.	>30	<50 ha	20
Scenario D:	The class is rare. It has more than 5 but fewer than 30 polygons and covers less than 50 hectares of the area. In this case, the recommended number of samples is 5. The rationale for reducing the sample size is that the class consists of small polygons and the frequency of the polygons is low. Specifying more than 5 sample sites will therefore probably result in multiple sample sites within the same (small) polygon. Collecting 5 sample sites will allow an accuracy estimate to be computed, although it will not be very precise.	5-30	<50 ha	5
Scenario E:	The class is very rare. It has fewer than 5 polygons and occupies less than 50 hectares of the total area. In this case, it is recommended that the existence of the class be confirmed by a visit to each sample site. The rationale for the recommendation is that with fewer than 5 sample sites (assuming 1 site per polygon) no estimate of level of confidence can be established for the sample (the existence of the class can only be confirmed through field checking).	<5	<50 ha	Visit all and confirm

During 2009 a total of 12 AA points were sampled (Figure 4). The data recorded on the field forms were subsequently entered into the PLOTS database and reviewed for data entry errors by KBS staff. The results were imported from the database into a GIS layer where they were visually compared in two stages to the vegetation map coverage. The first step was to compare the AA points to the original target locations to check for erroneous points. However, no GPS receiver or location errors were observed.

The second review step involved comparing the vegetation classification assigned by the field botanists to the vegetation classification assigned to the mapped polygon. If a mismatch was found, the mapped polygon would be corrected. However, due to the small nature of the park and the small number of AA points, there were no discrepancies between the mapped and observed vegetation classifications.

Once the data were reviewed, the accuracy analysis was conducted. In the case of HOME, the AA process was streamlined using methods developed from previous studies at Rocky Mountain National Park (Salas et al. 2004) and Wupatki National Monument (Hansen et al. 2004). All of the statistics and calculations used to analyze these data are described at length in the program manuals (TNC and ESRI 1994c) and are summarized in Table 2. Final assessments for each point were recorded using an error matrix.

Table 2. Summary of the AA statistics used at HOME.

Statistic	Description
User's Accuracy	The fraction of accuracy assessment observations in a map class that were found to have the correct vegetation class in the field.
Producer's Accuracy	The fraction of accuracy assessment observations in a vegetation class in the field that were found to be mapped correctly.
Overall Accuracy	The fraction of accuracy assessment observations within all map classes that were correctly mapped.
Kappa Index	Another measure of overall accuracy, which takes into account the probability that mapped polygons will be correct due to random chance.

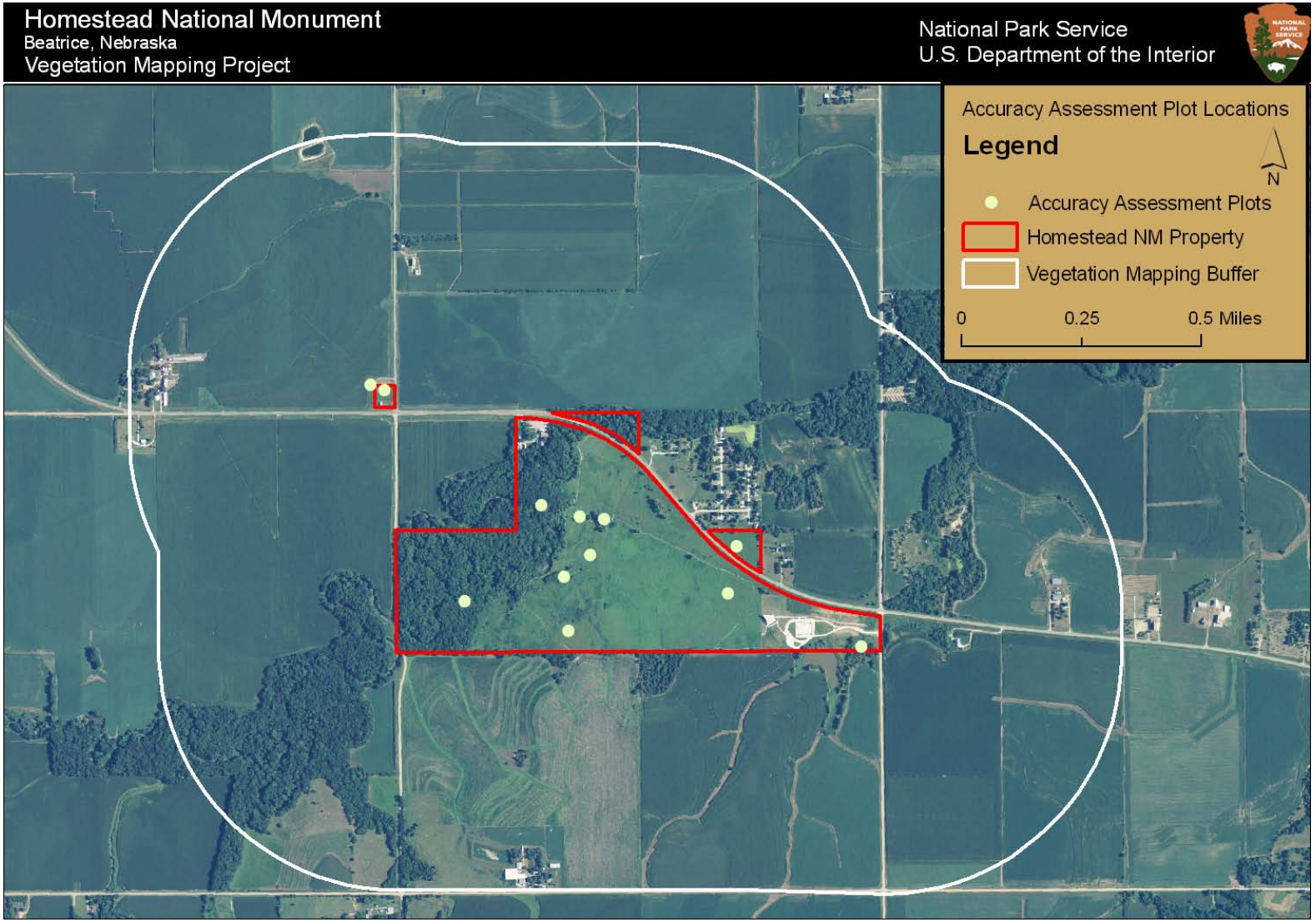

Figure 4. Locations of all accuracy assessment points collected at Homestead National Monument in 2009.

Results

Vegetation Classification

The final classification for HOME resulted in six vegetation classes, four of which had NVC descriptors. Two of the classes, upland and lowland restored prairie, were considered Park Specials. The classification results reflect both the moderate amount of diversity of vegetation in the park and a respectably high number of native species. During the sampling efforts a total of 318 species were recorded (Appendix E).

Digital Imagery and Interpretation

For HOME, ten map units were developed and directly matched to corresponding plant associations and land-use classes (Table 3). The types included six vegetation based map units and four land-use classes.

Vegetation Map

Just over 698 acres, including 214 acres in the authorized boundary of HOME and an additional 484 acres in the environs, were mapped using ten map classes (Figure 5). This included four land cover classes and six vegetation classes. Of all the map units, the most frequent was *Fraxinus pennsylvanica / Ulmus spp. / Celtis occidentalis* Forest with 21 polygons. *Fraxinus pennsylvanica / Ulmus spp. / Celtis occidentalis* Forest was also the most abundant map unit in terms of area other than cropfields in the environs, covering 219 acres (89 hectares) or about 13% of the project area. All of the frequencies for each map unit (i.e., number of polygons) along with acreage per map unit are listed in Table 3.

Normally the standard minimum mapping unit for NPS vegetation mapping projects is defined as 0.5 hectare. However this is a nominal unit and due to the small size of HOME and the resolution of the imagery it was reduced to allow for more detail in the mapping. Therefore, 13 of the total 60 polygons were under 0.5 hectare. The average area of polygons for this project was 28.8 acres (11.6 hectares).

Accuracy Assessment

The 2009 accuracy assessment effort yielded 12 points that were distributed throughout HOME; none were sampled in the environs due to access constraints.

During analysis of the AA points, a GIS point file was created from the AA point coordinates recorded in the field. These were then overlaid on the vegetation map and a comparison of the final AA field call versus the vegetation polygon label was conducted.

