



Vegetation Classification and Mapping of Pea Ridge National Military Park

Project Report

Natural Resource Report NPS/PERI/NRR—2013/649



ON THE COVER

The Battlefield in Fall

Photograph by: Courtesy of National Park Service, Pea Ridge National Military Park

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David D. Diamond^{1*}
Lee F. Elliott¹
Michael D. DeBacker²
Kevin M. James²
Dyanna L. Pursell¹
Alicia Struckhoff¹

¹Missouri Resource Assessment Partnership (MoRAP)
School of Natural Resources
University of Missouri
4200 New Haven Road
Columbia, MO 65201

²National Park Service
Heartland I&M Network
6424 West Farm Road 182
Republic, MO 65738

*contact diamonddd@missouri.edu

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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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Abstract/Executive Summary

Pea Ridge National Military Park (PERI) is situated in northwestern Arkansas, about five miles northeast of Rogers, AR. The site commemorates the critical March 1862 Civil War Battle of Pea Ridge. The border between the flatter Springfield Plains and the more hilly Dissected Springfield Plateau-Elk River Hills ecoregions bisects the park from east to west. Plant communities are therefore relatively diverse, reflecting the variety of landforms and abiotic habitats as well as past and current human use.

A vegetation classification and mapping project was initiated in 2010 and completed in 2012. Protocols and products were produced following National Park Service Vegetation Mapping Program guidelines. Classification was based on 47 quantitative field plots and an additional 96 observation points. Plots were placed across PERI in a stratified random manner based on qualitative field observation points and viewing of air photos. Mapping was based on photo-interpretation of both leaf-on and leaf-off air photos. Accuracy assessment points obtained during 2012 verified that the map is 93.9% accurate.

Natural and semi-natural vegetation covers 4,209.6 acres (1,703.6 ha), or >98% of the park. Of that area, 76% is in woodland or forest and 23% is herbaceous vegetation. Two-thirds of the grasslands are mowed more than once annually and are dominated primarily by the non-native tall fescue (*Schedonorus phoenix*). Dry and typic upland oak-hickory woodland and forest together comprise 2,481 acres (1,004 ha), or 59% of the natural and semi-natural vegetation of the park. A total of nine non-developed types were mapped, with an overall accuracy across all types of 93.1%.

Introduction

Pea Ridge National Military Park Vegetation Mapping Project

Pea Ridge National Military Park (PERI) Vegetation Mapping Inventory Project was a cooperative initiative involving the Missouri Resource Assessment Partnership (MoRAP) at the University of Missouri, the Heartland Inventory and Monitoring Program (HTLN) of the National Park Service (NPS), and park managers and resource specialists. MoRAP provided the classification and mapping and HTLN provided accuracy assessment and overall project coordination. All aspects of the project conform to overall requirements set forward by the National Park Service Vegetation Inventory Program (see <http://science.nature.nps.gov/im/inventory/veg/index.cfm>).

The project was initiated because accurate maps of existing vegetation facilitate natural and cultural resource management and interpretation. PERI contains examples of oak-hickory forest in relatively large patches, including communities over sandstone and limestone substrates. In addition, large patches of semi-natural grassland and some areas of restored tallgrass prairie are contained within the park. These communities offer good opportunities for conservation of regional flora and fauna that are compatible with interpretation of the Civil War battlefield.

Each NPS Vegetation Mapping Inventory Project has three major components: classification, mapping, and map accuracy assessment. This report provides details on each of these fundamental elements.

USGS-NPS Vegetation Mapping Program

The National Vegetation Inventory Program is an interagency initiative established to inventory, classify, describe, and map vegetation in National Park units and other areas across the United States. It is administered by the NPS Natural Resources Information Division, and provides baseline vegetation information to the NPS Inventory and Monitoring Program (I&M). Vegetation Inventory Program scientists have developed procedures for classification, mapping, and accuracy assessment (Lea 2011; Lea and Curtis 2010). Use of the National Vegetation Classification System (NVCS) as the standard classification 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; and
- is appropriate for mapping at multiple scales.

The use of the NVCS and the standardized vegetation mapping protocols facilitates effective resource stewardship by ensuring compatibility and widespread use of the information throughout the NPS as well as by other federal and state agencies. These vegetation maps and associated information support a wide variety of resource assessment, park management, and planning needs. In addition they can be used to provide a structure for framing and answering

critical scientific questions about vegetation communities and their relationship to environmental conditions and ecological processes across the landscape.

Before 1994, NVCS development was led by The Nature Conservancy (TNC), and further development was then passed on to the newly formed NatureServe organization. A network of state and regional ecologists involving dozens of individuals worked on the classification (TNC and ESRI 1994; Grossman et al. 1998). The NVCS is currently supported and endorsed by multiple federal agencies, the Federal Geographic Data Committee (FGDC 2008), NatureServe, state heritage programs, and the Ecological Society of America. Refinements to the classification have occurred in fits and spurts over the past decade, with funding from various federal and state agencies. A formal process for review of proposed revisions is in place (see Jennings et al. 2009), and the most accessible source for the NVCS is provided by NatureServe Explorer (<http://www.natureserve.org/explorer/servlet/NatureServe?init=Ecol>).

Vegetation Mapping Program Standards

The NPS I&M 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 1994)
- standards for field methods and mapping procedures (Jennings et al. 2009; Lea 2011)
- producing rigorous and consistent accuracy assessment procedures (Lea and Curtis 2010)
- establishing standards for using existing vegetation data (TNC 1996)

Standards

- National Vegetation Classification Standard (FGDC 2008)
- Spatial Data Transfer Standard (FGDC 1998)
- Content Standard for Digital Geospatial Metadata (FGDC 1998)
- 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

A 12-step guidance document provides details that cover the entire process with links to information extracted or summarized from publications described above (National Parks Service 2011), available at

http://science.nature.nps.gov/im/inventory/veg/docs/Veg_Inv_12step_Guidance_v1.1.pdf).

Product specifications are also provided in a document (National Park Service 2011a), available at http://science.nature.nps.gov/im/inventory/veg/docs/Product_Specifications.pdf)

Pea Ridge National Military Park

Pea Ridge National Military Park comprises approximately 4,267 acres (1,727 hectares) near Pea Ridge, Arkansas, about five miles northeast of Rogers, AR (Figure 1). A series of Civil War engagements that occurred in March, 1862, are commemorated and interpreted on site. The park was created by an act of Congress in 1956. Management of areas not associated with the battlefields, mainly woodlands and forests, have largely been passive. Efforts have been made to restore tallgrass prairie within limited areas. More recent (and on-going) active management has been initiated to increase visibility, reduce eastern redcedar (*Juniperus virginiana*) dominance,

and generally restore important portions of the park to conditions similar to those present at the time of the battle. Within the past decade, the HTLN has established baselines and on-going monitoring of key indicators of natural resource health (Annis et al. 2011).

The park contains oak-hickory woodlands that are in moderate overall condition and provide nesting habitat for Acadian Flycatchers (*Empidonax virescens*) and Yellow-throated Vireos (*Vireo flavifrons*), both forest interior birds of special concern (Peitz 2009). Relatively few invasive species occur, although patches of eastern redcedar are apparent in places and lower overall quality by reducing landscape condition scores (Annis et al. 2011). Bottomland forests and woodlands are only found along Lee Creek in the southeastern part of the park and are of relatively low quality (Annis et al. 2011). Mowed grasslands are part of the interpretive landscape, and some areas of shrubland and sparse woodland have grown up after abandonment of agricultural production. These shrubby areas provide nesting habitat for Indigo Buntings (*Passerina cyanea*) and Eastern Towhees (*Pipilo erythrophthalmus*), two shrubland birds of special concern (Peitz 2009).

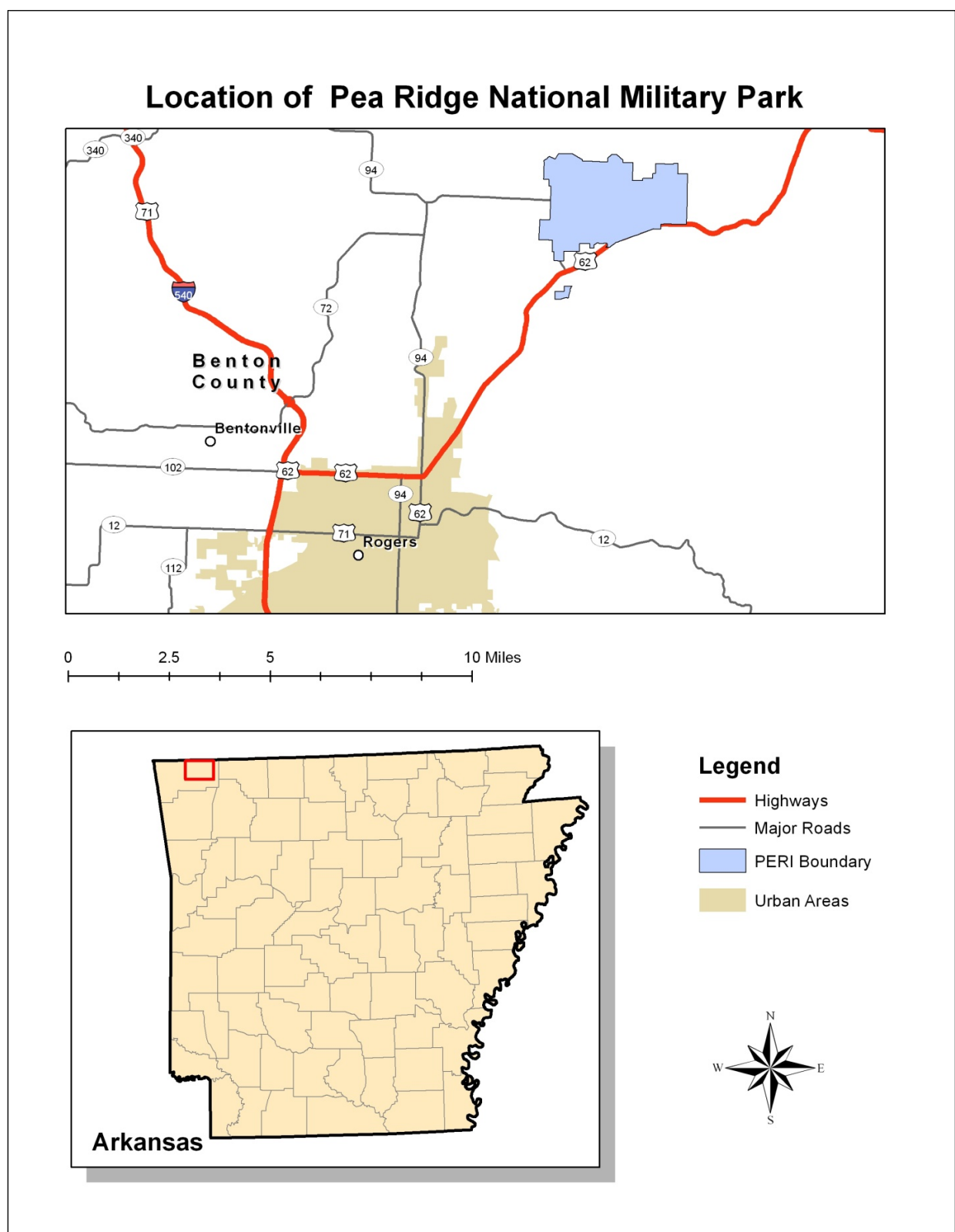


Figure 1. Location of Pea Ridge National Military Park in Benton County, Arkansas.

Project Statistics

Field Work Summer 2011:

Observation Points = 97

Collected between May 2010 and May 2012 by MoRAP staff

Plot Sampling = 47

Plots sampled in May 2011 by MoRAP staff

Accuracy Assessment Points = 155

All collected in July 2012 by Heartland Inventory and Monitoring Network staff

Classification:

7 NVC Plant Associations

2 Park Special Vegetation Classes

1 Developed Land-Use Class

GIS Database 2011 - 2012:

Pea Ridge National Military Park = 4,267 acres (1,727 hectares)

Base Imagery used for mapping (acquired by MoRAP):

2009, Benton County, AR, leaf-on, true color, 0.61 m (2 feet)

2009, Benton County, AR, leaf-off, 4-band CIR, 1 m

Minimum Mapping Unit = 0.5 hectares (ha)

Minimum Patch Size = .005 hectares (ha)

Total Size = 300 Polygons

Average Polygon Size = 14.22 acres (5.75 ha)

Overall Thematic Accuracy = 93.1%

Project Completion Date: 11/2012

Methods

Pea Ridge National Military Park, at 4,267 acres (1,726.8 ha), is a medium sized park as defined by sampling design protocols (TNC and ESRI 1994). Standard methodology for sampling and mapping therefore called for stratification of samples based on biophysical setting and current vegetation cover. These sites should sufficiently characterize the vegetation types and explain distributions across the landscape. Since access to private lands outside of the park was not ensured, the project boundary consisted of the boundary of the park itself (Figure 2). Five major tasks were identified and completed, including:

1. Plan, gather data, and coordinate tasks;
2. Survey PERI 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 as far as possible;
4. Acquire current digital imagery and interpret the vegetation from these using the classification scheme and a map unit crosswalk; and
5. Assess the accuracy of the final map product.

All protocols for this project are outlined by NPS and important sections are summarized or linked at <http://science.nature.nps.gov/im/inventory/veg/index.cfm>). Drilling down to additional linked documents can be accomplished via the link to the National Park Service 12-step guidance document on that web site (National Park Service 2011). Important references include TNC and ESRI (1994), Jennings et al. (2009), Lea (2011), and Lea and Curtis (2010).

Planning, Data Gathering, and Coordination

A Natural Resource Condition Assessment (NRCA) was completed for PERI and published in 2011 (Annis et al. 2011). During the course of that project, the current vegetation mapping project was discussed with appropriate park staff in coordination with HTLN and MoRAP staff. A proposal for vegetation mapping was subsequently completed and approved by NPS National Vegetation Mapping staff. Based on that proposal, MoRAP was responsible for classification, plot sampling, mapping, and development of digital databases. The HTLN was responsible for oversight of MoRAP activities in concert with NPS Mapping Program staff, and coordinated accuracy assessment tasks. PERI staff provided logistical and technical support, and helped coordinate field activities.

Field Survey

The field methods used in sampling and classifying the vegetation followed the methodology outlined by NPS Vegetation Mapping Program team (see Jennings 2009, Lea 2011, National Park Service 2011). The application of these methods to PERI is outlined below.

A generalized land cover classification was available from the PERI NRCA (Annis et al. 2011), and this information together with National Agriculture Imagery Program (NAIP) air photos, digital soils information, digital surface geology maps, digital elevation models, and field-

collected observation data were used to inform the design of field surveys and ultimately vegetation classification and mapping (Figure 3). Observation points consisted of brief visits (fewer than 15 minutes) by ecologists from MoRAP where general information on vegetation structure and composition was noted.

Vegetation data were collected at 47 plots by MoRAP staff in May of 2011 (Figure 4). In the lab, the locations of plots were randomly placed within the following general strata: deciduous woodlands and forests on moist upland soils, deciduous woodlands and forests on dry upland soils, deciduous woodlands and forests on slopes >20%, deciduous bottomland forests, upland juniper-dominated woodlands and forests, bottomland juniper dominated woodlands and forests, restored tallgrass prairie, disturbed grasslands and shrublands, mowed grasslands, and marsh (Figure 4). Plots were located >30 m from an obvious land cover edge, and for each point there was at least one alternate, should the original point be determined unusable in the field (e.g. close to an un-mapped trail or road, stand too small). Workers navigated to the stratified random plot sampling locations by GPS.

Woodlands and forests were sampled with a 10 m x 40 m plot (400 sq m), shrublands and open woodlands with a 10 m x 20 m plot (200 sq m), and herbaceous vegetation with a 5 m x 20 m plot (100 sq m). Minimal flagging was used to mark the plot. Data were collected using a plot survey form (Appendix B). The survey form includes sections for plot location and description, as well as vegetation and environmental information about the plot.

Vegetation sampling included information about structure and physiognomy, with leaf phenology, leaf type and physiognomic class recorded for the dominant vegetation stratum. Cover data were collected for the following strata, where applicable.

T1 = Emergent Tree (overstory) >30 m
T2 = Tree Canopy (overstory) 20-30 m
T3 = Tree Subcanopy (midstory) 5-20 m
S1 = Tall Shrub (understory woody species, tree and shrub) 1-5 m
S2 = Short Shrub (woody species, tree and shrub) <1 m
H = Herbaceous species, does not include S2

Additionally, cover was recorded in modified Daubenmire (1959) cover classes for each species by strata (Table 1).

Table 1. Canopy cover classes used for quantitative vegetation sampling.