Examination of the final error matrix (Appendix A) shows that there was no confusion between map units, as the accuracy assessment resulted in 100% accuracy. This high level of accuracy is likely due to the small size of HOME which allowed thorough sampling during the vegetation mapping stage.

Table 3. Map units identified at HOME, with their total frequency and acreage.

NVC Identifier	Common Name	Scientific Name / Description	Frequency	Acres	Hectares
Forest and Woodland					
CEGL002053	Bur Oak Woodland	*Quercus macrocarpa* / *Andropogon gerardii* / *Hesperostipa spartea* Woodland	1	22.8	9.2
CEGL002014	Successional Forest	*Fraxinus pennsylvanica* / *Ulmus* spp. / *Celtis occidentalis* Forest	21	219.0	88.6
Herbaceous Vegetation					
CEGL002202	Native Tallgrass Prairie	*Andropogon gerardii* / *Hesperostipa spartea* / *Sporobolus heterolepis* Herbaceous Vegetation	1	0.2	0.1
(No assigned code)	Upland Restored Prairie	Planted Semi-natural Upland Restored Tallgrass Prairie, areas of the upland that were restored to a tallgrass prairie mix of species	3	42.4	17.1
(No assigned code)	Lowland Restored Prairie	Planted Semi-natural Lowland Restored Tallgrass Prairie, areas of the lowland that were restored to a tallgrass prairie mix of species	2	55.9	22.6
CEGL005264	Smooth Brome	*Bromus inermis - (Pascopyrum smithii)* Semi-natural Herbaceous Vegetation	2	21.1	8.5
Land Use/Land Cover					
(No assigned code)	Cropfields	Areas planted to cropland	13	1212.8	490.8
(No assigned code)	Developed Land	Buildings and adjacent lands	13	76.4	30.9
(No assigned code)	Ponds/Water Bodies	Man-made impoundments	3	4.6	1.9
(No assigned code)	Roadways	Highways, county roads, and rights-of-way	1	69.8	28.3
Total Land Use/Land Cover			30	1363.7	551.9
Total Natural Vegetation			30	361.4	146.2
Totals			**60**	**1725.1**	**698.1**

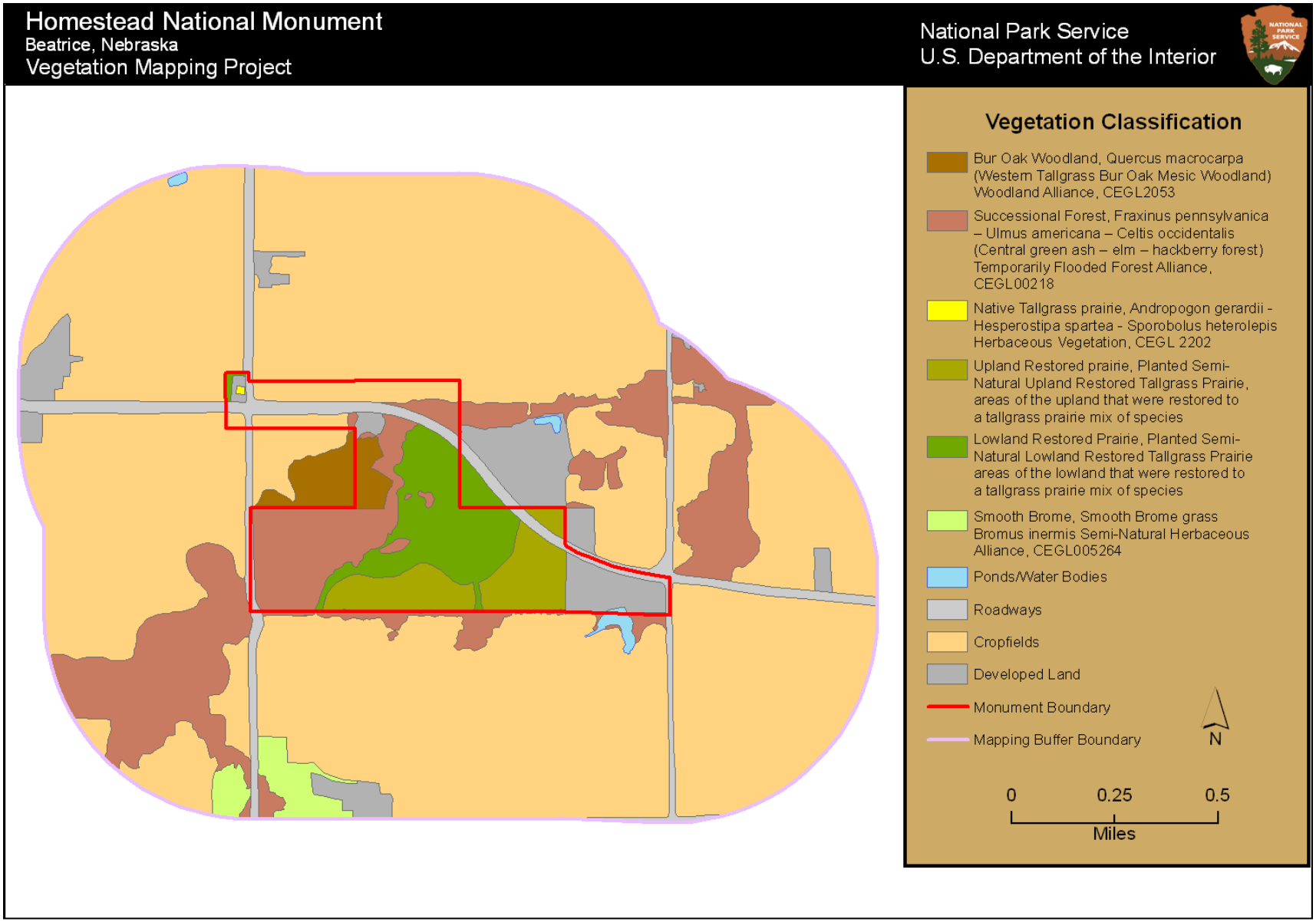

Figure 5. Vegetation map of Homestead National Monument and environs.

Vegetation Associations

Mapped Unit Name: Bur Oak Woodland
Common Name: Western Tallgrass Bur Oak Woodland
Scientific Name: *Quercus macrocarpa / Andropogon gerardii - Hesperostipa spartea* Woodland
Bur Oak / Big Bluestem - Porcupine Grass Woodland
NVC Identifier: CEGL002053

Figure 6. Bur Oak Woodland at Homestead National Monument, with understory of Canadian woodnettle (*Laportea canadensis*) and Virginia wildrye (*Elymus virginicus*), July 2009.

Global Summary: This bur oak woodland community (Figure 6) is associated with the floodplains of rivers and streams in the central-western tallgrass region of the midwestern United States. Stands occur on gentle to steep slopes with silt or loam soils. Soils are well-drained to moderately well-drained, sometimes shallow (0-40 cm), and formed from loess or glacial till. The overstory of this community is open and dominated by *Quercus macrocarpa* (bur oak). *Quercus muehlenbergii* (chinkapin oak) can be a common associate. Shrubs are absent to common, and include *Cornus drummondii* (roughleaf dogwood), *Ceanothus herbaceus* (New Jersey tea), *Corylus americana* (American hazelnut), *Prunus americana* (American plum), *Rhus glabra* (smooth sumac), *Ribes missouriense* (Missouri gooseberry), *Symphoricarpos occidentalis* (western snowberry), and *Zanthoxylum americanum* (common pricklyash). The herbaceous

stratum can be similar to dry prairie. It includes the grasses *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), *Sporobolus heterolepis* (prairie dropseed), and *Hesperostipa spartea* (porcupinegrass), as well as *Maianthemum stellatum* (starry false lily of the valley), *Monarda fistulosa* (wild bergamot), and *Solidago canadensis* (Canada goldenrod). In the past, periodic fires kept the canopy from closing. Where fire regimes have been disrupted, this community often begins to succeed to other, more closed oak types.