Cover Class Codes	Range of Cover (%)
7	95-100
6	75-95
5	50-75
4	25-50
3	5-25
2	1-5
1	0-0.99

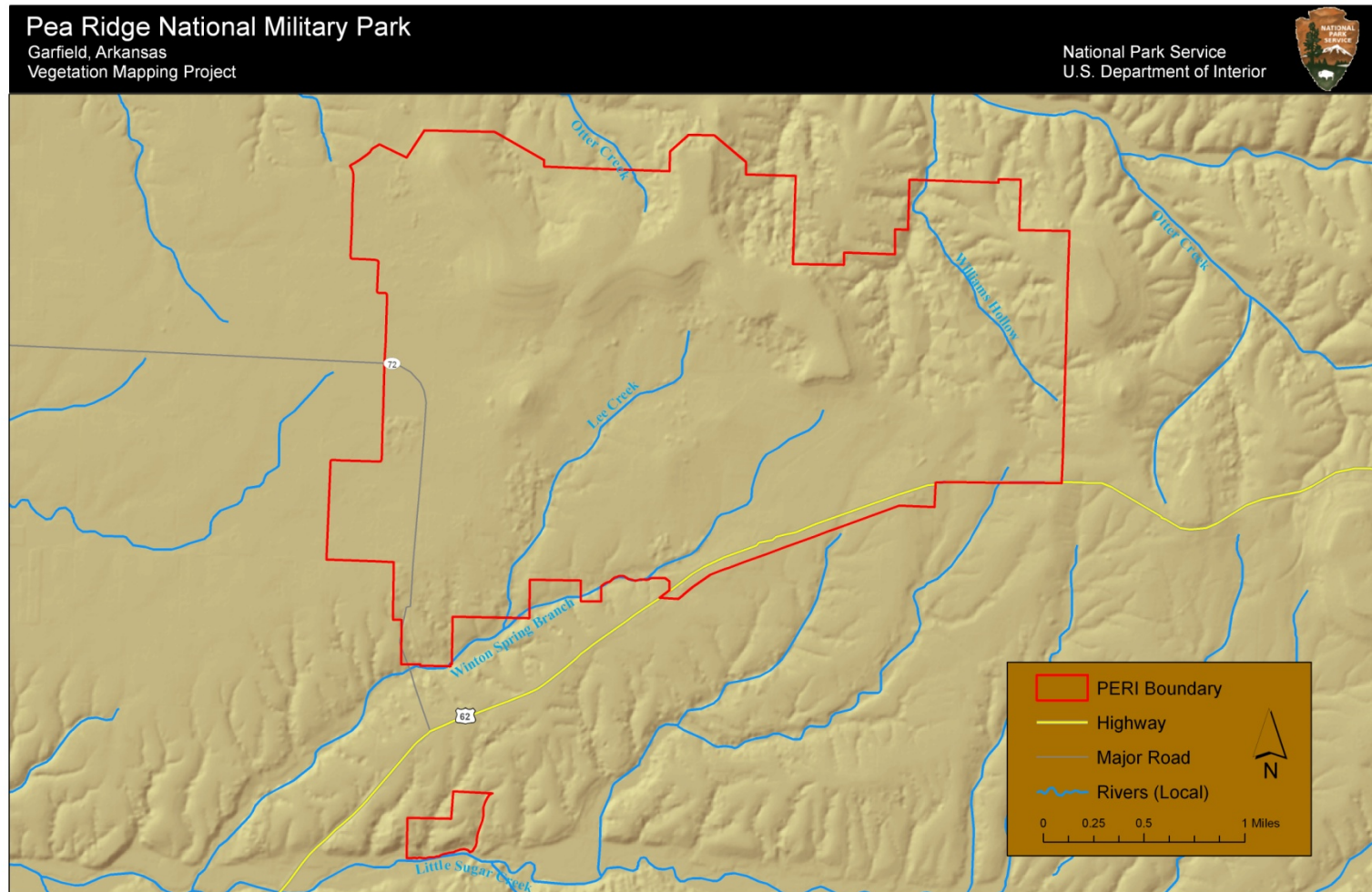


Figure 2. Map of Pea Ridge National Military Park.

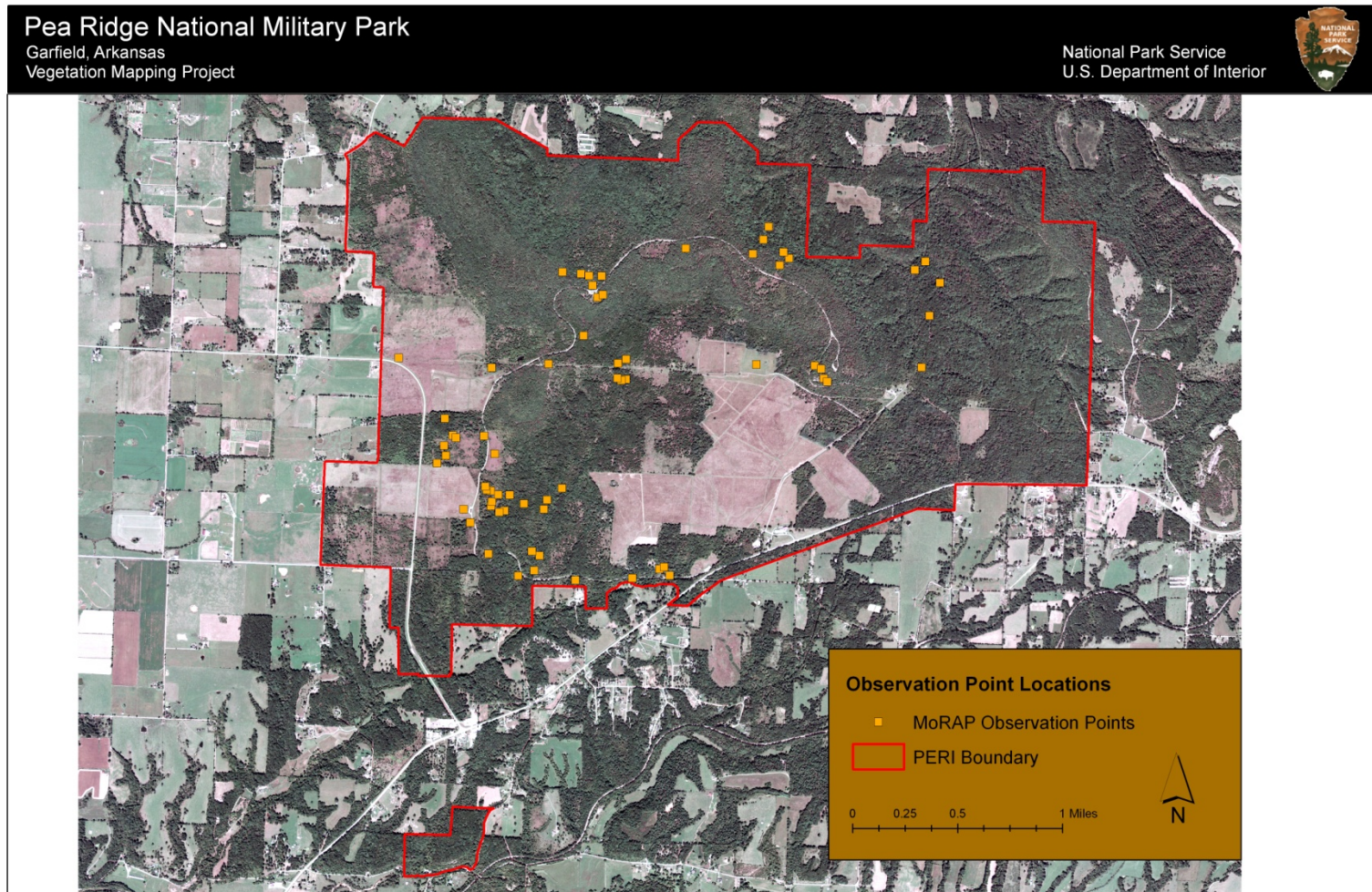


Figure 3. Location of 96 observation points collected in Pea Ridge National Military Park.

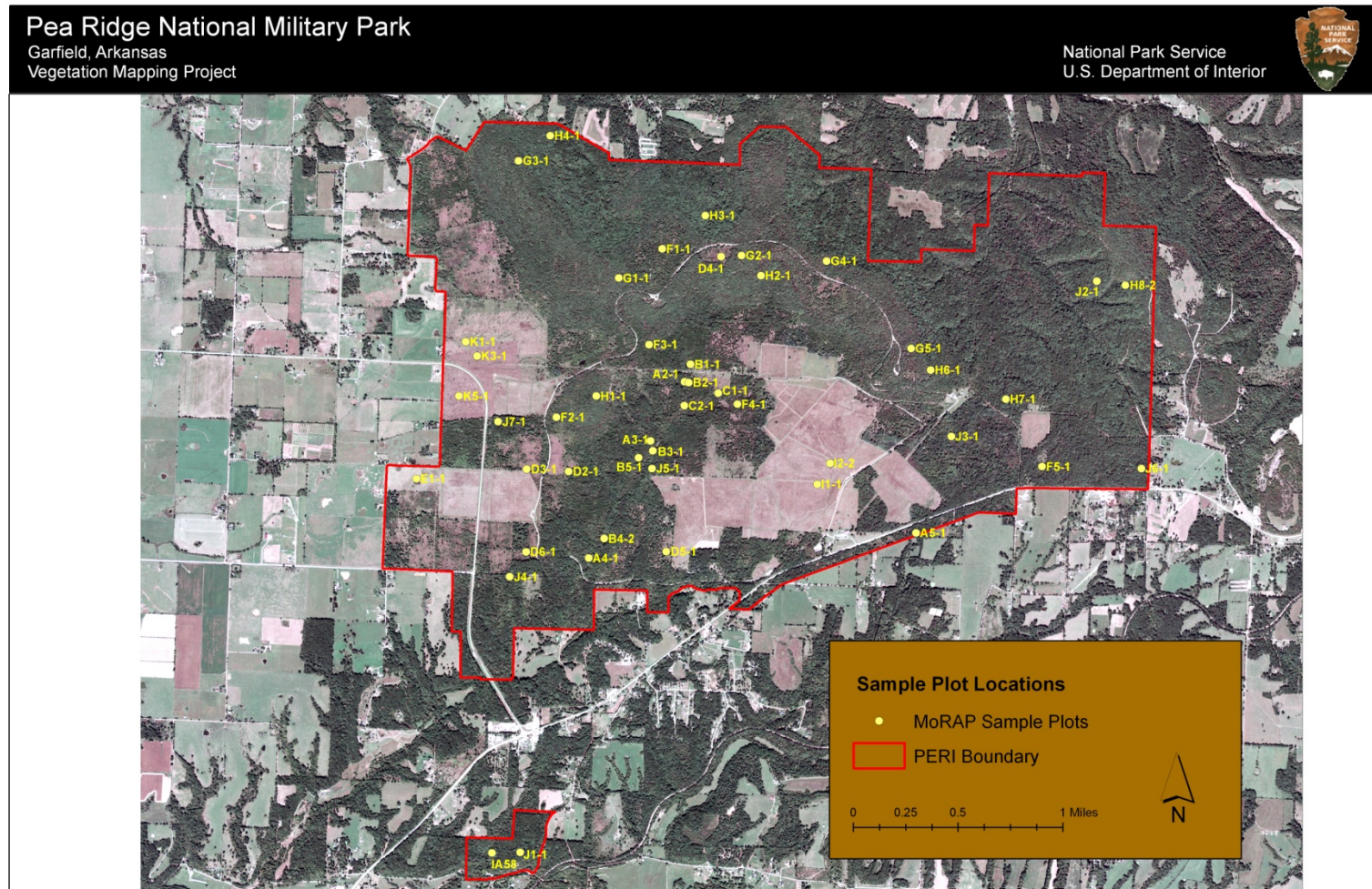


Figure 4. Location of 47 sampled plots within Pea Ridge National Military Park.

Vegetation Classification

All recorded data were entered into the NPS PLOTS v3.2 database (available at <http://science.nature.nps.gov/im/inventory/veg/plots.cfm>), a Microsoft Access-derived program. The PLOTS database was developed for the NPS National Vegetation Mapping Program so that 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, available at <http://plants.usda.gov/java/>). Data were thoroughly proofed after entry to minimize errors.

Plot data were subject to cluster analysis and ordination in order to help inform classification. Species-specific data were collected in multiple strata using cover classes, but for the purpose of analysis, the cover values for each species were combined into a single value using the midpoint of the cover class. The formula used to combine the strata cover values for each species was.

$$1 - \prod \left(1 - \frac{\%cover}{100}\right)$$

Use of this formula reduces the effects of overlapping cover in various strata. We used a log transformation to standardize cover values using the formula $\log(\text{cover} + 1)$. Bray-Curtis dissimilarity was used as the distance metric for the cluster and ordination analyses (Legendre & Legendre 1998). Clustering was performed using the hierarchical clustering algorithm known as flexible Beta with a $\beta = -0.25$ (Lance & Williams 1966, Maechler et al. 2011). Non-metric multidimensional scaling was used to develop the ordination (Legendre & Legendre 1998, Roberts 2010).

Descriptive information on NVC community composition concepts and classification were obtained from the NatureServe Explorer website available at <http://www.natureserve.org/explorer/servlet/NatureServe?init=Ecol>. PERI park-specific types were defined based on the quantitative data and observation points when the observed vegetation did not fit descriptions of associations described for Arkansas.

Once the classification was finalized, a dichotomous key was developed by MoRAP for use during the accuracy assessment (Appendix C). For mapped vegetation types (mapped types) with an NVC assignment, the ecological systems and association descriptions served as the basis for the global description of the mapped type. For other mapped types, descriptions are based on the quantitative plot data and on observation points. The final described mapped types were all mapped and linked to map classes for use in the photo-interpretation and mapping portions of the project.

Digital Imagery and Interpretation

The mapping component was produced by identifying land cover in a three-step process: (1) image objects were generated at 1 m resolution using e-Cognition applied to stacked leaf-on and leaf-off air photos, (2) image objects were coded with land cover classes on-screen, and (3) image objects were cut and corrected via heads-up digitizing at a display scale of 1:1,500 against

a back-drop of air photos. The best available imagery was from the NAIP (see http://www.fsa.usda.gov/Internet/FSA_File/naip_2009_info_final.pdf). This included 2009 leaf-on true color and 4-band color infrared (CIR) 1 m resolution photos, and 2007-2009 leaf-off true color 2 foot resolution photos (Figure 5).

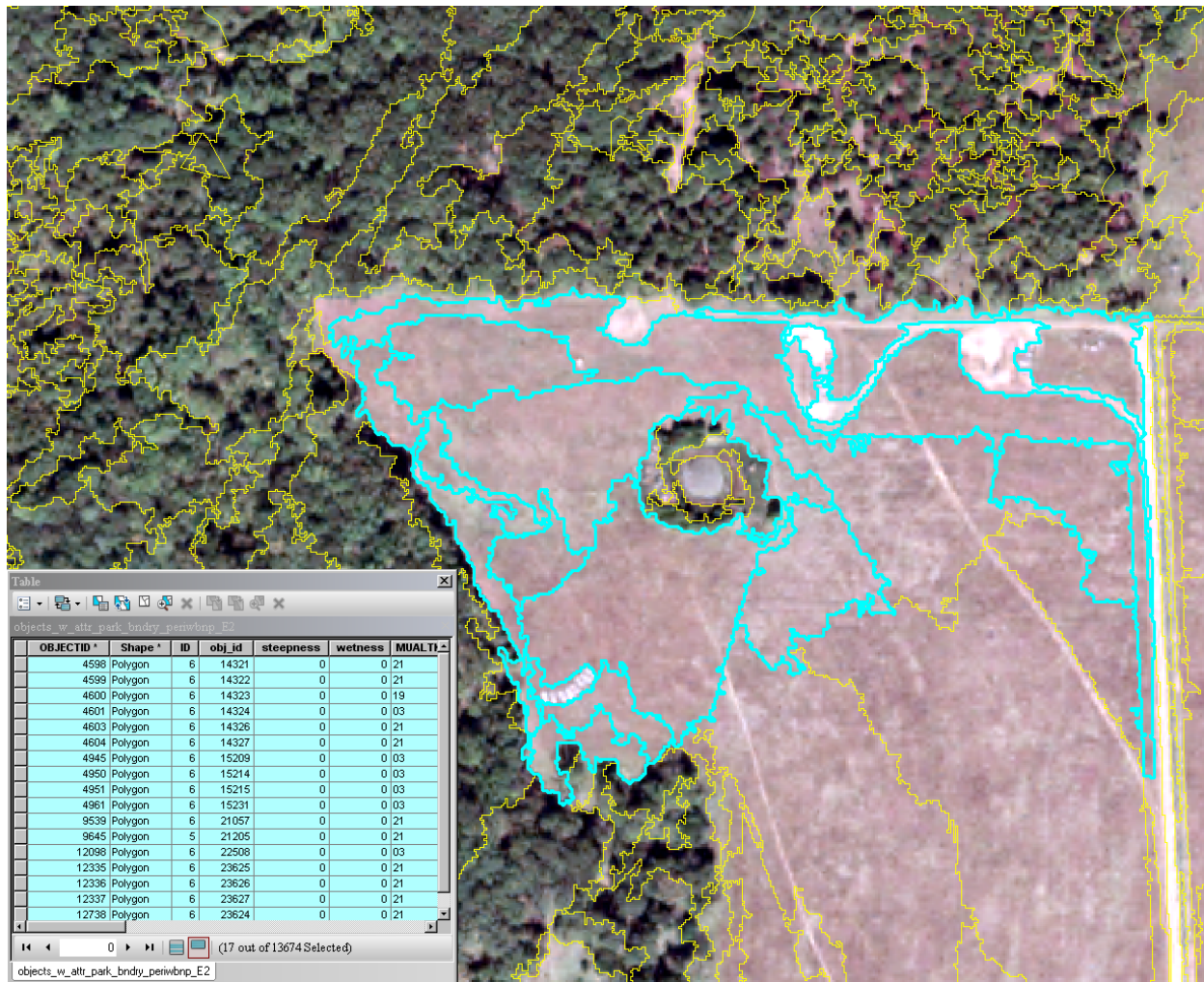


Figure 5. Image objects were generated and then corrected via heads-up digitization at a view scale of 1:1,500.

Accuracy Assessment

Thematic accuracy assessment (AA) was conducted by the HTLN. Methods and analysis for the accuracy assessment of vegetation mapping at PERI were based on NPS standards (Lea and Curtis 2010). Thematic or attribute accuracy of mapped vegetation types were assessed independently following the completion of the vegetation mapping inventory by the lead authors. Representative sites were identified and visited to determine if interpreted mapped types were correctly assigned by field observers using the dichotomous key to mapped current vegetation types (Appendix C). Identifying the degree of correspondence between field observations and mapped attributes provides a measure of the maps suitability for different applications.

Accuracy assessment consisted of first evaluating the spatial pattern (total area and number of polygons) of each mapped type. The number of samples in each mapped type was selected from five possible scenarios (Table 2). Accuracy assessment was restricted to natural and semi-natural vegetation mapped types, thus omitting developed areas and standing water. Once the appropriate sampling scenario for each mapped type was determined, site selection was performed using a geographical information system (ArcGIS 10.0).

Table 2. Target number of Accuracy Assessment samples per mapped type based on number of polygons and area.

Scenario	Description	Polygons in type	Area occupied by type	Recommended number of samples in type
Scenario A:	The mapped type 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 mapped type 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 scenario is that sample sites are more difficult to find because of the lower frequency of the type.	<30	>50 ha	20
Scenario C:	The mapped type 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 type occupies a small area. At the same time, however, the type 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

Table 2. Target number of Accuracy Assessment samples per mapped type based on number of polygons and area (continued).

Scenario	Description	Polygons in type	Area occupied by type	Recommended number of samples in type
Scenario D:	The mapped type 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 type 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 mapped type 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 type 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

Random sample points were generated in ArcGIS. Points were buffered 40 m from the park boundary and 80 m from another point for larger polygons. The minimum mapping unit used in delineating vegetation polygons was 0.5 hectare. All random points were selected within the park boundary to avoid any private land issues.

Randomly selected site locations were loaded onto a Garmin GPS unit for field navigation. Accuracy assessment field work was completed during August 2012. Field staff was provided with a GPS unit, dichotomous key for mapped types and vegetation definitions for each mapped type (Figure 6).

Plot shape and size varied according to the patch extent of the mapped vegetation type containing the sample point. Circular 0.25 hectare (28 m radius) plots were used for most patches. A mix of circular and rectangular 0.1 hectare plots were used for small patches and linear patch types, respectively. A circular plot size of 0.5 hectare (40 m radius) was used to capture information for the larger homogenous patches. In all cases, the plot size selection was made to ensure the most area was considered within a homogenous mapped type patch.

USGS-NPS Vegetation Mapping Program
Pea Ridge National Military Park

Field staff recorded plot size and shape, positional accuracy and vegetation classification at each point (Accuracy Assessment Field Form, Appendix D). Field data from the 155 points were entered into the PLOTS database and underwent quality assurance/quality control (QA/QC) verification. In addition, the associated project geodatabase was updated in ArcGIS to reflect any changes to the point location due to offsets made in the field. All classification and spatial field observations were compared with the vegetation map and AA point locations for any differences.

Upon completion of QA/QC, the accuracy assessment analysis was performed. All analysis and evaluation of producer and user accuracy was conducted using the AA Contingency Table Calculation Spreadsheet (<http://science.nature.nps.gov/im/inventory/veg/guidance.cfm>). Statistics and calculations performed in the spreadsheet are presented in Table 3.

Table 3. Summary of the Accuracy Assessment statistics used at Pea Ridge National Military Park.

Statistic	Description
User's Accuracy	The fraction of the accuracy assessment observations in a mapped type that were found to have the correct vegetation type in the field.
Producer's Accuracy	The fraction of the 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.

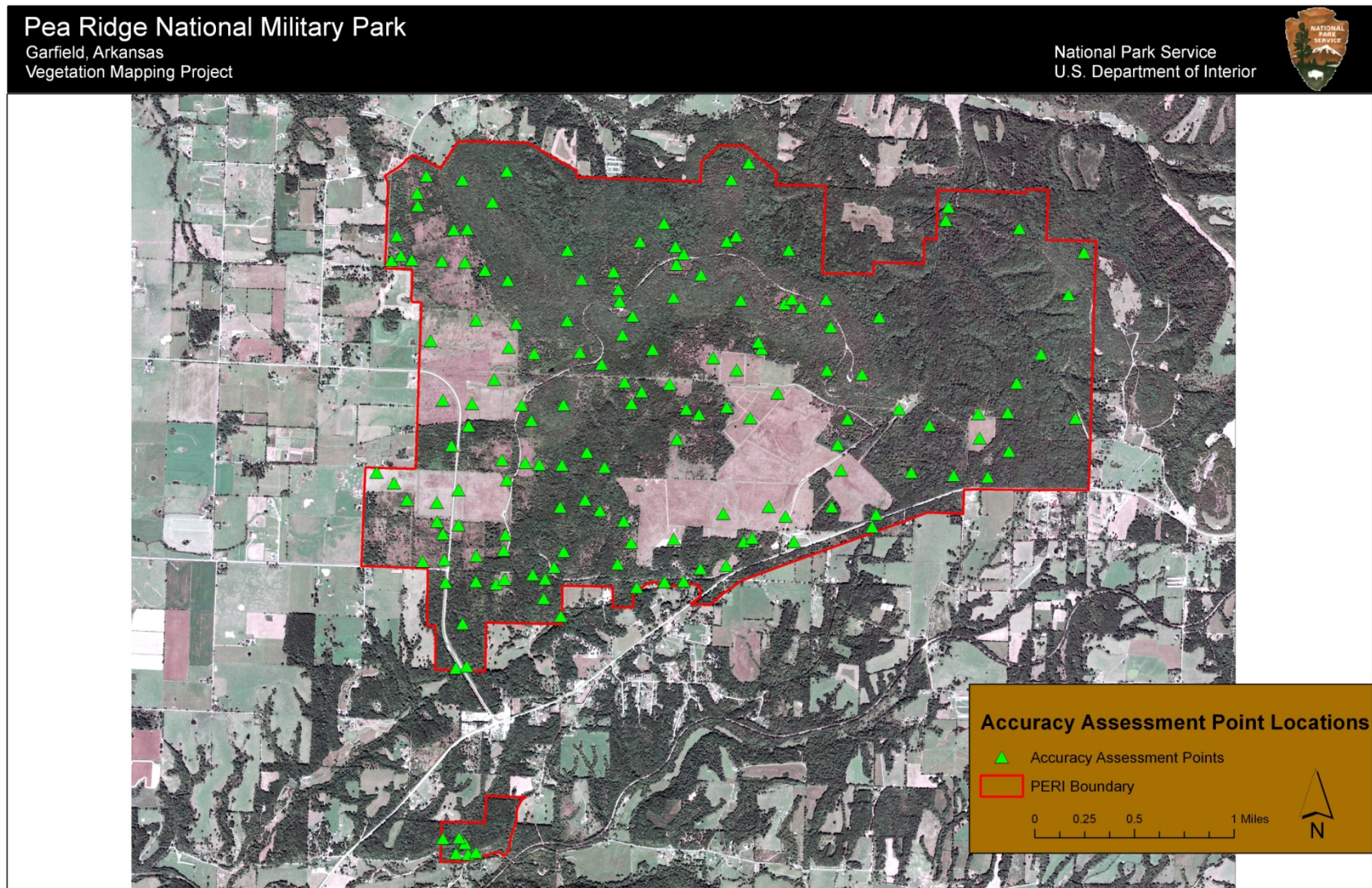


Figure 6. Accuracy Assessment points for Pea Ridge National Military Park.

Results

Vegetation Classification

We identified nine natural and semi-natural community types within the park. The Mowed Grassland type was considered semi-natural vegetation, but is part of the cultural landscape, and is managed mainly to enhance interpretation of the park's battlefield setting (Table 4). These types were identified based on a combination of quantitative analysis of plots and field observation. Of the 47 plots, we eliminated six from cluster analysis and ordination because they were collected from easily recognizable community types, and their composition was unlike other plots. These included plots from Mowed Grassland (3), Restored Tallgrass Prairie (2), and Marsh (1).

The remaining 41 plots were analyzed via cluster analysis and ordination (Figure 7). Deciduous forest plots over dry soils clustered away from those over more moist soils on the right side of the ordination, and those two types were identified as Dry Deciduous and Typic Upland Deciduous Woodland and Forest Communities (Figure 7). Deciduous forest plots on bottomland soils also formed a cluster on the left side of the ordination, and were identified as Bottomland Deciduous Woodland and Forest. Plots taken within non-forested areas, exclusive of mowed grasslands and restored prairie, formed a cluster on the lower center part of the ordination and were identified as Ruderal Grassland and Shrubland. Finally, all plots dominated by eastern redcedar, whether on bottomlands, dry uplands, or moist uplands, formed one group in the central part of the ordination and were identified as Eastern Redcedar Woodland and Forest.

One final type, Silver Maple Forest, occurred in only one small area of the park (6.4 acres or 2.6 ha), and was identified based on field observation. This type was discovered after field plots had been collected, and is a relatively low diversity, non-natural or at best successional forest.

During the plot sampling efforts a total of 327 taxa of flowering plants were observed (Appendix E). Hinterthuer (2003) found 520 taxa on a grid of 496 plots, 70 of which were visited three times over a 15-month period.

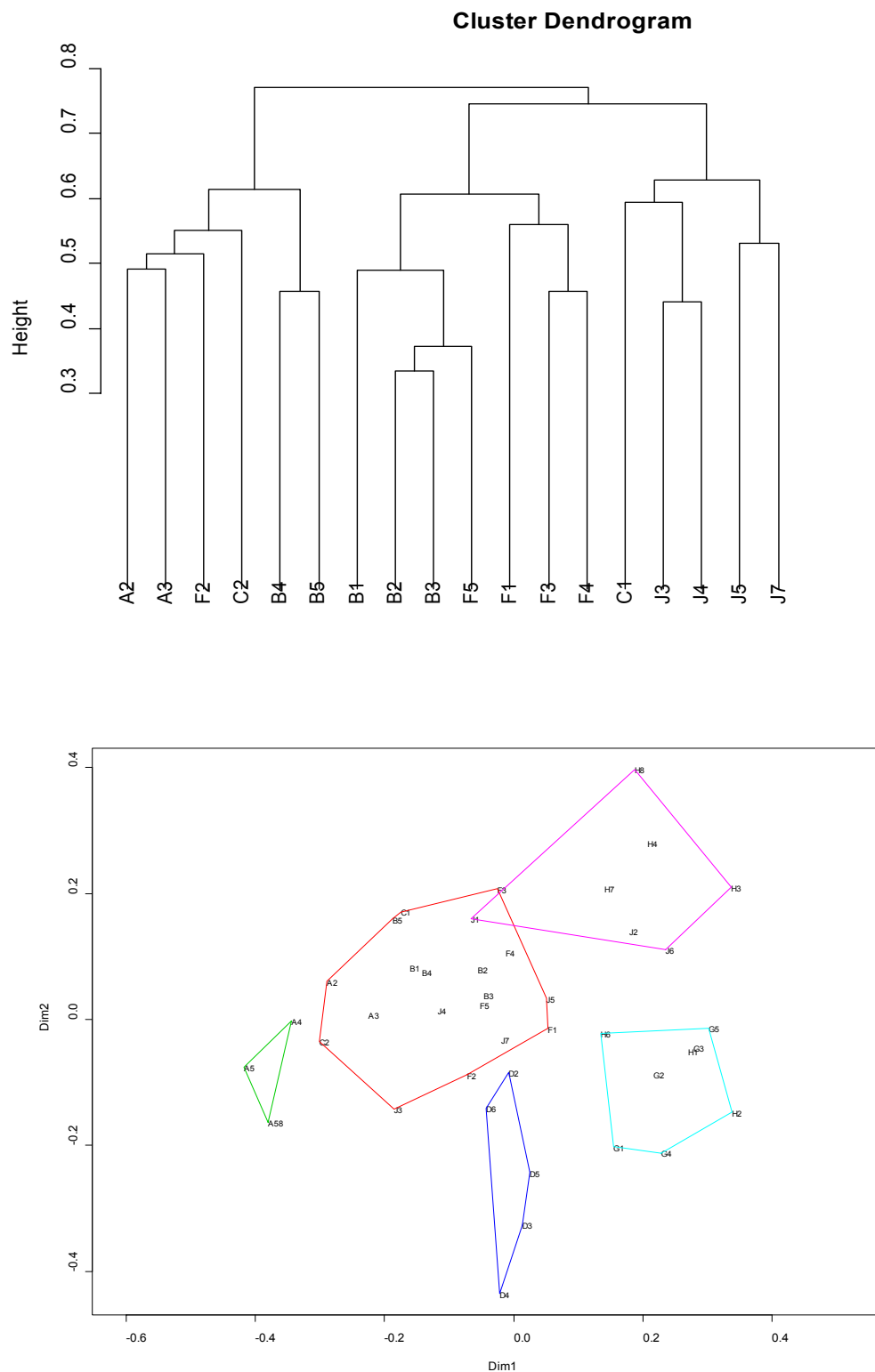


Figure 7. Ordination analysis and cluster dendrogram for 47 plots sampled in Pea Ridge. Groups of Mapped Types are, from left to right on the ordination, Bottomland Deciduous Woodland and Forest (green), Eastern Redcedar Woodland and Forest (red), Ruderal Grassland and Shrubland (blue), Typical Upland Deciduous Woodland and Forest (purple) and Dry Deciduous Woodland and Forest (cyan).

Digital Imaging and Interpretation

Image objects created from merged imagery generally corresponded with land cover visible on the aerial photographs. Heads-up digitization resulted in 'cleaner' edges between vegetation types that were apparent on the photographs. Image objects that were less than 36 square meters in size were merged with adjacent objects. In addition, trails and roads were defined by buffering existing line files, then intersecting with the image objects.

Eleven mapped types that corresponded directly with the classified vegetation plus developed land and water were created (Table 4). The developed land map class was a catch-all that included all areas without semi-natural vegetation.

Vegetation Map

The total of approximately 4,267 acres (1,727 ha) are within the accepted boundaries of PERI (Figure 8). The standard minimum mapping unit for NPS vegetation mapping projects is defined as 0.5 hectare, although several mapped polygons were smaller for PERI. Typic Upland Deciduous Woodland and Forest covers 2,001.4 acres (810 ha or 46.8%), of the park, and Dry Deciduous Woodland and Forest 480.0 acres (194.2 ha or 11.2%). Eastern Redcedar Woodland and Forest covers 673.9 acres (272.7 ha or 15.8% of the park). Thus, these three typic, dry, and successional woodlands and forests account for almost three-quarters of the total area of the park. Regularly mowed grassland covers 568.9 acres (230.2 ha or 13.3%) and Ruderal Grassland and Shrubland 362.9 acres (146.9 ha or 8.5%). Other types each account for less than 1.5% of the area.

Accuracy Assessment

The 2012 accuracy assessment for PERI was limited to the 4,210 acres (1,704 hectares) of natural and semi-natural vegetation within the park boundary. A total of 155 points were required to accurately evaluate the nine natural and semi-natural mapped vegetation types identified in the park (Table 4).

Navigational error (positional accuracy) of the GPS unit ranged from 1 – 5 meters for the 155 accuracy assessment points. Spatial offset was required for 7 sites to ensure the entire plot was composed of a homogenous mapped type. The new GPS coordinates for the offset were updated in both the project geodatabase as well as the tabular database.

Table 4. Mapped types identified at Pea Ridge National Battlefield.

NVC Identifier	Mapped Type	Scientific Name / Description	Number of Polygons	Acres	Hectares
Forest and Woodlands					
similar to CEGL002410	Bottomland Deciduous Woodland and Forest	<i>Juglans nigra</i> - <i>Morus rubra</i> - <i>Ulmus americana</i> Bottomland Forest	18	54.77	22.17
CEGL002149	Dry Deciduous Woodland and Forest	<i>Quercus stellata</i> - <i>Quercus</i> <i>marilandica</i> - <i>Quercus velutina</i> - <i>Carya texana</i> / <i>Schizachyrium</i> <i>scoparium</i> Woodland	8	480.04	194.27

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Table 4. Mapped types Identified at Pea Ridge National Battlefield (continued).

NVC Identifier	Mapped Type	Scientific Name / Description	Number of Polygons	Acres	Hectares
CEGL002593	Eastern Redcedar Woodland and Forest	<i>Juniperus virginiana</i> Midwest Forest	99	673.96	272.75
similar to CEGL002586	Silver Maple Forest	<i>Acer saccharinum</i> - <i>Ulmus americana</i> Forest	2	6.35	2.57
CEGL002076	Typic Upland Deciduous Woodland and Forest	<i>Quercus velutina</i> - <i>Quercus alba</i> - <i>Carya (glabra, ovata)</i> Forest	75	2,001.43	809.98
Herbaceous and Shrubland Vegetation					
CEGL002233	Marsh	<i>Typha spp.</i> Midwest Herbaceous Vegetation	2	.53	.21
CEGL004048	Mowed Grassland	<i>Schedonorus (phoenix, pratensis)</i> Herbaceous Vegetation	16	568.88	230.22
None assigned	Restored Tallgrass Prairie	<i>Schizachyrium scoparium</i> - <i>Andropogon gerardii</i> / <i>Symphoricarpos orbiculatus</i> Grassland	2	60.79	24.6
None assigned	Ruderal Grassland and Shrubland	<i>Symphoricarpos orbiculatus</i> - <i>Ulmus alata</i> - <i>Rubus pensilvanicus</i> / <i>Schedonorus phoenix</i> Grassland and Shrubland	35	362.86	146.85
Developed Land and Water					
Not applicable	Developed Land	buildings, parking lots, picnic areas, roads, cemetery, garden, sewage application field	38	57.28	23.18
None assigned	Water	man-made, spring-fed pond	5	.59	.24
Total Developed Land and Water			43	57.87	23.42
Total Natural and Semi-natural Vegetation			257	4,209.61	1,703.62
Totals			300	4,267.48	1,727.04

Overall accuracy of the final error matrix was 93.1% (the 90% confidence interval was between 88.6 and 97.6%) for the natural and semi-natural mapped vegetation types at PERI (Appendix A). All nine natural and semi-natural mapped vegetation types exceeded the 80% threshold for both producer's and user's accuracy. Of the 155 accuracy assessment points, 147 were assigned correctly. Kappa Index, or the random chance polygons were assigned correctly, was 93.9%.