Global Environmental Description: This community occurs near floodplains and on gently sloping to steep upland mesic sites especially within 30 km of the Missouri River but possibly along other rivers. In Nebraska it may have been most abundant in the southeast because conditions are most suitable for tree growth there. The soils on which this community occurs are silt or loam, shallow to deep, with a pH range from 5.6-7.3. The soils of this community are moderately well-drained to well-drained. The parent material is loess or glacial till (Nelson 1987, Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

Global Vegetation Description: The overstory of this community is open and dominated by *Quercus macrocarpa* (bur oak). *Quercus muehlenbergii* (chinkapin oak) can be a common associate. Shrubs are absent to common and include *Cornus drummondii* (roughleaf dogwood), *Ceanothus herbaceus* (New Jersey tea), *Corylus americana* (American hazelnut), *Prunus americana* (American plum), *Rhus glabra* (smooth sumac), *Ribes missouriense* (Missouri gooseberry), *Symphoricarpos occidentalis* (western snowberry), and *Zanthoxylum americanum* (common pricklyash). The herbaceous stratum can be similar to dry prairie. It includes the grasses *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass), *Sporobolus heterolepis* (prairie dropseed), and *Hesperostipa spartea* (porcupinegrass), as well as *Maianthemum stellatum* (starry false lily of the valley), *Monarda fistulosa* (wild bergamot), and *Solidago canadensis* (Canada goldenrod). In the past, periodic fires kept the canopy from closing. Where fire regimes have been disrupted, this community often begins to succeed to other, more closed oak types (Nelson 1987, Lauver et al. 1999, Steinauer and Rolfsmeier 2000).

Most Abundant Species:

Table 4. Overstory Tree Species within Bur Oak Woodland. (Data collected by the Heartland Network, n=1 plot).

Scientific Name	Common Name	Total DBH
Quercus macrocarpa	bur oak	549.1
Celitis occidentalis	common hackberry	260.2
Ulmus americana	American elm	143.3
Acer saccharum	sugar maple	107.9
Morus alba	white mulberry	15.9

Table 5. Average percent cover of the top twenty most common understory species within Bur Oak Woodland. (Data collected by the Heartland Network, n=1 plot).

Scientific Name	Common Name	% Cover
Laportea canadensis	Canadian woodnettle	22.7
Parthenocissus quinquefolia	Virginia creeper	3.7
Polygonum virginianum	jumpseed	2.7
Carex sp.	sedge	1.1
Smilax tamnoides	bristly greenbrier	1.0
Elymus virginicus	Virginia wildrye	0.8
Verbesina alternifolia	wingstem	0.5
Toxicodendron radicans	poison ivy	0.5
Urtica dioicia	California nettle	0.5
Cryptotaenia canadensis	Canadian honewort	0.4
Diarrhena obovata	obovate beakgrain	0.4
Symphoricarpos orbiculatus	coralberry	0.3
Ageratina altissima	white snakeroot	0.3
Geum canadense	white avens	0.3
Viola sp.	violet	0.3
Festuca subverticillata	nodding fescue	0.2
Galium aparine	stickywilly	0.2
Hackelia virginiana	beggarslice	0.1
Pilea pumila	Canadian clearweed	0.1
Sanicula odorata	clustered blacksnakeroot	0.1

Global Conservation Status Rank & Reasons: G2G3. This community has been highly degraded in the mesic sites where it occurred historically. Bur oak woodlands and forests have recently spread upslope into drier areas in the absence of fires. Sites also occur in Missouri in association with loess hill prairies, but are not tracked for conservation purposes because of low quality (M. Leahy pers. comm. 1999). Note that the bur oak woodland community type indicated here uses the current NVCS description, which is a broader treatment than that presented in Rolfsmeier and Steinhaur (2010, p. 78), who specifically mention the HOME stand as an exemplary site for the more narrowly defined Dry-Mesic Bur Oak Forest and Woodland.

Mapped Unit Name: Successional Forest
Common Name: Central Green Ash - Elm - Hackberry Forest
Scientific Name: *Fraxinus pennsylvanica* - *Ulmus* spp. - *Celtis occidentalis* Forest
Green Ash - Elm species - Common Hackberry Forest
NVC Identifier: CEGL002014

Figure 7. Successional Forest at Homestead National Monument, with understory of Virginia wildrye (*Elymus virginicus*) and coralberry (*Symphoricarpos orbiculatus*), July 2009.

Global Summary: This community (Figure 7) is found in the central United States along upper floodplain terraces of rivers and streams and in upland ravine bottoms. Soils are moderately well-drained to poorly drained. Tree canopies are dominated by *Fraxinus pennsylvanica* (green ash), *Celtis occidentalis* (common hackberry), and *Ulmus americana* (American elm). Other tree species that may be present include *Juglans nigra* (black walnut), *Tilia americana* (American basswood), *Acer saccharinum* (silver maple), and *Populus deltoides* (eastern cottonwood). *Ulmus rubra* (slippery elm) can be part of the subcanopy. The shrub layer in the western part of the range includes *Cornus drummondii* (roughleaf dogwood), *Ribes missouriense* (Missouri gooseberry), *Symphoricarpos occidentalis* (western snowberry), and *Zanthoxylum americanum* (common pricklyash), as well as woody vines, such as *Parthenocissus vitacea* (woodbine), *Smilax tamnoides* (bristly greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). The herbaceous layer in the western part of its range includes *Elymus*

virginicus (Virginia wildrye), *Festuca subverticillata* (nodding fescue), *Galium aparine* (stickywilly), *Geum canadense* (white avens), and *Laportea canadensis* (Canadian woodnettle).

Global Environmental Description: Stands occur along upper floodplain terraces of rivers and streams and in upland ravine bottoms. Soils are moderately well-drained to poorly drained.

Global Vegetation Description: The vegetation has an open to closed tree canopy that is dominated by *Fraxinus pennsylvanica* (green ash), *Celtis occidentalis* (common hackberry), and *Ulmus americana* (American elm). Other tree species that may be present include *Juglans nigra* (black walnut), *Tilia americana* (American basswood), *Acer saccharinum* (silver maple), and *Populus deltoides* (eastern cottonwood). *Ulmus rubra* (slippery elm) can be part of the subcanopy. The shrub layer in the western part of the range includes *Cornus drummondii* (roughleaf dogwood), *Ribes missouriense* (Missouri gooseberry), *Symphoricarpos occidentalis* (western snowberry), and *Zanthoxylum americanum* (common pricklyash), as well as woody vines such as *Parthenocissus vitacea* (woodbine), *Smilax tamnoides* (bristly greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). The herbaceous layer in the western part of the range includes *Elymus virginicus* (Virginia wildrye), *Festuca subverticillata* (nodding fescue), *Galium aparine* (stickywilly), *Geum canadense* (white avens), and *Laportea canadensis* (Canadian woodnettle) (Steinauer and Rolfsmeier 2000).

Most Abundant Species:

Table 6. Overstory Tree Species within Successional Forest. (Data collected by the Heartland Network, n=2 plots).

Scientific Name	Common Name	Total DBH
Celtis occidentalis	common hackberry	1810.6
Quercus macrocarpa	bur oak	298.2
Ulmus americana	American elm	70.1
Fraxinus pennsylvanica	green ash	61.0
Morus alba	white mulberry	41.2
Juglans nigra	black walnut	31.9

Table 7. Average percent cover of the top twenty-one most common understory species within Successional Forest. (Data collected by the Heartland Network, n=2 plots).

Scientific Name	Common Name	Average % Cover
Laportea canadensis	Canadian woodnettle	34.0
Verbesina alternifolia	wingstem	15.5
Parthenocissus quinquefolia	Virginia creeper	1.7
Elymus virginicus	Virginia wildrye	1.3
Carex sp.	sedge	1.0
Festuca subverticillata	nodding fescue	0.7
Parietaria pensylvanica	Pennsylvania pellitory	0.7
Toxicodendron radicans	poison ivy	0.7
Smilax tamnoides	bristly greenbrier	0.6
Viola missouriensis	Missouri violet	0.6
Urtica dioicia	California nettle	0.4
Boehmeria cylindrica	smallspike false nettle	0.4
Ageratina altissima	white snakeroot	0.3
Hackelia virginiana	beggarslice	0.2
Galium aparine	stickywilly	0.1
Phryma leptostachya	American lopseed	0.1
Polygonum virginianum	jumpseed	0.1
Sanicula odorata	clustered blacksnakeroot	0.1
Chenopodium berlandieri	pitseed goosefoot	0.1
Ribes missouriense	Missouri gooseberry	0.1
Symphoricarpos orbiculatus	coralberry	0.1

Global Conservation Status Rank & Reasons: G3G5.