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Garfield, Arkansas
Vegetation Mapping Project

National Park Service
U.S. Department of Interior

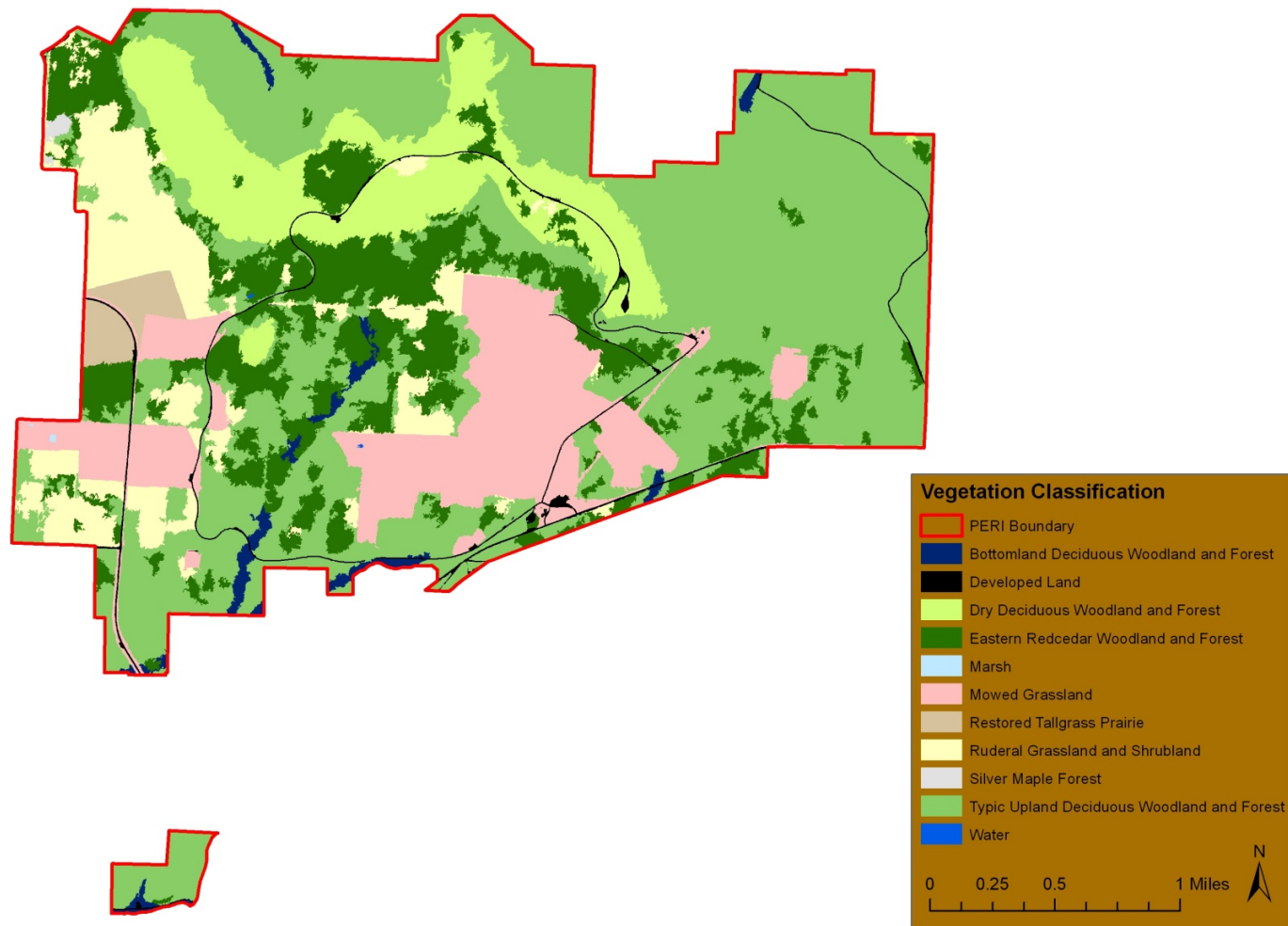


Figure 8. Vegetation map of Pea Ridge National Military Park.

Vegetation Associations

Mapped Type Name: *Bottomland Deciduous Woodland and Forest*

Macrogroup: Northern & Central Floodplain Forest & Scrub (MG029)

Group: Silver Maple – Green Ash – Sycamore – Hackberry Floodplain Forest (G040)

Association: No association assigned, but similar to CEG002410 *Fraxinus pennsylvanica* – *Celtis* spp. – *Quercus* spp. – *Platanus occidentalis* Bottomland Forest

Type Common Name: Black Walnut – Red Mulberry – American Elm Bottomland Forest

Type Scientific Name: *Juglans nigra* - *Morus rubra* - *Ulmus americana* Bottomland Forest



Figure 9. Bottomland Deciduous Woodland and Forest at Pea Ridge National Military Park.

Global Summary: The similar association is part of the broadly-defined North-Central Interior Floodplain ecological system that is found along rivers and streams in the Midwest. The system occurs from river's edge across the floodplain or to where it meets a wet meadow or upland system. The ash - oak - sycamore mesic bottomland forest association is found in Arkansas, Missouri and possibly other parts of the southeastern United States. Stands occur on level to gently sloping terraces and levees of stream and river floodplains, typically on larger streams. Soils are moderately well-drained and moist throughout the year, but only wet in spring. Ponding is typically absent. The species in the dominant tree layer include common hackberry (*Celtis occidentalis*), green ash (*Fraxinus pennsylvanica*), American sycamore (*Platanus occidentalis*), bur oak (*Quercus macrocarpa*) (or more rarely white oak (*Quercus alba*)). Canadian woodnettle (*Laportea canadensis*) is common in the ground layer (Figure 9).

Environmental Description: At PERI, this type was restricted to well-watered soils of narrow floodplains along small streams, especially Lee Creek.

Vegetation Description: Relatively early successional bottomland species dominated this type at PERI. Important overstory species included black walnut (*Juglans nigra*), American elm (*Ulmus americana*), red mulberry (*Morus rubra*), common hackberry (*Celtis occidentalis*), boxelder (*Acer negundo*), and chinkapin oak (*Quercus muehlenbergii*). Coralberry (*Symphoricarpos orbiculatus*) and northern spicebush (*Lindera benzoin*) were present within all plots and dominated the shrub layer. The non-native invasive multiflora rose (*Rosa multiflora*) also occurred in all plots. Virginia wildrye (*Elymus virginicus*) was the most dominant herbaceous species, although several others occurred in all plots (Table 5).

Most Abundant Species:

Table 5. Average cover (for plots where the species occurred) and frequency for four plots taken within Bottomland Deciduous Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown.

Bottomland Deciduous Woodland and Forest			
Scientific Name	Common Name	%Cover	Frequency
Tree			
<i>Ulmus rubra</i>	slippery elm	30.3	25.0%
<i>Juglans nigra</i>	black walnut	29.8	100.0%
<i>Nyssa sylvatica</i>	black gum	17.6	25.0%
<i>Morus rubra</i>	red mulberry	16.0	75.0%
<i>Acer negundo</i>	boxelder	15.8	50.0%
<i>Platanus occidentalis</i>	American sycamore	15.0	25.0%
<i>Ulmus americana</i>	American elm	12.0	100.0%
<i>Celtis occidentalis</i>	common hackberry	6.7	100.0%
<i>Quercus muehlenbergii</i>	chinkapin oak	5.6	75.0%
<i>Fraxinus pennsylvanica</i>	green ash	4.0	25.0%
<i>Maclura pomifera</i>	Osage orange	3.5	25.0%
<i>Gleditsia triacanthos</i>	honey locust	3.0	25.0%
<i>Quercus rubra</i>	northern red oak	2.5	75.0%

Table 5. Average cover (for plots where the species occurred) and frequency for four plots taken within Bottomland Deciduous Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Quercus velutina</i>	black oak	2.2	50.0%
<i>Fraxinus americana</i>	white ash	2.0	50.0%
<i>Aesculus glabra.</i>	Ohio buckeye	1.0	25.0%
<i>Asimina triloba</i>	pawpaw	1.0	25.0%
<i>Juniperus virginiana</i>	eastern redcedar	1.0	25.0%
<i>Cornus florida</i>	flowering dogwood	0.8	75.0%
<i>Carya cordiformis</i>	bitternut hickory	0.5	50.0%
<i>Prunus serotina</i>	black cherry	0.5	50.0%
Shrub			
<i>Symphoricarpos orbiculatus</i>	coralberry	41.2	100.0%
<i>Lindera benzoin</i>	northern spicebush	24.2	100.0%
<i>Lonicera japonica.</i>	Japanese honeysuckle	8.0	50.0%
<i>Rosa multiflora.</i>	multiflora rose	6.8	100.0%
<i>Toxicodendron radicans</i>	eastern poison ivy	6.3	75.0%
<i>Parthenocissus quinquefolia</i>	Virginia creeper	6.2	75.0%
<i>Vitis vulpina</i>	frost grape	3.5	75.0%
<i>Frangula caroliniana</i>	Carolina buckthorn	3.0	25.0%
<i>Ribes missouriense</i>	Missouri gooseberry	3.0	25.0%
<i>Rosa carolina</i>	Carolina rose	3.0	25.0%
<i>Smilax bona-nox</i>	saw greenbrier	2.0	50.0%
<i>Sambucus nigra</i> ssp. <i>canadensis</i>	American black elderberry	2.0	50.0%
<i>Euonymus fortunei</i>	winter creeper	1.0	25.0%
<i>Viburnum rufidulum</i>	rusty blackhaw	0.7	50.0%
<i>Smilax tamnoides</i>	bristly greenbrier	0.5	75.0%
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry	0.5	50.0%
Herbaceous			
<i>Glechoma hederacea</i>	ground ivy	37.5	25.0%
<i>Laportea canadensis</i>	Canadian woodnettle	37.5	25.0%
<i>Elymus virginicus</i>	Virginia wildrye	28.3	100.0%
<i>Chasmanthium latifolium</i>	Indian woodoats	26.0	75.0%
<i>Carex amphibola</i>	eastern narrowleaf sedge	5.3	75.0%
<i>Microstegium vimineum</i>	Nepalese browntop	5.3	75.0%

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Table 5. Average cover (for plots where the species occurred) and frequency for four plots taken within Bottomland Deciduous Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Carex blanda</i>	eastern woodland sedge	4.8	100.0%
<i>Verbesina alternifolia</i>	wingstem	2.2	75.0%
<i>Chaerophyllum tainturieri.</i>	hairyfruit chervil	1.8	50.0%
<i>Dichanthelium clandestinum</i>	deertongue	1.8	50.0%
<i>Festuca subverticillata</i>	nodding fescue	1.8	50.0%
<i>Valerianella radiata</i>	beaked cornsalad	1.8	50.0%
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	1.3	75.0%
<i>Galium aparine</i>	stickywilly	1.3	75.0%
<i>Sanicula odorata</i>	clustered blacksnakeroot	1.1	100.0%
<i>Geum canadense.</i>	white avens	0.5	100.0%
<i>Phryma leptostachya</i>	American lopseed	0.5	100.0%
<i>Viola sororia</i>	common blue violet	0.5	100.0%
<i>Agrimonia pubescens</i>	soft agrimony	0.5	75.0%
<i>Allium canadense</i>	meadow garlic	0.5	75.0%
<i>Amphicarpaea bracteata</i> var. <i>bracteata</i>	American hogpeanut	0.5	75.0%
<i>Elephantopus carolinianus.</i>	Carolina elephantsfoot	0.5	75.0%
<i>Arisaema dracontium</i>	green dragon	0.5	50.0%
<i>Botrychium virginianum</i>	rattlesnake fern	0.5	50.0%
<i>Geum vernum</i>	spring avens	0.5	50.0%
<i>Oxalis dillenii.</i>	slender yellowwWoodsorrel	0.5	50.0%
<i>Pilea pumila</i>	Canadian clearweed	0.5	50.0%
<i>Poa sylvestris</i>	woodland bluegrass	0.5	50.0%
<i>Polygonum virginianum</i>	jumpseed	0.5	50.0%
<i>Ranunculus recurvatus</i>	blisterwort	0.5	50.0%
<i>Triodanis perfoliata</i>	clasping Venus' looking-glass	0.5	50.0%
<i>Verbesina virginica</i>	white crownbeard	0.5	50.0%
<i>Veronica arvensis</i>	corn speedwell	0.5	50.0%
<i>Woodsia obtusa</i>	bluntlobe cliff fern	0.5	50.0%

Mapped Type Name: *Dry Deciduous Woodland and Forest*

Macrogroup: South-Central Oak – Hardwood & Pine Forest (MG016)

Group: *Quercus alba* – *Quercus falcata* – *Quercus rubra* Forest and Woodland Group (G159)

Association: CEG002149

NVC Common Name: Ozark/Ouachita Post Oak – Blackjack Oak – Black Oak / Little Bluestem Woodland

NVC Scientific Name: *Quercus stellata* - *Quercus marilandica* - *Quercus velutina* - *Carya texana* / *Schizachyrium scoparium* Woodland



Figure 10. Dry Deciduous Woodland and Forest at Pea Ridge National Military Park.

Global Summary: This type is part of the Ozark-Ouachita Dry Oak Woodland ecological system (Figure 10), which is common throughout the Ozarks and Ouachita's and into the Interior Low Plateau regions on dry site types. The post oak - blackjack oak woodland type occurs on gentle to steep hills and plains, bluff escarpments, and broad ridges and flats with any aspect, but primarily south- and west-facing slopes. Soils are rapidly to very rapidly drained, shallow, and strewn with boulders, cobbles, gravel, and sand. Soil pH is neutral to slightly acidic. Bedrock can be sandstone, chert, or igneous rock and is often exposed. The tree canopy is short to medium (7-20 m), spreading, open, and limby. Dominant species include post oak (*Quercus stellata*) and/or blackjack oak (*Quercus marilandica*). Other species may form a minor canopy component, scattered in the canopy, and include (e.g., *Quercus velutina*, *Quercus rubra*, *Quercus alba*, and *Carya alba*). The understory is very poorly developed, consisting of a few widely scattered shrubs and small trees, including, in addition to the dominant trees, winged elm (*Ulmus*

alata) and *Vaccinium* spp. (*Vaccinium arboreum*, *Vaccinium stamineum*, or *Vaccinium pallidum*). Coverage of the herbaceous stratum can vary from quite sparse to moderately dense, consisting of mixed grasses and forbs. Typical species include woodland sunflower (*Helianthus divaricatus*), American ipecac (*Porteranthus stipulatus*), poverty oatgrass (*Danthonia spicata*), little bluestem (*Schizachyrium scoparium*), common dittany (*Cunila origanoides*), big bluestem (*Andropogon gerardii*), and tall blazing star (*Liatris aspera*), but others may occur. Lichens and mosses can be abundant.

Environmental Description: At PERI, this type occurred on well-drained, elevated sandstone and shale hills and plateaus and down gentle slopes associated with the sandstone and shale. The largest expanse was on Elkhorn Mountain, a linear mountain that trends east to west across the north central portion of the park.

Vegetation Description: The most elevated portions of this type formed open woodlands with a grassy understory, and areas downslope were more closed with fewer herbaceous species in the understory. Post oak (*Quercus stellata*) was the prevailing dominant tree, with blackjack oak (*Quercus marilandica*), black hickory (*Carya texana*), and black oak (*Quercus velutina*) often important components. Coralberry (*Symphoricarpos orbiculatus*) was among the most important shrubs on every plot, and deerberry (*Vaccinium stamineum*), winged elm (*Ulmus alata*), common service berry (*Amelanchier arborea*), and rusty blackhaw (*Viburnum rufidulum*) were often important. Virginia creeper (*Parthenocissus quinquefolia*) and Pennsylvania blackberry (*Rubus pensilvanicus*) were important vines. Important herbaceous species included Virginia wildrye (*Elymus virginicus*), poverty oatgrass (*Danthonia spicata*), Muhlenberg's sedge (*Carex muehlenbergii*), and rock muhly (*Muhlenbergia sobolifera*) (Table 6).

Most Abundant Species:

Table 6. Average cover (for plots where the species occurred) and frequency for eight plots taken within Dry Deciduous Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown.

Dry Deciduous Woodland and Forest			
Scientific Name	Common Name	%Cover	Frequency
Tree			
<i>Quercus stellata</i>	post oak	40.99	87.5%
<i>Quercus rubra</i>	northern red oak	17.77	37.5%
<i>Carya ovata</i>	shagbark hickory	15.85	12.5%
<i>Carya glabra</i>	pignut hickory	15.00	12.5%
<i>Quercus velutina</i>	black oak	12.83	87.5%
<i>Quercus marilandica</i>	blackjack oak	10.94	62.5%
<i>Carya texana</i>	black hickory	10.18	100.0%
<i>Ulmus americana</i>	American elm	7.96	25.0%
<i>Quercus alba</i>	white oak	5.70	50.0%
<i>Juglans nigra</i>	black walnut	3.73	25.0%
<i>Carya alba</i>	mockernut hickory	3.00	12.5%
<i>Tilia americana</i>	American basswood	1.75	25.0%

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Table 6. Average cover (for plots where the species occurred) and frequency for eight plots taken within Dry Deciduous Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Morus rubra</i>	red mulberry	1.25	50.0%
<i>Nyssa sylvatica</i>	blackgum	1.00	25.0%
<i>Diospyros virginiana</i>	common persimmon	0.67	75.0%
<i>Juniperus virginiana</i>	eastern redcedar	0.58	75.0%
<i>Celtis occidentalis</i>	common hackberry	0.50	87.5%
<i>Fraxinus americana</i>	white ash	0.50	50.0%
<i>Sassafras albidum</i>	sassafras	0.50	37.5%
<i>Gleditsia triacanthos</i>	honeylocust	0.50	25.0%
Shrub			
<i>Vaccinium stamineum</i>	deerberry	9.75	50.0%
<i>Cornus florida</i>	flowering dogwood	6.33	37.5%
<i>Symphoricarpos orbiculatus</i>	Coralberry	3.07	100.0%
<i>Amelanchier arborea</i>	common serviceberry	1.41	75.0%
<i>Ulmus alata</i>	winged elm	0.87	87.5%
<i>Parthenocissus quinquefolia</i>	Virginia creeper	0.75	100.0%
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry	0.50	75.0%
<i>Vitis vulpina</i>	frost grape	0.50	75.0%
<i>Viburnum rufidulum</i>	rusty blackhaw	0.50	62.5%
<i>Smilax bona-nox</i>	saw greenbrier	0.50	50.0%
<i>Frangula caroliniana</i>	Carolina buckthorn	0.50	25.0%
<i>Lonicera flava</i>	yellow honeysuckle	0.50	25.0%
<i>Rosa carolina.</i>	Carolina rose	0.50	25.0%
<i>Toxicodendron radicans</i>	eastern poison ivy	0.50	25.0%
Herbaceous			
<i>Elymus virginicus</i>	Virginia wildrye	6.06	100.0%
<i>Danthonia spicata</i>	poverty oatgrass	4.00	87.5%
<i>Muhlenbergia sobolifera</i>	rock muhly	3.33	75.0%
<i>Carex muehlenbergii</i>	Muhlenberg's sedge	3.29	87.5%
<i>Stellaria media</i>	common chickweed	3.00	12.5%
<i>Cardamine parviflora</i>	sand bittercress	2.92	75.0%
<i>Cunila origanoides</i>	common dittany	1.75	25.0%
<i>Dichanthelium laxiflorum</i>	openflower rosette grass	1.75	25.0%
<i>Lespedeza violacea</i>	violet lespedeza	1.75	25.0%
<i>Woodsia obtusa</i>	bluntlobe cliff fern	1.75	25.0%
<i>Carex hirsutella.</i>	fuzzy wuzzy sedge	1.75	100.0%
<i>Carex albicans</i> var. <i>albicans</i>	whitetinge sedge	1.75	75.0%

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Table 6. Average cover (for plots where the species occurred) and frequency for eight plots taken within Dry Deciduous Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Krigia dandelion</i>	potato dwarf dandelion	1.33	37.5%
<i>Scutellaria parvula</i>	small skullcap	1.33	37.5%
<i>Carex cephalophora</i>	oval-leaf sedge	1.33	75.0%
<i>Triodanis perfoliata</i>	clasping Venus' looking-glass	1.21	87.5%
<i>Parietaria pensylvanica</i>	Pennsylvania pellitory	1.13	50.0%
<i>Schizachyrium scoparium</i>	little bluestem	1.13	50.0%
<i>Scutellaria ovata</i>	heartleaf skullcap	1.00	62.5%
<i>Solidago ulmifolia</i>	elmleaf goldenrod	1.00	62.5%
<i>Rubus flagellaris</i>	northern dewberry	0.67	37.5%
<i>Carex retroflexa</i>	reflexed sedge	0.50	100.0%
<i>Lespedeza procumbens</i>	trailing lespedeza	0.50	100.0%
<i>Asclepias quadrifolia</i>	fourleaf milkweed	0.50	87.5%
<i>Dichanthelium boscii</i>	Bosc's panicgrass	0.50	87.5%
<i>Antennaria plantaginifolia</i>	woman's tobacco	0.50	75.0%
<i>Desmodium perplexum</i>	perplexed ticktrefoil	0.50	75.0%
<i>Dichanthelium acuminatum</i> var. <i>fasciculatum</i>	western panicgrass	0.50	75.0%
<i>Dichanthelium linearifolium</i>	slimleaf panicgrass	0.50	75.0%
<i>Galium circaeans</i>	licorice bedstraw	0.50	75.0%
<i>Lespedeza virginica</i>	slender lespedeza	0.50	75.0%
<i>Aristolochia serpentaria</i>	Virginia snakeroot	0.50	62.5%
<i>Asplenium platyneuron</i>	ebony spleenwort	0.50	62.5%
<i>Carex nigromarginata</i>	black edge sedge	0.50	62.5%
<i>Carex umbellata</i>	parasol sedge	0.50	62.5%
<i>Hypericum hypericoides</i> spp. <i>hypericoides</i>	St. Andrew's cross	0.50	62.5%
<i>Acalypha virginica</i>	Virginia threeseed mercury	0.50	50.0%
<i>Amphicarpaea bracteata</i> var. <i>bracteata</i>	American hogpeanut	0.50	50.0%
<i>Bidens bipinnata</i>	Spanish needles	0.50	50.0%
<i>Festuca subverticillata</i>	nodding fescue	0.50	50.0%
<i>Galium aparine</i>	stickywilly	0.50	50.0%
<i>Lobelia spicata</i>	palespike lobelia	0.50	50.0%
<i>Oxalis violacea</i>	violet woodsorrel	0.50	50.0%
<i>Physalis virginiana</i>	Virginia groundcherry	0.50	50.0%
<i>Sanicula canadensis</i>	Canadian blacksnakeroot	0.50	50.0%
<i>Symphyotrichum patens</i> var. <i>patens</i>	late purple aster	0.50	50.0%
<i>Tridens flavus</i>	purpletop tridens	0.50	50.0%
<i>Andropogon virginicus</i>	broomsedge bluestem	0.50	37.5%

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Table 6. Average cover (for plots where the species occurred) and frequency for eight plots taken within Dry Deciduous Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Desmodium nuttallii</i>	Nuttall's ticktrefoil	0.50	37.5%
<i>Dichanthelium malacophyllum</i>	softleaf rosette grass	0.50	37.5%
<i>Galium pilosum</i>	hairy bedstraw	0.50	37.5%
<i>Hypoxis hirsuta</i>	common goldstar	0.50	37.5%
<i>Lespedeza repens</i>	creeping lespedeza	0.50	37.5%
<i>Mimosa nuttallii</i>	Nuttall's sensitive-briar	0.50	37.5%
<i>Panicum anceps.</i>	beaked panicgrass	0.50	37.5%
<i>Viola triloba.</i>	three-lobed violet	0.50	37.5%
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	0.50	25.0%
<i>Botrychium virginianum</i>	rattlesnake fern	0.50	25.0%
<i>Bromus pubescens</i>	hairy woodland brome	0.50	25.0%
<i>Carex glaucoidea</i>	blue sedge	0.50	25.0%
<i>Chaerophyllum tainturieri.</i>	hairyfruit chervil	0.50	25.0%
<i>Conyza canadensis</i>	Canadian horseweed	0.50	25.0%
<i>Desmodium marilandicum</i>	smooth small-leaf ticktrefoil	0.50	25.0%
<i>Desmodium rotundifolium</i>	prostrate ticktrefoil	0.50	25.0%
<i>Dichanthelium commutatum</i>	variable panicgrass	0.50	25.0%
<i>Dichanthelium dichotomum</i>	cypress panicgrass	0.50	25.0%
<i>Erigeron annuus.</i>	eastern daisy fleabane	0.50	25.0%
<i>Euphorbia corollata</i>	flowering spurge	0.50	25.0%
<i>Geum canadense</i>	white avens	0.50	25.0%
<i>Hieracium gronovii</i>	queendevil	0.50	25.0%
<i>Oxalis dillenii</i>	slender yellow woodsorrel	0.50	25.0%
<i>Penstemon digitalis</i>	talus slope penstemon	0.50	25.0%
<i>Poa sylvestris</i>	woodland bluegrass	0.50	25.0%
<i>Polygonum scandens</i>	climbing false buckwheat	0.50	25.0%
<i>Solanum carolinense</i>	Carolina horsenettle	0.50	25.0%
<i>Solidago buckleyi</i>	Buckley's goldenrod	0.50	25.0%
<i>Sphenopholis obtusata</i>	prairie wedgescale	0.50	25.0%
<i>Stylosanthes biflora</i>	sidebeak pencilflower	0.50	25.0%
<i>Thalictrum thalictroides</i>	rue anemone	0.50	25.0%
<i>Verbesina alternifolia</i>	wingstem	0.50	25.0%
<i>Vernonia baldwinii.</i>	Baldwin's ironweed	0.50	25.0%
<i>Viola bicolor</i>	field pansy	0.50	25.0%
<i>Viola sororia</i>	common blue violet	0.50	25.0%

Mapped Type Name: *Eastern Redcedar Woodland and Forest*

Macrogroup: Eastern North American Ruderal Forest and Plantation (MG013)

Group: North & Central Hardwood & Conifer Ruderal Forest Group (G0303)

Association: CEG002593

NVC Common Name: Eastern Redcedar Midwest Forest

NVC Scientific Name: *Juniperus virginiana* Midwest Forest



Figure 11. Eastern Redcedar Woodland and Forest at Pea Ridge National Military Park.

Global Summary: Eastern redcedar (*Juniperus virginiana*) is a common native successional tree throughout the Midwest and eastern United States, ranging from South Dakota east through the Great Lakes states to the Atlantic Coast of New England, and south to northern Florida and eastern Texas. The species germinates and grows in full sun but not in the shade, and thus is a common pioneer tree in old crop fields. Where conditions are moist enough for taller deciduous trees to grow, stands of eastern redcedar are over-topped and replaced by more shade-tolerant species over time (Figure 11).

Environmental Description: At PERI, this type occurred in old crop fields over all soils and in all landscape positions.

Vegetation Description: Eastern redcedar was the prevailing dominant of this type, often in low-diversity stands. Other trees found in all or almost all plots included American elm (*Ulmus americana*), common hackberry (*Celtis occidentalis*), black oak (*Quercus velutina*), and red mulberry (*Morus rubra*). These deciduous trees may overtop and replace eastern redcedar over

time, and hence stands that represent this type may become more different from each other through succession (e.g. stands in bottomlands versus stands in uplands will be dominated by different deciduous species). Other common small trees and shrubs included flowering dogwood (*Cornus florida*), common persimmon (*Diospyros virginiana*), and coral berry (*Symphoricarpos orbiculatus*). Common vines included Virginia creeper (*Parthenocissus quinquefolia*), saw greenbrier (*Smilax bona-nox*), eastern poison ivy (*Toxicodendron radicans*), and frost grape (*Vitis vulpina*). Common herbaceous species included ebony spleenwort (*Asplenium platyneuron*), eastern woodland sedge (*Carex blanda*), reflexed sedge (*Carex retroflexa*), and Virginia wildrye (*Elymus virginicus*) (Table 7).

Most Abundant Species:

Table 7. Average cover (for plots where the species occurred) and frequency for thirteen plots taken within Eastern Redcedar Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown.

Eastern Redcedar Woodland and Forest			
Scientific Name	Common Name	%Cover	Frequency
Tree			
<i>Juniperus virginiana</i>	eastern redcedar	54.9	100.0%
<i>Quercus alba</i>	white oak	28.1	7.7%
<i>Platanus occidentalis</i>	American sycamore	15.0	7.7%
<i>Quercus velutina</i>	black oak	10.4	76.9%
<i>Cornus florida</i>	flowering dogwood	10.0	92.3%
<i>Juglans nigra</i>	black walnut	9.8	38.5%
<i>Ulmus americana</i>	American elm	8.6	100.0%
<i>Maclura pomifera</i>	Osage orange	5.5	23.1%
<i>Quercus stellata</i>	post oak	5.0	69.2%
<i>Quercus muehlenbergii</i>	chinkapin oak	4.9	30.8%
<i>Sassafras albidum</i>	sassafras	4.5	69.2%
<i>Carya cordiformis</i>	bitternut hickory	3.5	15.4%
<i>Fraxinus americana</i>	white ash	3.3	84.6%
<i>Quercus marilandica</i>	blackjack oak	3.0	53.8%
<i>Morus rubra</i>	red mulberry	2.5	69.2%
<i>Diospyros virginiana</i>	common persimmon	1.6	61.5%
<i>Celtis occidentalis</i>	common hackberry	1.4	100.0%
<i>Prunus serotina</i>	black cherry	1.0	46.2%
<i>Carya texana</i>	black hickory	0.6	53.8%
<i>Gleditsia triacanthos</i>	honeylocust	0.5	38.5%
<i>Quercus rubra</i>	northern red oak	0.5	23.1%
<i>Acer rubrum</i>	red maple	0.5	15.4%
<i>Carya alba</i>	mockernut hickory	0.5	15.4%
<i>Salix nigra</i>	black willow	0.5	15.4%

Table 7. Average cover (for plots where the species occurred) and frequency for thirteen plots taken within Eastern Redcedar Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
Shrub			
<i>Lindera benzoin</i>	northern spicebush	10.5	61.5%
<i>Symphoricarpos orbiculatus</i>	coralberry	10.1	100.0%
<i>Vitis vulpina</i>	frost grape	7.6	92.3%
<i>Frangula caroliniana</i>	Carolina buckthorn	5.5	1.0%
<i>Parthenocissus quinquefolia</i>	Virginia creeper	1.3	100.0%
<i>Rosa multiflora</i>	multiflora rose	1.2	69.2%
<i>Viburnum rufidulum</i>	rusty blackhaw	1.1	38.5%
<i>Smilax bona-nox</i>	saw greenbrier	0.8	100.0%
<i>Ulmus alata</i>	winged elm	0.7	30.8%
<i>Toxicodendron radicans</i>	eastern poison ivy	0.5	76.9%
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry	0.5	61.5%
<i>Smilax tamnoides</i>	bristly greenbrier	0.5	53.8%
<i>Ribes missouriense</i>	Missouri gooseberry	0.5	30.8%
<i>Sideroxylon lanuginosum</i>	gum bully	0.5	30.8%
<i>Ilex opaca</i>	American holly	0.5	23.1%
<i>Prunus americana</i>	American plum	0.5	15.4%
<i>Rosa carolina</i>	Carolina rose	0.5	15.4%
Herbaceous			
<i>Bromus arvensis</i>	field brome	37.5	7.7%
<i>Chasmanthium latifolium</i>	Indian woodoats	17.8	61.5%
<i>Trifolium campestre</i>	field clover	5.3	23.1%
<i>Elymus virginicus</i>	Virginia wildrye	3.4	84.6%
<i>Lonicera japonica</i>	Japanese honeysuckle	3.0	46.0%
<i>Antennaria plantaginifolia</i>	woman's tobacco	3.0	7.7%
<i>Leersia oryzoides</i>	rice cutgrass	3.0	7.7%
<i>Carex retroflexa</i>	reflexed sedge	2.5	76.9%
<i>Carex blanda</i>	eastern woodland sedge	2.3	92.3%
<i>Danthonia spicata</i>	poverty oatgrass	1.4	61.5%
<i>Poa sylvestris</i>	woodland bluegrass	1.3	23.1%
<i>Amphicarpaea bracteata</i> var. <i>bracteata</i>	American hogpeanut	1.2	53.8%
<i>Carex cephalophora</i>	oval-leaf sedge	1.1	30.8%
<i>Carex amphibola</i>	eastern narrowleaf sedge	1.0	38.5%
<i>Sanicula odorata</i>	clustered blacksnakeroot	1.0	38.5%
<i>Asplenium platyneuron</i>	ebony spleenwort	0.9	100.0%
<i>Chaerophyllum tainturieri</i>	hairyfruit chervil	0.9	53.8%

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Table 7. Average cover (for plots where the species occurred) and frequency for thirteen plots taken within Eastern Redcedar Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Panicum anceps.</i>	beaked panicgrass	0.9	53.8%
<i>Festuca subverticillata</i>	nodding fescue	0.8	69.2%
<i>Carex hirsutella</i>	fuzzy wuzzy sedge	0.8	76.9%
<i>Galium aparine</i>	stickywilly	0.8	76.9%
<i>Muhlenbergia sobolifera</i>	rock muhly	0.8	76.9%
<i>Sanicula canadensis</i>	Canadian blacksnakeroot	0.5	69.2%
<i>Woodsia obtusa</i>	bluntlobe cliff fern	0.5	69.2%
<i>Dichanthelium malacophyllum</i>	softleaf rosette grass	0.5	61.5%
<i>Galium circaezans</i>	licorice bedstraw	0.5	61.5%
<i>Lespedeza procumbens.</i>	trailing lespedeza	0.5	61.5%
<i>Phryma leptostachya.</i>	American lopseed	0.5	61.5%
<i>Ranunculus abortivus.</i>	littleleaf buttercup	0.5	61.5%
<i>Desmodium perplexum</i>	perplexed ticktrefoil	0.5	53.8%
<i>Hackelia virginiana</i>	beggarslice	0.5	53.8%
<i>Ambrosia artemisiifolia</i>	annual ragweed	0.5	46.2%
<i>Cirsium altissimum</i>	tall thistle	0.5	46.2%
<i>Dichanthelium acuminatum</i> var. <i>fasciculatum</i>	western panicgrass	0.5	46.2%
<i>Lactuca floridana</i>	woodland lettuce	0.5	46.2%
<i>Rubus flagellaris.</i>	northern dewberry	0.5	46.2%
<i>Teucrium canadense</i>	Canada germander	0.5	46.2%
<i>Anemone virginiana</i>	tall thimbleweed	0.5	38.5%
<i>Carex nigromarginata</i>	black edge sedge	0.5	38.5%
<i>Elephantopus carolinianus.</i>	Carolina elephantsfoot	0.5	38.5%
<i>Parietaria pensylvanica</i>	Pennsylvania pellitory	0.5	38.5%
<i>Scutellaria ovata</i>	heartleaf skullcap	0.5	38.5%
<i>Triodanis perfoliata</i>	clasping Venus' looking-glass	0.5	38.5%
<i>Valerianella radiata</i>	beaked cornsalad	0.5	38.5%
<i>Vernonia baldwinii</i>	Baldwin's ironweed	0.5	38.5%
<i>Acalypha virginica</i>	Virginia threeseed mercury	0.5	30.8%
<i>Botrychium dissectum</i>	cutleaf grapefern	0.5	30.8%
<i>Erigeron annuus</i>	eastern daisy fleabane	0.5	30.8%
<i>Ipomoea pandurata</i>	man of the earth	0.5	30.8%
<i>Lactuca canadensis</i>	Canada lettuce	0.5	30.8%
<i>Lespedeza cuneata</i>	sericea lespedeza	0.5	30.8%
<i>Liparis liliifolia</i>	brown widelip orchid	0.5	30.8%
<i>Passiflora lutea</i>	yellow passionflower	0.5	30.8%

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Table 7. Average cover (for plots where the species occurred) and frequency for thirteen plots taken within Eastern Redcedar Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Penstemon digitalis</i>	talus slope penstemon	0.5	30.8%
<i>Perilla frutescens</i>	beefsteakplant	0.5	30.8%
<i>Potentilla simplex.</i>	common cinquefoil	0.5	30.8%
<i>Prunella vulgaris</i>	common selfheal	0.5	30.8%
<i>Ranunculus recurvatus</i>	blisterwort	0.5	30.8%
<i>Rudbeckia hirta</i>	blackeyed Susan	0.5	30.8%
<i>Taraxacum officinale</i>	common dandelion	0.5	30.8%
<i>Viola sororia</i>	common blue violet	0.5	30.8%
<i>Agrimonia pubescens.</i>	soft agrimony	0.5	23.1%
<i>Agrimonia rostellata</i>	beaked agrimony	0.5	23.1%
<i>Arisaema dracontium</i>	green dragon	0.5	23.1%
<i>Dichanthelium laxiflorum</i>	openflower rosette grass	0.5	23.1%
<i>Galium pilosum</i>	hairy bedstraw	0.5	23.1%
<i>Houstonia purpurea</i>	Venus' pride	0.5	23.1%
<i>Hypericum hypericoides</i>	St. Andrew's cross	0.5	23.1%
<i>Menispermum canadense</i>	common moonseed	0.5	23.1%
<i>Physalis virginiana</i>	Virginia groundcherry	0.5	23.1%
<i>Ranunculus hispidus</i>	bristly buttercup	0.5	23.1%
<i>Smilax ecirrhata</i>	upright carrionflower	0.5	23.1%
<i>Tridens flavus</i>	purpletop tridens	0.5	23.1%
<i>Verbesina virginica</i>	white crownbread	0.5	23.1%
<i>Allium canadense</i>	meadow garlic	0.5	15.4%
<i>Andropogon virginicus</i>	broomsedge bluestem	0.5	15.4%
<i>Barbarea vulgaris</i>	garden yellowrocket	0.5	15.4%
<i>Brachyelytrum erectum</i>	bearded shorthusk	0.5	15.4%
<i>Carex glaucoidea</i>	blue sedge	0.5	15.4%
<i>Carex muehlenbergii</i>	Muhlenberg's sedge	0.5	15.4%
<i>Desmodium nudiflorum</i>	nakedflower ticktrefoil	0.5	15.4%
<i>Desmodium paniculatum</i>	panickedleaf ticktrefoil	0.5	15.4%
<i>Dichanthelium boscii</i>	Bosc's panicgrass	0.5	15.4%
<i>Dichanthelium clandestinum</i>	deertongue	0.5	15.4%
<i>Erigeron strigosus</i>	prairie fleabane	0.5	15.4%
<i>Geranium carolinianum</i>	Carolina geranium	0.5	15.4%
<i>Hypericum punctatum</i>	spotted St. Johnswort	0.5	15.4%
<i>Juncus tenuis</i>	poverty rush	0.5	15.4%
<i>Leersia virginica</i>	whitegrass	0.5	15.4%

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Table 7. Average cover (for plots where the species occurred) and frequency for thirteen plots taken within Eastern Redcedar Woodland and Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Lespedeza repens</i>	creeping lespedeza	0.5	15.4%
<i>Lespedeza violacea</i>	violet lespedeza	0.5	15.4%
<i>Muhlenbergia schreberi</i>	nimblewill	0.5	15.4%
<i>Oxalis stricta</i>	common yellow oxalis	0.5	15.4%
<i>Oxalis violacea</i>	violet woodsorrel	0.5	15.4%
<i>Physalis heterophylla</i>	clammy groundcherry	0.5	15.4%
<i>Polystichum acrostichoides</i>	Christmas fern	0.5	15.4%
<i>Ruellia humilis</i>	fringeleaf wild petunia	0.5	15.4%
<i>Salvia lyrata</i>	lyreleaf sage	0.5	15.4%
<i>Solidago ulmifolia</i>	elmleaf goldenrod	0.5	15.4%
<i>Viola triloba</i>	three-lobed violet	0.5	15.4%

Mapped Type Name: *Marsh*

Macrogroup: Eastern North American Wet Meadow & Marsh (MG069)

Group: *Schoenoplectus* spp. – *Typha* spp. Freshwater Marsh Group (G125)

Association: CEG002233

NVC Common Name: Midwest Cattail Deep Marsh

NVC Scientific Name: *Typha* spp. Midwest Herbaceous Vegetation



Figure 12. Marsh at Pea Ridge National Military Park.