Mapped Unit Name: Native Tallgrass Prairie
Common Name: Northern Mesic Tallgrass Prairie
Scientific Name: *Andropogon gerardii - Hesperostipa spartea - Sporobolus heterolepis* Herbaceous Vegetation
Big Bluestem - Porcupine Grass - Prairie Dropseed Herbaceous Vegetation
NVC Identifier: CEGL002202

Figure 8. Native Tallgrass Prairie at Homestead National Monument. Note abundant Canada goldenrod (*Solidago canadensis*) and dead stalks of big bluestem (*Andropogon gerardii*), and one stem of common milkweed (*Asclepias syriaca*) in bloom, July 2009.

Global Summary: This mesic big bluestem prairie community (Figure 8) is found in the northern tallgrass prairie region of the United States and Canada. Stands occur on black, friable, organic-rich soils with highly-basic surface horizons. During the warm season, soils are intermittently dry for long periods or have subsurface horizons in which salts or carbonates have accumulated. This is a grassland community with dense vegetation dominated by tall grasses. Forbs are abundant and often have high local diversity. Clumps of trees and tall brush can often be found along the boundary between wetlands and this community. Otherwise, woody vegetation is rare. *Andropogon gerardii* (big bluestem), *Sporobolus heterolepis* (prairie dropseed), *Hesperostipa spartea* (porcupinegrass), and occasionally *Sorghastrum nutans* (Indiangrass), are the most abundant species in this community. *Amorpha canescens* (leadplant),

Symphyotrichum ericoides (white heath aster), and *Solidago canadensis* (Canada goldenrod) are common forbs across this community's range.

Global Environmental Description: Soils of this community are black, friable, organic-rich soils with highly-basic surface horizons. Heidel (1984) found clay loam soils at her two study sites. During the warm season, soils are intermittently dry for long periods or have subsurface horizons in which salts or carbonates have accumulated.

Global Vegetation Description: This is a grassland community with dense vegetation dominated by tall grasses 1-2 m tall. Forbs are abundant and often have high local diversity. Clumps of trees and tall brush can often be found along the boundary between wetlands and this community. Otherwise, woody vegetation is rare. *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indiangrass) are the most abundant species in this community. *Amorpha canescens* (leadplant), *Symphyotrichum ericoides* (white heath aster), and *Solidago canadensis* (Canada goldenrod) are common forbs across this community's range.

Most Abundant Species:

Table 8. Average percent cover of the top twenty-two most common species in plots within Native Tallgrass Prairie. (Plot data collected by KBS in 2008, n=3 plots.)

Scientific Name	Common Name	Average % Cover
Andropogon gerardii	big bluestem	91.67
Solidago canadensis	Canada goldenrod	28.33
Sporobolus heterolepis	prairie dropseed	20.00
Ambrosia trifida	great ragweed	3.00
Rosa arkansana	prairie rose	3.00
Helianthus annuus	common sunflower	2.00
Cirsium altissimum	tall thistle	1.67
Asclepias syriaca	common milkweed	1.33
Amorpha canescens	leadplant	0.68
Cirsium canescens	prairie thistle	0.67
Teucrium canadense	Canada germander	0.67
Conyza canadensis	Canadian horseweed	0.37
Salvia azurea	azure blue sage	0.35
Vernonia baldwinii	Baldwin's ironweed	0.35
Elymus virginicus	Virginia wildrye	0.33
Galium aparine	stickywilly	0.05
Oxalis stricta	common yellow oxalis	0.05
Asclepias sullivantii	prairie milkweed	0.03
Dalea candida	white prairie clover	0.03
Lactuca canadensis	Canada lettuce	0.03
Poa pratensis	Kentucky bluegrass	0.03
Viola pedatifida	prairie violet	0.03

Global Conservation Status Rank & Reasons: G2G3. Much of the former range of this community is now occupied by agriculture.

Mapped Unit/Name:
Common Name: ***Upland Restored Prairie***
Scientific Name: Planted Semi-Natural Upland Restored Tallgrass Prairie, areas of the upland that were restored to a tallgrass prairie mix of species
NVC Identifier: N/A

Figure 9. Upland Restored Prairie at Homestead National Monument. Big bluestem (*Andropogon gerardii*) thrives after a spring burn, with leadplant (*Amorpha canescens*) interspersed, July 2009.

Global Summary: This community (Figure 9) has been defined for Homestead National Monument. At HOME, managers are attempting to restore vegetation to Northern Mesic Tallgrass Prairie through planting native grasses and forbs in formerly plowed fields. Natural vegetation of this community is found throughout the northern tallgrass prairie region of the United States and Canada.

Environmental Description: The fields that have been re-planted with native grasses at Homestead National Monument were once plowed, and have silt-loam soils.

Vegetation Description: This is a grassland community with dense vegetation dominated by tall grasses 1-2 m tall. The abundance of forbs has not reached the abundance found in native Northern Mesic Tallgrass Prairie. *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans*

(Indiangrass) are the most abundant grasses in this community. *Helianthus pauciflorus* (stiff sunflower) and *Solidago canadensis* (Canada goldenrod) are common forbs.

Most Abundant Species:

Table 9. Average percent cover of the top twenty most common species in plots within upland restored prairies. (Plot data collected by KBS in 2008, n=9 plots.)

Scientific Name	Common Name	Average % Cover
Andropogon gerardii	big bluestem	50.56
Helianthus pauciflorus	stiff sunflower	18.11
Schizachyrium scoparium	little bluestem	18.88
Solidago canadensis	Canada goldenrod	7.78
Rhus glabra	smooth sumac	3.89
Panicum virgatum	switchgrass	3.57
Solidago missouriensis	Missouri goldenrod	2.89
Lotus unifoliolatus	American bird's-foot trefoil	2.78
Astragalus canadensis	Canadian milkvetch	2.78
Ambrosia psilostachya	Cuman ragweed	2.56
Symphyotrichum ericoides	white heath aster	2.46
Amorpha canescens	leadplant	1.44
Sorghastrum nutans	Indiangrass	1.23
Psoralidium tenuiflorum	slimflower scurfpea	1.23
Antennaria neglecta	field pussytoes	0.89
Lespedeza capitata	roundhead lespedeza	0.89
Poa pratensis	Kentucky bluegrass	0.80
Dalea candida	white prairie clover	0.56
Achillea millefolium	common yarrow	0.46
Vernonia baldwinii	Baldwin's ironweed	0.36

Mapped Unit/Name:
Common Name: ***Lowland Restored Prairie***
Scientific Name: Planted Semi-Natural Lowland Restored Tallgrass Prairie, areas of the lowland that were restored to a tallgrass prairie mix of species
NVC Identifier: N/A

Figure 10. Lowland Restored Prairie (in the foreground) at Homestead National Monument. Tall grasses, mainly big bluestem (*Andropogon gerardii*), interspersed with Baldwin's ironweed (*Vernonia baldwinii*) and roughleaf dogwood (*Cornus drummondii*), July 2009.

Global Summary: This community (Figure 10) has been defined for Homestead National Monument. At HOME, managers are attempting to restore vegetation to Northern Mesic Tallgrass Prairie through planting native grasses and forbs in formerly plowed fields. Natural vegetation of this community is found throughout the northern tallgrass prairie region of the United States and Canada.

Environmental Description: The fields that have been re-planted with native grasses at Homestead National Monument were once plowed, and have silt-loam soils.

Vegetation Description: This is a grassland community with dense vegetation dominated by tall grasses 1-2 m tall. The abundance of forbs has not reached the abundance found in native Northern Mesic Tallgrass Prairie. *Andropogon gerardii* (big bluestem) and *Sorghastrum nutans* (Indiangrass) are the most abundant grasses in this community. *Solidago canadensis* (Canada goldenrod) and *Rudbeckia hirta* (blackeyed Susan) are common forbs. There is some encroachment by woody shrubs and tree seedlings, such as *Cornus drummondii* (roughleaf dogwood) and *Rhus glabra* (smooth sumac).

Most Abundant Species:

Table 10. Average percent cover of the top twenty-two most common species in plots within lowland restored prairie. (Plot data collected by KBS in 2008, n=5 plots.)