Global Summary: This type is within the North – Central Interior Freshwater Marsh ecological system, which is found throughout the Midwest north to southern Canada (Figure 12). Soils are hydric and representative stands include shallow, emergent herbaceous vegetation and submerged rooted vegetation. Many sources of water are included in the concept, from local depressions to streamsides and lakesides. The system occurs as small patches in the landscape.

Environmental Description: At PERI, this type was restricted to a single small area that retained water in the southeastern part of the park. The marsh was surrounded by grassland and includes small areas of open water in most years and seasons.

Vegetation Description: The marsh was dominated by broadleaf cattail (*Typha latifolia*) together with sedges (*Carex lurida*, *C. molesta*). Yellow pond-lily (*Nuphar lutea*) was also found in the often-flooded areas. A few small trees and shrubs, including common persimmon

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(*Diospyros virginiana*), American sycamore (*Platanus occidentalis*), and silver maple (*Acer saccharinum*) were scattered in the marsh (Table 8).

Most Abundant Species:

Table 8. Cover by layer and species for one plot taken within Marsh.

Marsh		
Scientific Name	Common Name	%Cover
Tree		
<i>Diospyros virginiana</i>	common persimmon	3
<i>Platanus occidentalis</i>	American sycamore	3
<i>Acer saccharinum</i>	silver maple	0.5
<i>Juniperus virginiana</i>	eastern redcedar	0.5
Herbaceous		
<i>Typha latifolia</i>	broadleaf cattail	62.5
<i>Carex lurida</i>	shallow sedge	15
<i>Carex molesta</i>	troublesome sedge	15
<i>Nuphar lutea</i>	yellow pond-lily	15
<i>Polygonum</i> sp.	knotweed	15
<i>Leersia oryzoides</i>	rice cutgrass	3
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	0.5
<i>Andropogon virginicus</i>	broomsedge bluestem	0.5
<i>Carex annectens</i>	yellowfruit sedge	0.5
<i>Eleocharis</i> sp.	spikerush	0.5
<i>Juncus tenuis</i>	poverty rush	0.5
<i>Lycopus americanus</i>	American water horehound	0.5
<i>Phleum pratense</i>	timothy	0.5
<i>Scirpus</i> sp.	bulrush	0.5
<i>Vicia sativa</i>	garden vetch	0.5

Mapped Type Name: *Mowed Grassland*

Macrogroup: Eastern Ruderal Shrubland and Grassland (MG123)

Group: Eastern Ruderal Shrubland and Grassland (G059)

Association: CEG004048

NVC Common Name: (Tall Fescue, Meadow Fescue) Herbaceous Vegetation

NVC Scientific Name: *Schedonorus (phoenix, pratensis)* Herbaceous Vegetation



Figure 13. Mowed Grassland at Pea Ridge National Military Park.

Global Summary: This association includes grassland pastures and hayfields, more-or-less cultural, though sometimes no longer actively maintained. The dominant species in this type are the European "tall or meadow fescues" of uncertain and controversial generic placement. Several other exotic grasses including redtop (*Agrostis gigantea*), orchardgrass (*Dactylis glomerata*), common velvetgrass (*Holcus lanatus*), timothy (*Phleum pratense*), and Kentucky bluegrass (*Poa pratensis*) are common associates. These communities are sometimes nearly monospecific but can also be very diverse and contain many native as well as exotic species of grasses, sedges, and forbs. Exotic forbs include the legumes sericea lespedeza (*Lespedeza cuneata*), field clover (*Trifolium campestre*), alsike clover (*Trifolium hybridum*), red clover (*Trifolium pratense*), and white clover (*Trifolium repens*), as well as common yarrow (*Achillea millefolium*), hedge false bindweed (*Calystegia sepium*), Queen Anne's lace (*Daucus carota*), oxeye daisy (*Leucanthemum vulgare*), common yellow oxalis (*Oxalis stricta*), and narrowleaf plantain (*Plantago lanceolata*). Common native herbs include Indianhemp (*Apocynum cannabinum*), hoary ticktrefoil (*Desmodium canescens*), Gould deertongue (*Dichanthelium clandestinum*), eastern daisy fleabane (*Erigeron annuus*), Virginia strawberry (*Fragaria virginiana*), common cinquefoil (*Potentilla simplex*), Carolina horsenettle (*Solanum carolinense*), Canada goldenrod (*Solidago canadensis*), and yellow crownbeard (*Verbesina occidentalis*). This vegetation is currently defined for the central and southern Appalachians,

Ozarks, Ouachita Mountains, and parts of the Piedmont and Interior Low Plateau, but it is possible throughout much of the eastern United States and southern Canada (Figure 13).

Environmental Description: At PERI, this type occurred as mowed fields in the central and southern part of the park. The condition of the fields, especially the views afforded visitors, is designed to enhance interpretation of the historic battlefield.

Vegetation Description: Tall fescue (*Schedonorus phoenix*) was the prevailing dominant of this type, and broomsedge bluestem (*Andropogon virginicus*) was present in all plots. Chapman's bluegrass (*Poa chapmaniana*) was often important (Table 9). No species of woody plant or vine was present in more than one plot, and overall cover values were always low.

Most Abundant Species:

Table 9. Average cover (for plots where the species occurred) and frequency for three plots taken within Mowed Grassland. Only species with at least 0.5% cover in at least two plots are shown.

Mowed Grassland			
Scientific Name	Common Name	%Cover	Frequency
Tree			
<i>Acer negundo</i>	boxelder	0.5	33.0%
<i>Diospyros virginiana</i>	common persimmon	0.5	33.0%
<i>Fraxinus americana</i>	white ash	0.5	33.0%
Shrub			
<i>Parthenocissus quinquefolia</i>	Virginia creeper	0.5	33.0%
<i>Prunus americana</i>	American plum	0.5	33.0%
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry	0.5	33.0%
<i>Symphoricarpos orbiculatus</i>	coralberry	0.5	33.0%
<i>Ulmus alata</i>	winged elm	0.5	33.0%
<i>Vitis vulpina</i>	frost grape	0.5	33.0%
Herbaceous			
<i>Pycnanthemum tenuifolium</i>	narrowleaf mountainmint	62.5	33.3%
<i>Schedonorus phoenix</i>	tall fescue	61.7	100.0%
<i>Poa chapmaniana</i>	Chapman's bluegrass	26.3	66.7%
<i>Carex annectens</i>	yellowfruit sedge	15.0	33.3%
<i>Carex molesta</i>	troublesome sedge	15.0	33.3%
<i>Andropogon virginicus</i>	broomsedge bluestem	6.2	100.0%
<i>Lolium perenne</i> ssp. <i>multiflorum</i>	Italian ryegrass	3.0	33.3%
<i>Poa pratensis</i>	Kentucky bluegrass	3.0	33.3%
<i>Vernonia baldwinii</i>	Baldwin's ironweed	3.0	33.3%
<i>Dactylis glomerata</i>	orchardgrass	0.5	66.7%
<i>Oxalis dillenii</i>	slender yellow woodsorrel	0.5	66.7%
<i>Pseudognaphalium obtusifolium</i> ssp. <i>obtusifolium</i>	rabbit-tobacco	0.5	66.7%
<i>Vicia sativa</i>	garden vetch	0.5	66.7%

Table 9. Average cover (for plots where the species occurred) and frequency for three plots taken within Mowed Grassland. Only species with at least 0.5% cover in at least two plots are shown. (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	0.5	33.3%
<i>Carex bushii</i>	Bush's sedge	0.5	33.3%
<i>Carex cephalophora</i>	oval-leaf sedge	0.5	33.3%
<i>Carex retroflexa</i>	reflexed sedge	0.5	33.3%
<i>Desmodium paniculatum</i>	panicledleaf ticktrefoil	0.5	33.3%
<i>Dichanthelium acuminatum</i> var. <i>fasciculatum</i>	western panicgrass	0.5	33.3%
<i>Dichanthelium oligosanthes</i>	Heller's rosette grass	0.5	33.3%
<i>Dichanthelium ravenelii</i>	Ravenel's rosette grass	0.5	33.3%
<i>Eleocharis</i> sp.	spikerush	0.5	33.3%
<i>Elymus virginicus</i>	Virginia wildrye	0.5	33.3%
<i>Erigeron annuus</i>	eastern daisy fleabane	0.5	33.3%
<i>Eupatorium serotinum</i>	lateflowering thoroughwort	0.5	33.3%
<i>Galium virgatum</i>	southwestern bedstraw	0.5	33.3%
<i>Geranium carolinianum</i>	Carolina geranium	0.5	33.3%
<i>Hordeum pusillum</i>	little barley	0.5	33.3%
<i>Juncus tenuis</i>	poverty rush	0.5	33.3%
<i>Lobelia spicata</i>	palespike lobelia	0.5	33.3%
<i>Panicum anceps</i>	beaked panicgrass	0.5	33.3%
<i>Poa annua</i>	annual bluegrass	0.5	33.3%
<i>Potentilla simplex</i>	common cinquefoil	0.5	33.3%
<i>Rubus flagellaris</i>	northern dewberry	0.5	33.3%
<i>Scirpus</i> sp.	bulrush	0.5	33.3%
<i>Sisyrinchium campestre</i>	prairie blue-eyed grass	0.5	33.3%
<i>Solidago ulmifolia</i>	elmleaf goldenrod	0.5	33.3%
<i>Tridens flavus</i>	purpletop tridens	0.5	33.3%
<i>Trifolium campestre</i>	field clover	0.5	33.3%
<i>Valerianella radiata</i>	beaked cornsalad	0.5	33.3%
<i>Vernonia arkansana</i>	Arkansas ironweed	0.5	33.3%
<i>Veronica arvensis</i>	corn speedwell	0.5	33.3%

Mapped Type Name: *Restored Tallgrass Prairie*

Macrogroup: Planted to replicate – Great Plains Tallgrass Prairie, Savannah & Shrubland (MG054)

Group: Planted to replicate – Central Great Plains Tallgrass Prairie Group (G333)

Association: None assigned

Type Common Name: Little Bluestem – Big Bluestem / Coralberry Herbaceous Vegetation

Type Scientific Name: *Schizachyrium scoparium* - *Andropogon gerardii* / *Symphoricarpos orbiculatus* Herbaceous Vegetation



Figure 14. Restored Tallgrass Prairie at Pea Ridge National Military Park.

Global Summary: Efforts to restore tallgrass prairie have been made throughout the range of this type in the Midwest. Native tall grasses are planted from seed, and some native forbs may also be present in seed mixes. Both native and non-native grasses and forbs may volunteer in. Restoration efforts are often on-going and uneven, with managers adding native forbs or grasses in an ad hoc fashion. Restored sites are often visually dominated by tall grasses with flowering culms over 2 m tall, but prairie forbs are often lacking or may be present in novel proportions. Weedy shrubs and vines such as blackberry (*Rubus* spp.) and sumac (*Rhus* spp.) are nearly always present in prairie restorations (Figure 14).

Environmental Description: At PERI, restored prairie occurred in a defined block on the far eastern side of the park. Soils were relatively moist and fertile, and the flower culms of dominate grasses reach over 2 m tall.

Vegetation Description: A combination of little bluestem (*Schizachyrium scoparium*) and big bluestem (*Andropogon gerardii*) dominated the restored prairie. Other important species included yellowfruit sedge (*Carex annectens*), Indiangrass (*Sorghastrum nutans*), and broomsedge bluestem (*Andropogon virginicus*). Cool season grasses, including non-native Kentucky bluegrass (*Poa pratensis*) and tall fescue (*Schedonorus phoenix*), were important components under the warm-season grass canopy. Coralberry (*Symphoricarpos orbiculatus*) was found in every plot, and small trees or shrubs, including common persimmon (*Diospyros virginiana*), boxelder (*Acer negundo*), and American elm (*Ulmus americana*), and winged elm (*Ulmus alata*) were minor components (Table 10).

Most Abundant Species:

Table 10. Average cover (for plots where the species occurred) and frequency for two plots taken within Restored Tallgrass Prairie. Only species with at least 0.5% cover in at least two plots are shown.

Restored Tallgrass Prairie			
Scientific Name	Common Name	%Cover	Frequency
Tree			
<i>Diospyros virginiana</i>	common persimmon	3	50.0%
<i>Acer negundo</i>	boxelder	0.5	50.0%
<i>Ulmus americana</i>	American elm	0.5	50.0%
Shrub			
<i>Symphoricarpos orbiculatus</i>	coralberry	7.75	100.0%
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry	3	100.0%
<i>Dioscorea quaternata</i>	fourleaf yam	0.5	50.0%
<i>Ulmus alata</i>	winged elm	0.5	50.0%
Herbaceous			
<i>Andropogon gerardii</i>	big bluestem	62.5	50.0%
<i>Schizachyrium scoparium</i>	little bluestem	38.75	100.0%
<i>Carex annectens</i>	yellowfruit sedge	15	50.0%
<i>Carex molesta</i>	troublesome sedge	7.75	100.0%
<i>Poa pratensis</i>	Kentucky bluegrass	3	100.0%
<i>Sorghastrum nutans</i>	Indiangrass	3	100.0%
<i>Andropogon virginicus</i>	broomsedge bluestem	3	50.0%
<i>Carex blanda</i>	eastern woodland sedge	3	50.0%
<i>Carex bushii</i>	Bush's sedge	3	50.0%
<i>Polygonum</i>	knotweed	3	50.0%
<i>Schedonorus phoenix</i>	tall fescue	1.75	100.0%

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Table 10. Average cover (for plots where the species occurred) and frequency for two plots taken within Restored Tallgrass Prairie. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Agrostis hyemalis</i>	winter bentgrass	0.5	100.0%
<i>Barbarea vulgaris</i>	garden yellowrocket	0.5	100.0%
<i>Galium virgatum</i>	southwestern bedstraw	0.5	100.0%
<i>Lespedeza capitata</i>	roundhead lespedeza	0.5	100.0%
<i>Oxalis dillenii</i>	slender yellow woodsorrel	0.5	100.0%
<i>Plantago virginica</i>	Virginia plantain	0.5	100.0%
<i>Valerianella radiata</i>	beaked cornsalad	0.5	100.0%
<i>Vicia sativa</i>	garden vetch	0.5	100.0%
<i>Acalypha virginica</i>	Virginia threeseed mercury	0.5	50.0%
<i>Achillea millefolium</i>	common yarrow	0.5	50.0%
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	0.5	50.0%
<i>Bidens bipinnata</i>	Spanish needles	0.5	50.0%
<i>Bromus pubescens</i>	hairy woodland brome	0.5	50.0%
<i>Cardamine parviflora</i>	sand bittercress	0.5	50.0%
<i>Cirsium altissimum</i>	tall thistle	0.5	50.0%
<i>Conyza canadensis</i>	Canadian horseweed	0.5	50.0%
<i>Desmodium paniculatum</i>	panickedleaf ticktrefoil	0.5	50.0%
<i>Dichanthelium acuminatum</i> var. <i>fasciculatum</i>	western panicgrass	0.5	50.0%
<i>Dichanthelium commutatum</i>	variable panicgrass	0.5	50.0%
<i>Eleocharis</i> sp.	spikerush	0.5	50.0%
<i>Erigeron annuus</i>	eastern daisy fleabane	0.5	50.0%
<i>Galium aparine</i>	stickywilly	0.5	50.0%
<i>Geranium carolinianum</i>	Carolina geranium	0.5	50.0%
<i>Juncus tenuis</i>	poverty rush	0.5	50.0%
<i>Lactuca floridana</i>	woodland lettuce	0.5	50.0%
<i>Lespedeza cuneata</i>	sericea lespedeza	0.5	50.0%
<i>Lobelia spicata</i>	palespike lobelia	0.5	50.0%
<i>Panicum anceps</i>	beaked panicgrass	0.5	50.0%
<i>Phytolacca americana</i>	American pokeweed	0.5	50.0%
<i>Plantago rugelii</i>	blackseed plantain	0.5	50.0%
<i>Potentilla recta</i>	sulphur cinquefoil	0.5	50.0%
<i>Rumex acetosella</i>	common sheep sorrel	0.5	50.0%
<i>Rumex crispus</i>	curly dock	0.5	50.0%
<i>Salvia lyrata</i>	lyreleaf sage	0.5	50.0%

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Table 10. Average cover (for plots where the species occurred) and frequency for two plots taken within Restored Tallgrass Prairie. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Sisyrinchium campestre</i>	prairie blue-eyed grass	0.5	50.0%
<i>Solanum carolinense</i>	Carolina horsenettle	0.5	50.0%
<i>Solidago altissima</i>	Canada goldenrod	0.5	50.0%
<i>Trifolium campestre</i>	field clover	0.5	50.0%
<i>Triodanis perfoliata</i>	clasping Venus' looking-glass	0.5	50.0%
<i>Veronica arvensis</i>	corn speedwell	0.5	50.0%

Mapped Type Name: *Ruderal Grassland and Shrubland*

Macrogroup: Eastern Ruderal Shrubland and Grassland (MG123)

Group: Eastern Ruderal Shrubland and Grassland (G059)

Association: None assigned

Type Common Name: Coralberry – Winged Elm – Pennsylvania Blackberry / Tall Fescue
Grassland and Shrubland

Type Scientific Name: *Symphoricarpos orbiculatus* - *Ulmus alata* - *Rubus pensilvanicus* /
Schedonorus phoenix Grassland and Shrubland



Figure 15. Ruderal Grassland and Shrubland at Pea Ridge National Military Park.