Scientific Name	Common Name	Average % Cover
Andropogon gerardii	big bluestem	56.00
Solidago canadensis	Canada goldenrod	16.60
Cornus drummondii	roughleaf dogwood	15.00
Rhus glabra	smooth sumac	8.00
Symphoricarpos orbiculatus	coralberry	8.00
Chamaecrista fasciculata	partridge pea	7.00
Sorghastrum nutans	Indiangrass	5.41
Bromus inermis	smooth brome	4.00
Poa pratensis	Kentucky bluegrass	3.21
Rudbeckia hirta	blackeyed Susan	3.20
Solidago gigantea	giant goldenrod	3.00
Desmodium illinoense	Illinois ticktrefoil	1.41
Panicum virgatum	switchgrass	1.21
Silphium integrifolium	wholeleaf rosinweed	1.00
Rosa arkansana	prairie rose	0.80
Sporobolus compositus	composite dropseed	0.80
Vernonia baldwinii	Baldwin's ironweed	0.61
Polygonum amphibium	water knotweed	0.40
Oxalis stricta	common yellow oxalis	0.23
Eupatorium altissimum	tall thoroughwort	0.21
Symphyotrichum lanceolatum	white panicle aster	0.21
Ulmus rubra	slippery elm	0.21

Mapped Unit Name: Smooth Brome

Common Name: Smooth Brome Semi-natural Grassland

Scientific Name: *Bromus inermis - (Pascopyrum smithii)* Semi-natural Herbaceous Vegetation
Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation

NVC Identifier: CEGL005264

Global Summary: This smooth brome grassland type occurs widely throughout the northern Great Plains, in disturbed montane meadows in the Rocky Mountains, 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. The dominant grass is *Bromus inermis* (smooth brome), a naturalized species from Eurasia that forms moderately dense to dense stands that often develop into monocultures. Other weedy species such as *Cirsium arvense* (Canada thistle) and *Poa pratensis* (Kentucky bluegrass) 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* (western wheatgrass), *Deschampsia caespitosa* (tufted hairgrass), and *Hesperostipa comata* (needle-and-thread), and sparse, scattered mesic shrubs such as *Symphoricarpos* (snowberry) 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.

Global Environmental Description: This smooth brome grassland type occurs widely throughout the northern Great Plains, 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. This community is found at all elevational ranges with best examples occurring on mesic alluvial terraces. *Bromus inermis* (smooth brome) grows best on moist, well-drained, finer-textured loam and clay loams, not heavy clays or sand, and does not tolerate prolonged flooding, however, it does persist quite well on well-drained sandy loam derived from granitic parent material. It also occurs in foothills and plains at lower elevations on relatively mesic sites. It occurs on poorly drained sites to rapidly drained sites with fine-textured alluvial soils derived from shale formations found in Utah. This community persists because it is rhizomatous, and once seeded, with enough moisture, will persist, regardless of elevation, soil or landform.

Global Vegetation Description: This association is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Bromus inermis* (smooth brome), a naturalized species from Eurasia that forms moderately dense to dense stands that often develop into monocultures. Other weedy species, such as *Cirsium arvense* (Canada thistle), *Poa pratensis* (Kentucky bluegrass), and other introduced forage species, 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 *Juncus balticus* (Baltic rush), *Pascopyrum smithii* (western wheatgrass), *Deschampsia*

caespitosa (tufted hairgrass), and *Hesperostipa comata* (needle-and-thread), and sparse scattered mesic shrubs, such as *Artemisia tridentata ssp. wyomingensis* (Wyoming big sagebrush), *Ericameria nauseosa* (rubber rabbitbrush), and *Symphoricarpos* (snowberry) spp., and ruderal forbs, such as *Heterotheca villosa* (hairy false goldenaster), 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.

Global Conservation Status Rank & Reasons: GNA (invasive). This is a naturalized type from Europe and Asia, widely planted for cover, pasture, and hay, and has escaped into a variety of habitats.

Discussion

Homestead National Monument combines a unique mix of historically important structures, agricultural lands, remnants of native plant communities, and restored prairie. Across this fragmented landscape a wide array of native and exotic plants thrive in habitats typical of the Great Plains. Due to the small size of the park and the accessibility afforded for the sampling crews and verification efforts, a highly accurate classification and map was completed.

The restored prairie at HOME is the second oldest known tallgrass prairie restoration.

Field Survey

The vegetation data presented in this project should be used as a baseline to build upon. New survey work in a timely manner would greatly improve both the classification and mapping efforts. Also, accessing neighboring private lands would allow new plot samples to be obtained, increasing the confidence in these types, thereby strengthening the classification.

NVC Classification

Along with access onto private lands, the other main classification challenge at HOME is keeping up with the rapid changes to plant life caused by agricultural manipulation and anthropogenic disturbance. Changes include tree removal, prairie restoration, wild fires, and flooding. At all times, but especially after these events, new data should be collected to reflect these changes. For example, as the park continues to restore its tallgrass prairie, this type may later need to be classified using a more natural association such as a Big Bluestem – Indiangrass community type. Overall more specialized and targeted data collection in these areas would help to document any changes and would greatly increase our understanding of these types in general.

Digital Imagery and Interpretation

Multiple sources of imagery were used to digitize the vegetation map. Along with the small size of the park, this allowed very thorough examination of subtle vegetation characteristics and photo signatures (e.g., shadows of canopy trees). Analyzing imagery taken over multiple seasons, multiple years, and with multiple color band displays allowed us to map boundaries in fine detail and with high confidence.

Accuracy Assessment

The high level of accuracy we obtained is likely due to the small size of HOME, which allowed thorough sampling during the vegetation mapping stage. Our overall accuracy assessment is well above the 80% required by VMP (taking into account the 90% confidence interval). Individual accuracies also met the 80% requirement, although three vegetation categories (Tallgrass Prairie, Lowland Restored Prairie, and Bur Oak Woodland) had a confidence interval below 80% simply because the low occurrence of these types required only 1 or 2 sample points during accuracy assessment.

Future Recommendations

In summary, this project represents the best efforts put forth by a multi-disciplined team over a relatively short period in time. In order to create the best possible “long-term” vegetation classification for HOME and the most accurate and detailed GIS layer, this project should be

viewed as a place to start rather than an end product. Present and future NPS staff should be encouraged to scrutinize this project, building from its strengths and bolstering its weaknesses. By keeping in mind that this project was only a snapshot in time, future efforts can help complete our understanding of the vegetation in and around HOME and how it changes. It is the hope of the producers that the products presented here will help focus and direct future efforts. The following recommendations are summarized below.

1. The diversity of plant species and dynamic nature of the park with respect to the agricultural aspect warrants periodic **field surveys** by experienced ecologists. Further, the inaccessibility of the private lands in the environs should be addressed by seeking permission to sample and verify the vegetation. In this way new plant associations could be discovered and existing types could be updated.

2. Remote sensing does not replace on-the-ground knowledge provided by GPS-linked plots, observations and ground verification. Time and funding limitations curtailed the amount of map **ground-truthing** performed. As opportunities arise, maps should be examined in the field by experienced crews. Also GPS receiver data and other GIS layers should be used to improve and update the spatial data. This map product should not be viewed as static but should be updated with more current and accurate information.

3. For monitoring purposes, **change over time** could be addressed by similar remote sensing projects. New aerial photos or NAIP imagery acquired every year could be used in regular intervals to capture change. Specifically, this new imagery could be used to create up-to-date vegetation layers that could be used to compare changes in both individual vegetation stands and across the entire park.

4. In the future, resource management personnel could link the habitat for **species of concern** to specific associations and map units. These map units could then be used to help locate potential sites of endangered or threatened species in the field or identify areas for non-native plant removal or treatment.

Research Opportunities

Having an accurate and current vegetation classification and map presents many new and exciting research opportunities. Research could include expanding or linking the GIS layer to derive other information such as fire models, habitat monitoring locations, guides for rare plant surveys, and inventorying areas that likely contain exotic or invasive species. The map could also be enhanced by overlaying other existing GIS layers such as geology, hydrology, elevation, and soils. In this manner complex interactions between these layers could be examined and yield important information about growth rates, regeneration after disturbance, biomass distribution, and stream morphology. Finally, through innovative analyses the vegetation layer could possibly be used as a springboard for other ecological studies such as monitoring the tallgrass prairie restoration or examining how the vegetation interacts with soil chemistry, pollution, archeological sites, weather patterns, etc.

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Appendix A: Contingency table for vegetation mapping at HOME

		Reference Data (Accuracy Assessment Field Data)						User's Error		
Sample Data (Polygon Map Data)	Map Units	Tallgrass Prairie	Success. Forest	Lowland Restored	Upland Restored	Bur Oak	Totals	Commission Accuracy	90% Conf. Interval	
									-	+
	Tallgrass Prairie	**1**	0	0	0	0	1	100%	50%	150%
	Success. Forest	0	**5**	0	0	0	5	100%	90%	110%
	Lowland Restored	0	0	**2**	0	0	2	100%	75%	125%
	Upland Restored	0	0	0	**3**	0	3	100%	83%	117%
	Bur Oak	0	0	0	0	**1**	1	100%	50%	150%
	Totals	1	5	2	3	1				
Producer's Error	Omission Accuracy	100%	100%	100%	100%	100%	**12 Total Correct Points**			
	90% Conf. -	50%	90%	75%	83%	50%	**12 Total Points**			
	Level +	150%	110%	125%	117%	150%				
Overall Total Accuracy = 100%		**Overall Kappa Index = 100%**			**Overall 90% Upper and Lower Confidence Interval = 95.8% and 104%**					

Instructions on Using the Accuracy Assessment Contingency Table:

The contingency table or error matrix found above presents an array of numbers set out in rows and columns corresponding to a particular vegetation map unit relative to the actual vegetation type as verified on the ground. The column headings represent the vegetation classification as determined in the field and the row headings represent the vegetation classification taken from the vegetation map. The highlighted diagonal indicates the number of points assessed in the field that agree with the map label. Conversely, the inaccuracies of each map unit are described as both errors of inclusion (user's or commission errors) and errors of exclusion (producer's or omission errors). By reading across this table (i.e., rows) one can calculate the percent error of commission, or how many polygons for each map unit were incorrectly labeled when compared to the field data. By reading down the table (i.e., columns) one can calculate the percent error of omission, or how many polygons for that type were left off the map. Numbers "on the diagonal" tell the user how well the map unit was interpreted and how confident they can be in using it. Numbers "off the diagonal" yield important information about the deficiencies of the map including which types were: 1) over- mapped - commission errors on the right or 2) under-mapped - omission errors on the bottom.

Appendix B: Example of a Plot Survey Form

IDENTIFIERS/LOCATORS

Plot Code_____

Provisional Community Name_____

State ___ Site Name_____ Local Site Name_____

Quad Name_____

GPS file name_____ Field UTM X___ ___ ___ ___ ___ ___ m E Field UTM Y___ ___ ___ ___ ___ ___ ___ m N

Datum_____ Error +/-_____ m

please do not complete the following information when in the field

Corrected UTM X___ ___ ___ ___ ___ ___ m E Corrected UTM Y___ ___ ___ ___ ___ ___ ___ m N UTM Zone_____

Project Name_____ Project Leader_____

Survey Date_____ Surveyor Lead _____Surveyors_____

Taxonomic authority _____

Directions to Plot

Plot length_____ Plot width_____ Plot area _____

Plot Photos (y/n) ___ Roll Number _____ Frame Number _____ Plot Permanent (y/n) ____

Plot representativeness

ENVIRONMENTAL DESCRIPTION

Elevation _____ Slope _____ Aspect_____

Topographic Position

Cowardan System	Non-Tidal		Tidal
___Upland ___Riverine ___Palustrine ___Lacustrine	___Permanently Flooded ___Semipermanently Flooded ___Seasonally Flooded ___Temporarily Flooded	___Saturated ___Seasonally Flooded/Saturated ___Intermittently Flooded	___ _____

Environmental Comments:	Soil Drainage ___ Rapidly drained ___ Well drained ___ Moderately well drained ___ Somewhat poorly drained ___ Poorly drained ___ Very poorly drained
Soil Comments	Landscape/Landform Comments

1

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Cover Scale for Species	Height Scale for Strata
Trees or Shrubs ___Evergreen ___Cold-deciduous ___Drought-deciduous ___Mixed evergreen - cold-deciduous ___Mixed evergreen - drought-deciduous Herbs ___Annual ___Perennial	___Broad-leaved ___Needle-leaved ___Microphyllous ___Graminoid ___Forb ___Pteridophyte	___Forest ___Woodland ___Shrubland ___Dwarf-shrubland ___Herbaceous ___Nonvascular ___Sparsely Vegetated	√ Nearby 1 0-.01% 2 .01-1% 3 1-2% 4 2-5% 5 5-10% 6 10-25% 7 25-50% 8 50-75% 9 75-95% 10 95-100%	01 <0.5 m 02 0.5-1m 03 1-2 m 04 2-5 m 05 5-10 m 06 10-15 m 07 15-20 m 08 20-35 m 09 35 - 50 m 10 >50 m

Layer (sublayer–optional)	Height Class	Layer % Cover	Dominant and characteristic Species and Cover Class
T Tree			
T_ _____			
T_ _____			
S Shrub			
S_ ____			
S_ ____			
H Herbaceous			
N Nonvascular			
_ ____			

please see above table for height and cover scales

Animal Use Evidence

Natural and Anthropogenic Disturbance Comments

Other Comments

2

Appendix C: Homestead National Monument Dichotomous Key Plant Associations

Key to Natural and Semi-Natural Plant Communities at Homestead National Monument

1a. Plant community dominated by trees.....**2**

1b. Plant community dominated by herbaceous vegetation. If woody plants are present, they are scattered individuals or brush due to lack of recent fire.....**3**

2a. Woodland or forest of mixed trees of mixed heights, and mixed ages with no old growth trees.....**Central green ash – elm – hackberry forest CEGL00218**

2b. Forest with mix of trees, but includes old-growth bur oaks.....
Western Tallgrass Bur Oak Mesic Woodland CEGL

3a. Native prairie grassland with forbs.....**4**

3b. Planted non-native grasses—brome grass, green very early and late in the growing season.....
Smooth Brome grass *Bromus inermis* Semi-Natural Herbaceous Alliance

4a. Native prairie with forbs (located near schoolhouse).....
Big Bluestem-Yellow Indiangrass Tallgrass Prairie CEGL

4b. Replanted or Restored Tallgrass Prairie (may contain some patches of brush.....**5**

5a. Restored Tallgrass Prairie in the uplands.....
Planted Semi-Natural Upland Restored Tallgrass Prairie

5b. Restored Tallgrass Prairie in the lowlands, below 1280 ft.....
Planted Semi-Natural Lowland Restored Tallgrass Prairie

Appendix D: Example of an Accuracy Assessment Survey Form

NPS Vegetation Mapping: Accuracy Assessment Form

Plot #_____ Park Code: **HOME** Observers: _____ Date: _____
UTM X __ __ __ __ __ __m E UTM Y __ __ __ __ __ __ __ m N Zone: _____
Datum: _____ PDOP_____ Elevation _____ Waypoint: _____
Topography: _____ Slope: _____ Picture no(s): _____

	Stratum	Height (m)	% Cover of Strata	Major Species Present	% Cover of Each Species
T1	Emergent				
T2	Canopy				
T3	Subcanopy (<10 cm DBH)				
S1	Tall Shrub (2-5 m)				
S2	Short Shrub (<2m)				
H	Herbaceous				
A1	Floating Leaved Aquatic				
A2	Submerged Aquatic				
N	Nonvascular				

Comments on indicator species or rare species: _____
_____

Mapped Vegetation Association: _____

Observed Vegetation Association: _____

Comments (note influences on vegetation, difficulties with classification, etc):

Appendix E: Homestead National Monument Species List

This is not a complete list for HOME. This list only contains the species recorded for the 2008 sample plots, the Heartland Network plots, and the 2009 accuracy assessment points (318 species). Genus-only records indicate an unknown species.