Global Summary: This type represents retired crop fields that have not been mowed or burned frequently enough to suppress a significant woody component, but have been managed in a way that has generally suppressed eastern redcedar (*Juniperus virginiana*). The abundance of this type in the region is not clear, but similar communities, dominated by weedy shrubs, vines, and herbaceous species, are found throughout the Midwestern United States (Figure 15).

Environmental Description: At PERI, this type was found mainly on former croplands on the eastern side of the park. Soils were relatively moist and the topography was very gently rolling to nearly flat.

Vegetation Description: A mix of shrubs, vines, small trees, and herbaceous species were characteristic of this fairly broadly-defined type. Common small woody species included Pennsylvania blackberry (*Rubus pensilvanicus*), coralberry (*Symphoricarpos orbiculatus*), winged elm (*Ulmus alata*), winged sumac (*Rhus copallinum*), saw greenbrier (*Smilax bona-nox*), eastern poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and frost grape (*Vitis vulpina*). Common herbaceous species included Japanese honeysuckle (*Lonicera japonica*), fuzzy wuzzy sedge (*Carex hirsutella*), Virginia wildrye (*Elymus virginicus*), softleaf rosette grass (*Dichanthelium malacophyllum*), tall fescue (*Schedonorus phoenix*), and sericea lespedeza (*Lespedeza cuneata*). Small trees were often present, including common persimmon (*Diospyros virginiana*), sassafras (*Sassafras albidum*), black cherry (*Prunus serotina*), post oak (*Quercus stellata*), and black oak (*Quercus velutina*) (Table 11).

Most Abundant Species:

Table 11. Average cover (for plots where the species occurred) and frequency for four plots taken within Ruderal Grassland and Shrubland. Only species with at least 0.5% cover in at least two plots are shown.

Ruderal Grassland and Shrubland			
Scientific Name	Common Name	%Cover	Frequency
Tree			
<i>Sassafras albidum</i>	sassafras	23.43	75.0%
<i>Quercus stellata</i>	post oak	15.56	50.0%
<i>Acer negundo</i>	boxelder	15.00	25.0%
<i>Diospyros virginiana</i>	common persimmon	6.12	100.0%
<i>Prunus serotina</i>	black cherry	5.33	75.0%
<i>Quercus velutina</i>	black oak	2.33	75.0%
<i>Quercus marilandica</i>	blackjack oak	1.99	50.0%
<i>Carya texana</i>	black hickory	0.50	50.0%
<i>Celtis occidentalis</i>	common hackberry	0.50	50.0%
<i>Juniperus virginiana</i>	eastern redcedar	0.50	50.0%
Shrub			
<i>Cornus florida</i>	flowering dogwood	37.81	25.0%
<i>Symphoricarpos orbiculatus</i>	coralberry	33.89	75.0%
<i>Ulmus alata</i>	winged elm	13.46	75.0%
<i>Toxicodendron radicans</i>	eastern poison ivy	10.46	50.0%
<i>Smilax bona-nox</i>	saw greenbrier	10.26	50.0%
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry	9.01	100.0%
<i>Rhus copallinum</i>	winged sumac	6.33	75.0%
<i>Lindera benzoin</i>	northern spicebush	3.00	25.0%

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Table 11. Average cover (for plots where the species occurred) and frequency for four plots taken within Ruderal Grassland and Shrubland. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Viburnum rufidulum</i>	rusty blackhaw	3.00	25.0%
<i>Rosa setigera</i>	climbing rose	1.99	50.0%
<i>Vitis aestivalis</i>	summer grape	1.99	50.0%
<i>Rosa multiflora</i>	multiflora rose	1.75	50.0%
<i>Parthenocissus quinquefolia</i>	Virginia creeper	1.33	75.0%
<i>Cercis canadensis</i>	eastern redbud	1.00	25.0%
<i>Vitis vulpina</i>	frost grape	0.50	75.0%
Herbaceous			
<i>Schedonorus phoenix</i>	tall fescue	26.25	50.0%
<i>Lespedeza cuneata</i>	sericea lespedeza	19.00	50.0%
<i>Agalinis tenuifolia</i>	slenderleaf false foxglove	15.00	25.0%
<i>Lonicera japonica</i>	Japanese honeysuckle	9.83	100.0%
<i>Carex hirsutella</i>	fuzzy wuzzy sedge	5.38	100.0%
<i>Poa sylvestris</i>	woodland bluegrass	3.00	25.0%
<i>Desmodium marilandicum</i>	smooth small-leaf ticktrefoil	2.17	75.0%
<i>Muhlenbergia sobolifera</i>	rock muhly	2.17	75.0%
<i>Penstemon digitalis</i>	talus slope penstemon	2.17	75.0%
<i>Plantago rugelii</i>	blackseed plantain	1.75	50.0%
<i>Teucrium canadense</i>	Canada germander	1.75	50.0%
<i>Elymus virginicus</i>	Virginia wildrye	1.75	100.0%
<i>Dichanthelium malacophyllum</i>	softleaf rosette grass	1.13	100.0%
<i>Cirsium altissimum</i>	tall thistle	0.50	100.0%
<i>Mimosa nuttallii</i>	Nuttall's sensitive-briar	0.50	100.0%
<i>Oxalis dillenii</i>	slender yellow woodsorrel	0.50	100.0%
<i>Panicum anceps</i>	beaked panicgrass	0.50	100.0%
<i>Achillea millefolium</i>	common yarrow	0.50	75.0%
<i>Amphicarpaea bracteata</i>	American hogpeanut	0.50	75.0%
<i>Andropogon virginicus</i>	broomsedge bluestem	0.50	75.0%
<i>Carex retroflexa</i>	reflexed sedge	0.50	75.0%
<i>Danthonia spicata</i>	poverty oatgrass	0.50	75.0%
<i>Desmodium nuttallii</i>	Nuttall's ticktrefoil	0.50	75.0%
<i>Desmodium paniculatum</i>	panicledleaf ticktrefoil	0.50	75.0%
<i>Dichanthelium acuminatum</i> var. <i>fasciculatum</i>	western panicgrass	0.50	75.0%
<i>Houstonia purpurea</i>	Venus' pride	0.50	75.0%
<i>Lespedeza virginica</i>	slender lespedeza	0.50	75.0%
<i>Orbexilum pedunculatum</i> var. <i>pedunculatum</i>	Sampson's snakeroot	0.50	75.0%

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Table 11. Average cover (for plots where the species occurred) and frequency for four plots taken within Ruderal Grassland and Shrubland. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Potentilla simplex</i>	common cinquefoil	0.50	75.0%
<i>Rudbeckia hirta</i>	blackeyed Susan	0.50	75.0%
<i>Tridens flavus</i>	purpletop tridens	0.50	75.0%
<i>Valerianella radiata</i>	beaked cornsalad	0.50	75.0%
<i>Acalypha virginica</i>	Virginia threeseed mercury	0.50	50.0%
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	0.50	50.0%
<i>Apocynum cannabinum</i>	Indianhemp	0.50	50.0%
<i>Asplenium platyneuron</i>	ebony spleenwort	0.50	50.0%
<i>Botrychium virginianum</i>	rattlesnake fern	0.50	50.0%
<i>Desmodium laevigatum</i>	smooth ticktrefoil	0.50	50.0%
<i>Desmodium perplexum</i>	perplexed ticktrefoil	0.50	50.0%
<i>Elephantopus carolinianus</i> .	Carolina elephantsfoot	0.50	50.0%
<i>Euphorbia corollata</i>	flowering spurge	0.50	50.0%
<i>Fragaria virginiana</i>	Virginia strawberry	0.50	50.0%
<i>Galium circaeans</i>	licorice bedstraw	0.50	50.0%
<i>Galium pilosum</i>	hairy bedstraw	0.50	50.0%
<i>Geranium carolinianum</i>	Carolina geranium	0.50	50.0%
<i>Geum canadense</i>	white avens	0.50	50.0%
<i>Leucanthemum vulgare</i>	oxeye daisy	0.50	50.0%
<i>Lobelia spicata</i>	palespike lobelia	0.50	50.0%
<i>Prenanthes altissima</i>	tall rattlesnakeroor	0.50	50.0%
<i>Rubus flagellaris</i>	northern dewberry	0.50	50.0%
<i>Solanum carolinense</i>	Carolina horsenettle	0.50	50.0%
<i>Vernonia baldwinii</i>	Baldwin's ironweed	0.50	50.0%

Mapped Type Name: *Silver Maple Forest*

Macrogroup: Northern & Cenrtal Flooded & Swamp Forest (MG029)

Group: Silver Maple – Green Ash – Sycamore Floodplain Group (G040)

Association: No association assigned, but similar to CEG002586 *Acer saccharinum* – *Ulmus americana* Forest

Type Common Name: Silver Maple – American Elm Forest

Type Scientific Name: *Acer saccharinum* - *Ulmus americana* Forest



Figure 16. Silver Maple Forest at Pea Ridge National Military Park.

Global Summary: Communities dominated or co-dominated by silver maple (*Acer saccharinum*) often are components of floodplain complexes in the Midwest, and are part of the North-Central Interior Floodplain ecological system (Figure 16). Silver maple also grows on disturbed, moist soils in a variety to circumstances throughout the range of the species. The naturally occurring silver maple – American elm forest is found throughout the midwestern United States and parts of the eastern United States. Stands occur on large, regularly flooded floodplains. The canopy cover is more-or-less closed and dominated by silver maple (*Acer saccharinum*). Codominants may include American sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), and rarely sugar maple (*Acer saccharum*). Associated species may include American elm (*Ulmus americana*), slippery elm (*Ulmus rubra*), boxelder (*Acer negundo*), black

willow (*Salix nigra*), common hackberry (*Celtis occidentalis*), bitternut hickory (*Carya cordiformis*), black walnut (*Juglans nigra*), and green ash (*Fraxinus pennsylvanica*). The shrub and sapling layer is often open (<25% cover). Species that may be present include American black elderberry (*Sambucus nigra* ssp. *canadensis*), black raspberry (*Rubus occidentalis*), or northern spicebush (*Lindera benzoin*). Woody and herbaceous vines can be prominent, including among the woody vines Virginia creeper (*Parthenocissus quinquefolia*), eastern poison ivy (*Toxicodendron radicans*), and riverbank grape (*Vitis riparia*). Herbaceous vine species include groundnut (*Apios americana*), American hogpeanut (*Amphicarpaea bracteata*), and wild cucumber (*Echinocystis lobata*). Herbaceous grasses, forbs, and ferns dominate the ground layer, including calico aster (*Symphotrichum lateriflorum* = *Aster lateriflorus*), smallspike false nettle (*Boehmeria cylindrica*), dogtooth violet (*Erythronium americanum*), giant goldenrod (*Solidago gigantea*), sweet woodreed (*Cinna arundinacea*), whitegrass (*Leersia virginica*), Virginia wildrye (*Elymus virginicus*), pale touch-me-not (*Impatiens pallida*), Canadian woodnettle (*Laportea canadensis*), ostrich fern (*Matteuccia struthiopteris*), sensitive fern (*Onoclea sensibilis*), Canadian clearweed (*Pilea pumila*), stinging nettle (*Urtica dioica*), and others. A variety of exotics may be present, including yellow loosestrife (*Lysimachia* spp.), Nepalese browntop (*Microstegium vimineum*), Japanese knotweed (*Polygonum cuspidatum*), multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*).

Environmental Description: At PERI, this type was limited to a location on the northwestern boundary of the park over poorly-drained, nearly flat soils adjacent to a road. The adjacent road may impede drainage of the site, and hence it is probably a response to human disturbance.

Vegetation Description: Young silver maples were the prevailing dominant of this forest. Other tree species, including American elm (*Ulmus americana*), common hackberry (*Celtis occidentalis*), black cherry (*Prunus serotina*), and green ash (*Fraxinus pennsylvanica*) made up little of the overstory canopy cover. Shrubs and small trees included redbud (*Cercis canadensis*), coralberry (*Symphoricarpos orbiculatus*), multiflora rose (*Rosa multiflora*), eastern redcedar (*Juniperus virginiana*), and common persimmon (*Diospyros virginiana*). Herbaceous species included Indian woodoats (*Chasmanthium latifolium*), Japanese honeysuckle (*Lonicera japonica*), and stickywilly (*Galium aparine*).

Most Abundant Species:

No plot was taken within this stand. Species present were as described above based on notes taken during a site visit.

Mapped Unit Name: *Typic Upland Deciduous Woodland and Forest*

Macrogroup: Central Oak – Hardwood & Pine Forest (M012)

Group: Northeastern & North-Central Oak – Hickory Forest Group (G158)

Association: CEGL002076

NVC Common Name: Black Oak – White Oak – Hickory Forest

NVC Scientific Name: *Quercus velutina* - *Quercus alba* – *Carya (glabra, ovata)* Forest



Figure 17. Typic Upland Deciduous Woodland and Forest at Pea Ridge National Military Park.

Global Summary: This type is an association within the Ozark-Ouachita Dry-Mesic Oak Forest ecological system (Figure 17). This system is found throughout the Ozark and Ouachita Highlands ranging to the western edge of the Interior Low Plateau. The black oak - white oak – hickory forest community is found throughout the range of the ecological system. Stands occur on dry to dry-mesic mid- to upper slopes and terraces where soils are more well-drained. Bedrock is sandstone, siltstone, limestone, chert, or shale, and may be covered by thin loess. Trees in this community often have moderate to short trunks and spreading crowns, and the canopy can vary from open to closed (50-100%). Black oak (*Quercus velutina*), white oak (*Quercus alba*), pignut hickory (*Carya glabra*), and shagbark hickory (*Carya ovata*) are typical tree dominants. Associated oaks can include chinkapin oak (*Quercus muehlenbergii*), scarlet oak (*Quercus coccinea*), chestnut oak (*Quercus prinus*), and post oak (*Quercus stellata*). Typical shrubs and small trees include flowering dogwood (*Cornus florida*)(southward), stiff dogwood (*Cornus foemina*), hophornbeam (*Ostrya virginiana*), and sassafras (*Sassafras albidum*). Vines include eastern poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and grape (*Vitis* spp.). The herbaceous layer can include tall hairy agrimony

(*Agrimonia gryposepala*), beaked agrimony (*Agrimonia rostellata*), American hogpeanut (*Amphicarpaea bracteata*), rattlesnake fern (*Botrychium virginianum*), eastern woodland sedge (*Carex blanda*), Pennsylvania sedge (*Carex pensylvanica*), pointedleaf ticktrefoil (*Desmodium glutinosum*), nakedflower ticktrefoil (*Desmodium nudiflorum*), fourleaf yam (*Dioscorea quaternata*), licorice bedstraw (*Galium circaeazans*), spotted geranium (*Geranium maculatum*), Christmas fern (*Polystichum acrostichoides*), feathery false lily of the valley (*Maianthemum racemosum*), and starry false lily of the valley (*Maianthemum stellatum*), among others. More southern stands may contain poverty oatgrass (*Danthonia spicata*).

Environmental Description: This was the primary forest association at PERI, and comprised almost twice as much area as all other types combined. The black oak (*Quercus velutina*) dominated and co-dominated variants of this ecological system are most common in Missouri and adjacent Arkansas than elsewhere in the range of the type. At PERI, the type occurred on all landscape positions and slopes over well-drained or moderately well-drained upland soils.

Vegetation Description: Black oak (*Quercus velutina*) was among the most important canopy species of all 12 plots sampled that represented this type. Other important canopy dominants included white oak (*Quercus alba*), northern red oak (*Quercus rubra*), mockernut hickory (*Carya alba*), and post oak (*Quercus stellata*). Important shrubs included coralberry (*Symphoricarpos orbiculatus*), flowering dogwood (*Cornus florida*), and northern spicebush (*Lindera benzoin*). Frost grape (*Vitis vulpia*), saw greenbrier (*Smilax bona-nox*), Virginia creeper (*Parthenocissus quinquefolia*), and Pennsylvania blackberry (*Rubus pensilvanicus*) were common vines. The herbaceous layer was often sparse and varied from plot to plot, with only rock muhly (*Muhlenbergia sobolifera*), reflexed sedge (*Carex retroflexa*), white snakeroot (*Ageratina altissima*), and American lopseed (*Phryma leptostachya*), and ebony spleenwort (*Asplenium platyneuron*) occurring in 8 of 12 samples (Table 12).

Most Abundant Species:

Table 12. Average cover (for plots where the species occurred) and frequency for twelve plots taken within Typic Upland Deciduous Woodland & Forest. Only species with at least 0.5% cover in at least two plots are shown.