Family	Scientific Name	Common Name
Acanthaceae	*Justicia americana*	American water-willow
	Ruellia caroliniensis	Carolina wild petunia
Amaranthaceae	*Amaranthus palmeri*	carelessweed
	Amaranthus rudis	tall amaranth
	Amaranthus sp.	pigweed
Anacardiaceae	*Rhus aromatica*	fragrant sumac
	Rhus glabra	smooth sumac
	Toxicodendron radicans	eastern poison ivy
Apiaceae	*Cicuta maculata*	spotted water hemlock
	Cryptotaenia canadensis	Canadian honewort
	Sanicula odorata	clustered blacksnakeroot
	Spermolepis inermis	Red River scaleseed
	Torilis arvensis	spreading hedgeparsley
Apocynaceae	*Apocynum cannabinum*	Indianhemp
Asclepiadaceae	*Asclepias sullivantii*	prairie milkweed
	Asclepias syriaca	common milkweed
	Asclepias tuberosa	butterfly milkweed
	Asclepias verticillata	whorled milkweed
	Asclepias viridiflora	green comet milkweed
	Asclepias viridis	green antelopehorn
Asteraceae	*Achillea millefolium*	common yarrow
	Ageratina altissima	white snakeroot
	Ambrosia artemisiifolia	annual ragweed
	Ambrosia psilostachya	Cuman ragweed
	Ambrosia trifida	great ragweed
	Amphiachyris dracunculoides	prairie broomweed
	Antennaria neglecta	field pussytoes
	Arnoglossum plantagineum	groovestem Indian plaintain
	Artemisia ludoviciana	white sagebrush
	Bidens frondosa	devil's beggartick
	Brickellia eupatorioides	false boneset
	Cirsium sp.	thistle
	Cirsium altissimum	tall thistle
	Cirsium canescens	prairie thistle
Asteraceae cont.	*Cirsium undulatum*	wavyleaf thistle

Family	Scientific Name	Common Name
	Conyza canadensis	Canadian horseweed
	Eclipta prostrata	false daisy
	Erechtites hieracifolia	burnweed
	Erigeron annuus	eastern daisy fleabane
	Erigeron philadelphicus	Philadelphia fleabane
	Erigeron strigosus	prairie fleabane
	Eupatorium altissimum	tall thoroughwort
	Euthamia gymnospermoides	Texas goldentop
	Helianthus annuus	common sunflower
	Helianthus grosseserratus	sawtooth sunflower
	Helianthus laetiflorus	cheerful sunflower
	Helianthus maximiliani	Maximilian sunflower
	Helianthus pauciflorus	stiff sunflower
	Hieracium longipilum	hairy hawkweed
	Hymenopappus scabiosaeus	Carolina woollywhite
	Iva annua	annual marshelder
	Lactuca canadensis	Canada lettuce
	Lactuca floridana	woodland lettuce
	Lactuca saligna	willowleaf lettuce
	Lactuca serriola	prickly lettuce
	Liatris punctata	dotted blazing star
	Liatris pycnostachya	prairie blazing star
	Oligoneuron rigidum	stiff goldenrod
	Packera plattensis	prairie groundsel
	Ratibida columnifera	upright prairie coneflower
	Ratibida pinnata	pinnate prairie coneflower
	Rudbeckia hirta	blackeyed Susan
	Senecio plattensis	prairie groundsel
	Silphium integrifolium	wholeleaf rosinweed
	Solidago canadensis	Canada goldenrod
	Solidago gigantea	giant goldenrod
	Solidago missouriensis	Missouri goldenrod
	Solidago speciosa	showy goldenrod
	Symphyotrichum ericoides	white heath aster
	Symphyotrichum lanceolatum	white panicle aster
	Symphyotrichum oblongifolium	aromatic aster
	Symphyotrichum praealtum	willowleaf aster
	Taraxacum officinale	common dandelion
	Verbesina alternifolia	wingstem
	Vernonia baldwinii	Baldwin's ironweed

Family	Scientific Name	Common Name
Asteraceae cont.	*Xanthium strumarium*	rough cockleburr
Boraginaceae	*Lithospermum canescens*	hoary puccoon
	Lithospermum incisum	narrowleaf stoneseed
	Onosmodium molle	softhair marbleseed
Brassicaceae	*Alliaria petiolata*	garlic mustard
	Lepidium densiflorum	common pepperweed
	Rorippa nasturtium-aquaticum	watercress
	Thlaspi arvense	field pennycress
Cactaceae	*Escobaria missouriensis*	Missouri foxtail cactus
	Opuntia macrorhiza	twistspine pricklypear
Campanulaceae	*Lobelia siphilitica*	great blue lobelia
	Triodanis perfoliata	clasping Venus' looking-glass
Caprifoliaceae	*Sambucus nigra*	European black elderberry
	Symphoricarpos occidentalis	western snowberry
	Symphoricarpos orbiculatus	coralberry
Caryophyllaceae	*Dianthus armeria*	Deptford pink
	Silene antirrhina	sleepy silene
	Stellaria media	common chickweed
Chenopodiaceae	*Chenopodium sp.*	goosefoot
	Chenopodium album	lambsquarters
	Chenopodium berlandieri	pitseed goosefoot
	Chenopodium simplex	mapleleaf goosefoot
	Kochia scoparia	Mexican-fireweed
Convolvulaceae	*Calystegia sepium*	hedge false bindweed
	Convolvulus arvensis	field bindweed
	Evolvulus nuttallianus	shaggy dwarf morning-glory
Cornaceae	*Cornus drummondii*	roughleaf dogwood
	Cornus foemina	stiff dogwood
Cucurbitaceae	*Cucurbita foetidissima*	Missouri gourd
Cupressaceae	*Juniperus virginiana*	eastern redcedar
Cuscutaceae	*Cuscuta megalocarpa*	bigfruit dodder
Cyperaceae	*Carex sp.*	sedge
	Carex amphibola	eastern narrowleaf sedge
	Carex annectens	yellowfruit sedge
	Carex austrina	southern sedge
	Carex bicknellii	Bicknell's sedge
	Carex brevior	shortbeak sedge
	Carex frankii	Frank's sedge
	Carex gravida	heavy sedge
	Carex molesta	troublesome sedge

Family	Scientific Name	Common Name
	Carex muehlenbergii	Muhlenberg's sedge
Cyperaceae cont.	*Carex vulpinoidea*	fox sedge
	Cyperus sp.	flatsedge
	Cyperus acuminatus	tapertip flatsedge
	Cyperus lupulinus	Great Plains flatsedge
	Cyperus odoratus	fragrant flatsedge
	Cyperus setigerus	lean flatsedge
	Cyperus strigosus	strawcolored flatsedge
	Eleocharis sp.	spikerush
	Eleocharis compressa	flatstem spikerush
	Schoenoplectus tabernaemontani	softstem bulrush
	Scirpus atrovirens	green bulrush
	Scirpus pendulus	rufous bulrush
Euphorbiaceae	*Acalypha ostryifolia*	pineland threeseed mercury
	Acalypha rhomboidea	Virginia threeseed mercury
	Acalypha virginica	Virginia threeseed mercury
	Chamaesyce sp.	sandmat
	Chamaesyce maculata	spotted sandmat
	Chamaesyce nutans	eyebane
	Croton monanthogynus	prairie tea
	Euphorbia corollata	flowering spurge
	Euphorbia dentata	toothed spurge
	Euphorbia marginata	snow on the mountain
	Tragia betonicifolia	betonyleaf noseburn
Fabaceae	*Amorpha canescens*	leadplant
	Amorpha fruticosa	desert false indigo
	Astragalus canadensis	Canadian milkvetch
	Baptisia alba	white wild indigo
	Baptisia australis	blue wild indigo
	Baptisia bracteata	longbract wild indigo
	Cercis canadensis	eastern redbud
	Chamaecrista fasciculata	sleepingplant
	Dalea candida	white prairie clover
	Dalea purpurea	violet prairie clover
	Desmanthus illinoensis	prairie bundleflower
	Desmodium glutinosum	pointedleaf ticktrefoil
	Desmodium illinoense	Illinois ticktrefoil
	Desmodium sessilifolium	sessileleaf ticktrefoil
	Gleditsia triacanthos	honeylocust
	Glycine max	soybean

Family	Scientific Name	Common Name
	Glycyrrhiza lepidota	American licorice
	Gymnocladus dioicus	Kentucky coffeetree
Fabaceae cont.	*Lespedeza capitata*	roundhead lespedeza
	Lespedeza frutescens	shrubby lespedeza
	Lotus unifoliolatus var. unifoliolatus	American bird's-foot trefoil
	Medicago lupulina	black medick
	Melilotus officinalis	yellow sweetclover
	Mimosa nuttallii	Nuttall's sensitive-briar
	Psoralidium tenuiflorum	slimflower scurfpea
	Strophostyles leiosperma	slickseed fuzzybean
Fagaceae	*Quercus macrocarpa*	bur oak
Gentianaceae	*Gentiana puberulenta*	downy gentian
Grossulariaceae	*Ribes missouriense*	Missouri gooseberry
Iridaceae	*Sisyrinchium campestre*	prairie blue-eyed grass
Juglandaceae	*Juglans nigra*	black walnut
Juncaceae	*Juncus sp.*	rush
	Juncus dudleyi	Dudley's rush
	Juncus interior	inland rush
	Juncus torreyi	Torrey's rush
Lamiaceae	*Hedeoma hispida*	rough false pennyroyal
	Lycopus americanus	American water horehound
	Monarda fistulosa	wild bergamot
	Prunella vulgaris	common selfheal
	Salvia azurea	azure blue sage
	Scutellaria parvula	small skullcap
	Teucrium canadense	Canada germander
Lemnaceae	*Lemna minor*	common duckweed
Liliaceae	*Maianthemum stellatum*	starry false lily of the valley
Linaceae	*Linum sulcatum*	grooved flax
Loasaceae	*Mentzelia oligosperma*	chickenthief
Lythraceae	*Ammannia coccinea*	valley redstem
	Lythrum alatum	winged lythrum
Malvaceae	*Abutilon theophrasti*	velvetleaf
	Callirhoe alcaeoides	light poppymallow
	Sida spinosa	prickly fanpetals
Menispermaceae	*Menispermum canadense*	common moonseed
Molluginaceae	*Mollugo verticillata*	green carpetweed
Moraceae	*Maclura pomifera*	osage orange
	Morus alba	white mulberry
	Morus rubra	red mulberry

Family	Scientific Name	Common Name
Nyctaginaceae	*Mirabilis albida*	white four o'clock
	Mirabilis nyctaginea	heartleaf four o'clock
Oleaceae	*Fraxinus nigra*	black ash
Oleaceae cont.	*Fraxinus pennsylvanica*	green ash
Onagraceae	*Calylophus serrulatus*	yellow sundrops
	Gaura mollis	velvetweed
	Ludwigia alternifolia	seedbox
	Ludwigia peploides	floating primrose-willow
	Oenothera biennis	common evening-primrose
	Oenothera macrocarpa	bigfruit evening-primrose
	Oenothera speciosa	pinkladies
Oxalidaceae	*Oxalis stricta*	common yellow oxalis
	Oxalis violacea	violet woodsorrel
Phytolaccaceae	*Phytolacca americana*	American pokeweed
Plantaginaceae	*Plantago rugelii*	blackseed plantain
	Plantago virginica	Virginia plantain
Platanaceae	*Platanus occidentalis*	American sycamore
Poaceae	*Andropogon gerardii*	big bluestem
	Bouteloua curtipendula	sideoats grama
	Bouteloua gracilis	blue grama
	Bouteloua hirsuta	hairy grama
	Bromus arvensis	field brome
	Bromus inermis	smooth brome
	Buchloe dactyloides	buffalograss
	Diarrhena obovata	obovate beakgrain
	Dichanthelium acuminatum	tapered rosette grass
	Dichanthelium oligosanthes	Heller's rosette grass
	Dichanthelium wilcoxianum	fall rosette grass
	Digitaria cognata	Carolina crabgrass
	Digitaria sanguinalis	hairy crabgrass
	Echinochloa muricata	rough barnyardgrass
	Elymus sp.	wildrye
	Elymus canadensis	Canada wildrye
	Elymus virginicus	Virginia wildrye
	Elymus vulpinus	Rydberg's wildrye
	Festuca subverticillata	nodding fescue
	Glyceria striata	fowl mannagrass
	Hesperostipa spartea	porcupinegrass
	Koeleria macrantha	prairie Junegrass
	Leersia oryzoides	rice cutgrass

Family	Scientific Name	Common Name
	Leersia virginica	whitegrass
	Leptochloa panicea	mucronate sprangletop
	Lolium arundinaceum	tall fescue
	Muhlenbergia sp.	muhly
Poaceae cont.	*Muhlenbergia cuspidata*	plains muhly
	Muhlenbergia frondosa	wirestem muhly
	Muhlenbergia mexicana	Mexican muhly
	Muhlenbergia racemosa	marsh muhly
	Panicum capillare	witchgrass
	Panicum virgatum	switchgrass
	Paspalum pubiflorum	hairyseed paspalum
	Poa sp.	bluegrass
	Poa pratensis	Kentucky bluegrass
	Schizachyrium scoparium	little bluestem
	Setaria sp.	bristlegrass
	Setaria faberi	Japanese bristlegrass
	Setaria pumila	yellow bristlegrass
	Setaria pumila ssp. pallidifusca	yellow bristlegrass
	Setaria viridis	green bristlegrass
	Sorghastrum nutans	Indiangrass
	Sorghum halepense	Johnsongrass
	Spartina pectinata	prairie cordgrass
	Sphenopholis obtusata	prairie wedgescale
	Sporobolus compositus	composite dropseed
	Sporobolus heterolepis	prairie dropseed
	Tridens flavus	purpletop tridens
	Tripsacum dactyloides	eastern gamagrass
	Vulpia octoflora	sixweeks fescue
Polygalaceae	*Polygala verticillata*	whorled milkwort
Polygonaceae	*Polygonum sp.*	knotweed
	Polygonum amphibium	water knotweed
	Polygonum pensylvanicum	Pennsylvania smartweed
	Polygonum persicaria	spotted ladysthumb
	Polygonum scandens	climbing false buckwheat
	Polygonum virginianum	jumpseed
	Rumex altissimus	pale dock
	Rumex crispus	curly dock
Portulacaceae	*Portulaca oleracea*	little hogweed
Pteridaceae	*Pellaea glabella*	smooth cliffbrake
Rhamnaceae	*Ceanothus americanus*	New Jersey tea

Family	Scientific Name	Common Name
	Ceanothus herbaceus	Jersey tea
Rosaceae	*Agrimonia parviflora*	harvestlice
	Geum canadense	white avens
	Prunus americana	American plum
	Rosa arkansana	prairie rose
Rubiaceae	*Galium aparine*	stickywilly
Salicaceae	*Populus deltoides*	eastern cottonwood
	Populus fremontii	Fremont cottonwood
	Salix exigua	narrowleaf willow
	Salix gooddingii	Goodding's willow
	Salix nigra	black willow
Scrophulariaceae	*Agalinis tenuifolia*	slenderleaf false foxglove
	Leucospora multifida	narrowleaf paleseed
	Mimulus ringens	Allegheny monkeyflower
	Veronica anagallis-aquatica	water speedwell
	Veronica peregrina	neckweed
Smilacaceae	*Smilax tamnoides*	bristly greenbrier
Solanaceae	*Physalis heterophylla*	clammy groundcherry
	Physalis longifolia	longleaf groundcherry
	Physalis pubescens	husk tomato
	Physalis pumila	dwarf groundcherry
	Physalis virginiana	Virginia groundcherry
	Solanum carolinense	Carolina horsenettle
	Solanum rostratum	buffalobur nightshade
Ulmaceae	*Celtis occidentalis*	common hackberry
	Ulmus americana	American elm
	Ulmus rubra	slippery elm
Urticaceae	*Boehmeria cylindrica*	smallspike false nettle
	Laportea canadensis	Canadian woodnettle
	Parietaria pensylvanica	Pennsylvania pellitory
	Pilea pumila	Canadian clearweed
	Urtica dioica	stinging nettle
Verbenaceae	*Glandularia bipinnatifida*	Dakota mock vervain
	Phryma leptostachya	American lopseed
	Verbena hastata	swamp verbena
	Verbena simplex	narrowleaf vervain
	Verbena stricta	hoary verbena
	Verbena urticifolia	white vervain
Violaceae	*Hybanthus verticillatus*	babyslippers
	Viola missouriensis	Missouri violet

Family	Scientific Name	Common Name
	Viola nephrophylla	northern bog violet
	Viola pedatifida	prairie violet
Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper

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

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