Typic Upland Woodland			
Scientific Name	Common Name	%Cover	Frequency
Tree			
<i>Acer saccharinum</i>	silver maple	64.89	8.3%
<i>Quercus alba</i>	white oak	38.10	58.3%
<i>Quercus velutina</i>	black oak	21.82	100.0%
<i>Quercus rubra</i>	northern red oak	15.74	41.7%
<i>Gleditsia triacanthos</i>	honeylocust	13.56	33.3%
<i>Carya alba</i>	mockernut hickory	13.47	41.7%
<i>Sassafras albidum</i>	sassafras	9.89	83.3%
<i>Quercus stellata</i>	post oak	7.94	66.7%
<i>Acer rubrum</i>	red maple	7.40	33.3%
<i>Carya texana</i>	black hickory	6.33	66.7%

Table 12. Average cover (for plots where the species occurred) and frequency for twelve plots taken within Typic Upland Deciduous Woodland & Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Nyssa sylvatica</i>	blackgum	4.87	33.3%
<i>Diospyros virginiana</i>	common persimmon	4.51	83.3%
<i>Juniperus virginiana</i>	eastern redcedar	3.98	50.0%
<i>Ulmus americana</i>	American elm	3.33	83.3%
<i>Celtis occidentalis</i>	common hackberry	3.20	75.0%
<i>Quercus marilandica</i>	blackjack oak	2.08	41.7%
<i>Prunus serotina</i>	black cherry	1.00	58.3%
<i>Fraxinus americana</i>	white ash	0.94	66.7%
<i>Juglans nigra</i>	black walnut	0.83	25.0%
<i>Acer negundo</i>	boxelder	0.67	25.0%
<i>Morus rubra</i>	red mulberry	0.50	75.0%
<i>Platanus occidentalis</i>	American sycamore	0.50	16.7%
Shrub			
<i>Symphoricarpos orbiculatus</i>	coralberry	20.98	91.7%
<i>Cornus florida</i>	flowering dogwood	10.90	91.7%
<i>Lindera benzoin</i>	northern spicebush	10.37	41.7%
<i>Rosa multiflora</i>	multiflora rose	7.85	25.0%
<i>Ulmus alata</i>	winged elm	6.05	41.7%
<i>Ostrya virginiana</i>	hophornbeam	3.49	8.3%
<i>Rubus pensilvanicus</i>	Pennsylvania blackberry	3.44	100.0%
<i>Toxicodendron radicans</i>	eastern poison ivy	3.40	41.7%
<i>Vaccinium stamineum</i>	deerberry	2.92	50.0%
<i>Parthenocissus quinquefolia</i>	Virginia creeper	2.70	83.3%
<i>Asimina triloba</i>	pawpaw	2.24	16.7%
<i>Lonicera flava</i>	yellow honeysuckle	1.75	16.7%
<i>Cercis canadensis</i>	eastern redbud	1.66	25.0%
<i>Smilax bona-nox</i>	saw greenbrier	1.10	75.0%
<i>Frangula caroliniana</i>	Carolina buckthorn	1.07	58.3%
<i>Vitis aestivalis</i>	summer grape	1.00	50.0%
<i>Castanea pumila</i> var. <i>ozarkensis</i>	Ozark chinkapin	1.00	8.3%
<i>Corylus americana</i>	American hazelnut	1.00	8.3%
<i>Rubus occidentalis</i>	black raspberry	1.00	8.3%
<i>Amelanchier arborea</i>	common serviceberry	0.62	33.3%
<i>Vitis vulpina</i>	frost grape	0.50	83.3%
<i>Smilax tamnoides</i>	bristly greenbrier	0.50	58.3%

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Table 12. Average cover (for plots where the species occurred) and frequency for twelve plots taken within Typic Upland Deciduous Woodland & Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Viburnum rufidulum</i>	rusty blackhaw	0.50	50.0%
<i>Prunus americana</i>	American plum	0.50	33.3%
<i>Dioscorea quaternata</i>	fourleaf yam	0.50	16.7%
<i>Rosa carolina</i>	Carolina rose	0.50	16.7%
<i>Vaccinium pallidum</i>	blue ridge blueberry	0.50	16.7%
Herbaceous			
<i>Lonicera japonica</i>	Japanese honeysuckle	8.49	33.3%
<i>Bromus pubescens</i>	hairy woodland brome	7.75	16.7%
<i>Desmodium nudiflorum</i>	nakedflower ticktrefoil	6.71	58.3%
<i>Microstegium vimineum</i>	Nepalese browntop	5.33	25.0%
<i>Perilla frutescens</i>	beefsteakplant	3.00	8.3%
<i>Pycnanthemum tenuifolium</i>	narrowleaf mountainmint	3.00	8.3%
<i>Amphicarpaea bracteata</i> var. <i>bracteata</i>	American hogpeanut	2.93	58.3%
<i>Muhlenbergia sobolifera</i>	rock muhly	2.31	66.7%
<i>Stellaria media</i>	common chickweed	2.17	25.0%
<i>Galium aparine</i>	stickywilly	1.33	25.0%
<i>Elymus virginicus</i>	Virginia wildrye	0.92	50.0%
<i>Carex retroflexa</i>	reflexed sedge	0.75	83.3%
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	0.50	75.0%
<i>Asplenium platyneuron</i>	ebony spleenwort	0.50	66.7%
<i>Phryma leptostachya</i>	American lopseed	0.50	66.7%
<i>Aristolochia serpentaria</i>	Virginia snakeroot	0.50	58.3%
<i>Carex hirsutella</i>	fuzzy wuzzy sedge	0.50	58.3%
<i>Dichanthelium boscii</i>	Bosc's panicgrass	0.50	58.3%
<i>Geum canadense</i>	white avens	0.50	58.3%
<i>Hypericum hypericoides</i> ssp. <i>hypericoides</i>	St. Andrew's cross	0.50	58.3%
<i>Viola triloba</i>	three-lobed violet	0.50	58.3%
<i>Carex muehlenbergii</i>	Muhlenberg's sedge	0.50	50.0%
<i>Galium circaeazans</i>	licorice bedstraw	0.50	50.0%
<i>Sanicula canadensis</i>	Canadian blacksnakeroot	0.50	50.0%
<i>Botrychium virginianum</i>	rattlesnake fern	0.50	41.7%
<i>Carex umbellata</i>	parasol sedge	0.50	41.7%
<i>Danthonia spicata</i>	poverty oatgrass	0.50	41.7%
<i>Dichanthelium dichotomum</i>	cypress panicgrass	0.50	41.7%
<i>Festuca subverticillata</i>	nodding fescue	0.50	41.7%
<i>Rubus flagellaris</i>	northern dewberry	0.50	41.7%

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Table 12. Average cover (for plots where the species occurred) and frequency for twelve plots taken within Typic Upland Deciduous Woodland & Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Brachyelytrum erectum</i>	bearded shorthusk	0.50	33.3%
<i>Carex albicans</i> var. <i>albicans</i>	whitening sedge	0.50	33.3%
<i>Carex blanda</i>	eastern woodland sedge	0.50	33.3%
<i>Carex cephalophora</i>	oval-leaf sedge	0.50	33.3%
<i>Dichanthelium acuminatum</i> var. <i>fasciculatum</i>	western panicgrass	0.50	33.3%
<i>Hackelia virginiana</i>	beggarslice	0.50	33.3%
<i>Lespedeza procumbens</i>	trailing lespedeza	0.50	33.3%
<i>Podophyllum peltatum</i>	mayapple	0.50	33.3%
<i>Scutellaria ovata</i>	heartleaf skullcap	0.50	33.3%
<i>Acalypha virginica</i>	Virginia threeseed mercury	0.50	25.0%
<i>Andropogon virginicus</i>	broomsedge bluestem	0.50	25.0%
<i>Carex jamesii</i>	James' sedge	0.50	25.0%
<i>Carex nigromarginata</i>	black edge sedge	0.50	25.0%
<i>Desmodium perplexum</i>	perplexed ticktrefoil	0.50	25.0%
<i>Desmodium glutinosum</i>	pointedleaf ticktrefoil	0.50	25.0%
<i>Galium arkansanum</i>	Arkansas bedstraw	0.50	25.0%
<i>Geranium carolinianum</i>	Carolina geranium	0.50	25.0%
<i>Juncus tenuis</i>	poverty rush	0.50	25.0%
<i>Lespedeza virginica</i>	slender lespedeza	0.50	25.0%
<i>Oxalis dillenii</i>	slender yellow woodsorrel	0.50	25.0%
<i>Panicum anceps</i>	beaked panicgrass	0.50	25.0%
<i>Passiflora lutea</i>	yellow passionflower	0.50	25.0%
<i>Physalis virginiana</i>	Virginia groundcherry	0.50	25.0%
<i>Sanicula odorata</i>	clustered blacksnakeroot	0.50	25.0%
<i>Solidago ulmifolia</i>	elmleaf goldenrod	0.50	25.0%
<i>Symphyotrichum anomalum</i>	manyray aster	0.50	25.0%
<i>Symphyotrichum patens</i> var. <i>patens</i>	late purple aster	0.50	25.0%
<i>Thalictrum thalictroides</i>	rue anemone	0.50	25.0%
<i>Tridens flavus</i>	purpletop tridens	0.50	25.0%
<i>Viola sororia</i>	common blue violet	0.50	25.0%
<i>Agrimonia rostellata</i>	beaked agrimony	0.50	16.7%
<i>Allium canadense</i>	meadow garlic	0.50	16.7%
<i>Ambrosia artemisiifolia</i>	annual ragweed	0.50	16.7%
<i>Chasmanthium latifolium</i>	Indian woodoats	0.50	16.7%
<i>Cirsium altissimum</i>	tall thistle	0.50	16.7%
<i>Cunila origanoides</i>	common dittany	0.50	16.7%
<i>Desmodium laevigatum</i>	smooth ticktrefoil	0.50	16.7%

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Table 12. Average cover (for plots where the species occurred) and frequency for twelve plots taken within Typic Upland Deciduous Woodland & Forest. Only species with at least 0.5% cover in at least two plots are shown (continued).

Scientific Name	Common Name	%Cover	Frequency
<i>Desmodium paniculatum</i>	panicledleaf ticktrefoil	0.50	16.7%
<i>Desmodium rotundifolium</i>	prostrate ticktrefoil	0.50	16.7%
<i>Dichanthelium malacophyllum</i>	softleaf rosette grass	0.50	16.7%
<i>Euphorbia corollata</i>	flowering spurge	0.50	16.7%
<i>Houstonia purpurea</i>	Venus' pride	0.50	16.7%
<i>Leersia virginica</i>	whitegrass	0.50	16.7%
<i>Lespedeza frutescens</i>	shrubby lespedeza	0.50	16.7%
<i>Lespedeza violacea</i>	violet lespedeza	0.50	16.7%
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	feathery false lily of the valley	0.50	16.7%
<i>Monarda russeliana</i>	redpurple beebalm	0.50	16.7%
<i>Oxalis violacea</i>	violet woodsorrel	0.50	16.7%
<i>Packera aurea</i>	golden ragwort	0.50	16.7%
<i>Parietaria pensylvanica</i>	Pennsylvania pellitory	0.50	16.7%
<i>Phytolacca americana</i>	American pokeweed	0.50	16.7%
<i>Poa sylvestris</i>	woodland bluegrass	0.50	16.7%
<i>Polygonum</i> sp.	Knotweed	0.50	16.7%
<i>Polystichum acrostichoides</i>	Christmas fern	0.50	16.7%
<i>Prenanthes altissima</i>	tall rattlesnakeroot	0.50	16.7%
<i>Pseudognaphalium obtusifolium</i> ssp. <i>obtusifolium</i>	rabbit-tobacco	0.50	16.7%
<i>Rudbeckia hirta</i>	blackeyed Susan	0.50	16.7%
<i>Schedonorus phoenix</i>	tall fescue	0.50	16.7%
<i>Solanum carolinense</i> L.	Carolina horsenettle	0.50	16.7%
<i>Symphyotrichum turbinellum</i>	smooth violet prairie aster	0.50	16.7%
<i>Taraxacum officinale</i>	common dandelion	0.50	16.7%
<i>Teucrium canadense</i>	Canada germander	0.50	16.7%
<i>Verbesina virginica</i>	white crownbeard	0.50	16.7%
<i>Viola bicolor</i>	field pansy	0.50	16.7%
<i>Woodsia obtusa</i>	bluntlobe cliff fern	0.50	16.7%

Discussion

Pea Ridge National Military Park supports 2,490 acres (1,007.7 ha) of oak woodland and forest, which cover 58% of the park, in relatively natural condition (Annis et al. 2011). This result is similar to an earlier map provided by Wright et al. (1970), although they mapped fewer and different types based on fewer quantitative data samples. The top and slopes of Elkhorn Mountain support a Dry Deciduous Woodland and Forest whereas most of the rest of the park supports a Typic (wetter) Upland Deciduous Woodland and Forest type. These oak forests together with successional and bottomland types form a large block of essentially uninterrupted woodland and forest landscape that surrounds mowed grassland, which in turn forms the core of the cultural portion of the park.

Field Survey

The classification and mapping completed for this project should help provide a baseline. Eastern Redcedar Woodland and Forest will be dynamic over time in the absence of management, but active management of some portions of this type is on-going at the date of publication of this report. Documentation of change via repeated sampling will be highly desirable, especially in the juniper treatment areas. Sampling of the general landscape around the park (e.g. interpretation of general vegetation types such as urban, grassland, and woodland/forest) will help to document context and provide early signs of urban encroachment on the boundaries. The proximity of expanding urban areas (e.g. Bentonville, Rogers) makes urban encroachment on the park's boundaries highly likely.

NVC Classification

Only four of nine types defined and mapped have good matches in the NVC, and two others have similar associations defined. Quantitative data from the park may help in the description of three other types, including Eastern Redcedar Woodland and Forest, Restored Tallgrass Prairie, and Ruderal Grassland and Shrubland. Among these, Restored Tallgrass Prairie may remain outside of the NVC as a cultural type. However, eastern redcedar and ruderal shrublands and grasslands are common components of the landscape and descriptions within the NVC may be appropriate.

Digital Imagery and Interpretation

Multiple years of both leaf-on and leaf-off imagery were available for the park and were used to develop map polygons. The use of leaf-on and leaf-off data helped ensure high quality results. Because the park was small, heads-up corrections to initial image objects were made at fine resolution. Small mapped polygons were retained in the final results, again due to the small size of the park.

Accuracy Assessment

Overall thematic accuracy of the vegetation mapping inventory met the required threshold. The combination of fewer natural and semi-natural vegetation types distributed among larger polygons added to the overall high degree of thematic accuracy. Of those rare map classes (Scenario E), they were easy to identify in the field using the dichotomous key and vegetation descriptions. For all vegetation map classes, the dichotomous key allowed for clear identification at the majority of points.

Future Recommendations

The current results help document the composition of plant communities at this point in time. They can be built upon in several ways. First, permanent plot locations could be modified or established based on the classification and mapping completed by this project. In particular, stratification of randomly located permanent plots across all mapped types may be advisable. Second, the grassy and shrubby areas of the park will tend to succeed to woodlands without active management, and current active management to remove junipers from some areas is on-going. Given the dynamic nature of these communities, a new, carefully constructed, easy to interpret, easy to populate, spatially specific database to track management activities and their results would be advisable.

Research Opportunities

On-going eastern redcedar control efforts at PERI provide a significant opportunity for research. Clearing has resulted in canopy gaps, and documentation of the fate of these sites over time is highly desirable. A second avenue of research may involve linking of HTLN inventory and monitoring activities with the results of this mapping project.

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Appendix A: Contingency Table for Vegetation Mapping at Pea Ridge National Military Park

	Reference Data (Accuracy Assessment Field Data)											User's Error		
Sample Data (Polygon Map Data)	Map Units	Bottomland Deciduous Woodland and Forest	Dry Deciduous Woodland and Forest	Eastern Redcedar Woodland and Forest	Marsh	Mowed Grassland	Restored Tallgrass Prairie	Ruderal Grassland and Shrubland	Silver Maple Forest	Typic Upland and Deciduous Woodland Forest	Totals	Commission Accuracy	90% Conf. Interval	
													-	+
	Bottomland Deciduous Woodland and Forest	20	0	0	0	0	0	0	0	0	20	100%	97.5%	100%
	Dry Deciduous Woodland and Forest	0	19	0	0	0	0	0	0	2	21	90.5%	77.6%	100%
	Eastern Redcedar Woodland and Forest	0	0	27	0	0	0	0	0	0	27	100%	98.1%	100%
	Marsh	0	0	0	2	0	0	0	0	0	2	100%	75%	100%
	Mowed Grassland	0	0	0	0	19	0	1	0	0	20	95%	84.5%	100%
	Restored Tallgrass Prairie	0	0	0	0	0	2	0	0	0	2	100%	75%	100%
	Ruderal Grassland and Shrubland	0	0	0	0	1	0	29	0	1	31	93.5%	84.7%	100%
	Silver Maple Forest	0	0	0	0	0	0	0	2	0	2	100%	75%	100%
	Typic Upland Deciduous Woodland and Forest	0	1	2	0	0	0	0	0	27	30	90%	79.3%	100%
	Totals	20	20	29	2	20	2	30	2	30				
Producer's Error	Omission Accuracy	100%	86.7%	83.5%	100%	97.9%	100%	92.3%	100%	96.9%	147 Total Correct Points			
	90% Conf. -	100%	85.4%	82.7%	100%	96.9%	100%	91.7%	100%	94.4%	155 Total Points			
	Level +	100%	87.9%	84.3%	100%	98.8%	100%	92.9%	100%	99.4%				
Overall Total Accuracy = 93.1% Overall Kappa Index = 93.9% Overall Upper and Lower Confidence Interval = 97.6% and 88.6%														

Accuracy Assessment Contingency Table:

The contingency table combines the sample contingency and population contingency tables in which rows represent the map classes from the vegetation map and columns are the map classes determined in the field. The shaded areas display the number of accuracy assessment points where the field determination of the map class agrees with the vegetation map. Disagreement between field data (columns) and map data result in producer's error (omission error). Conversely, disagreement between map data (rows) and field data reflect user's error (errors of commission). Both types of error are reported in terms of accuracy (100% indicates no errors) and a corresponding 90% confidence interval. The total number of correct points out of the total number of accuracy assessment points (shaded diagonal values) provides the degree to which map classes were interpreted correctly. The Kappa Index is an index that accounts for chance agreement in the contingency table.

Appendix B: Example of Plot Survey Form

NPS VEGETATION MAPPING PROGRAM – PLOT SURVEY FORM PLOT LOCATION AND DESCRIPTION

Plot Code _____	Surveyors _____
Date _____	
Plot Directions	
Plot Dimensions _____ by _____ m	
Provisional Community Name _____	
Photos (y/n) _____	
Relative Stand Size extensive (>100x plot), large (>10-100x plot), small (3-10x plot), very small (1-3x plot), unknown	
Representativeness	
Landform (circle) <u>interfluv</u> , gap/saddle, side slope, terrace/bench flat plain	
Topographic Position (circle) <u>crest</u> , upper slope, middle slope, lower slope, toe slope, <u>plain/level/bottom</u> , basin/depression	
Hydrologic Regime <u>Upland</u> Permanently flooded <u>Semipermanently</u> flooded <u>Seasonally/Temporarily flooded</u> Unknown	
Plot Shape (circle) <u>concave</u> convex flat irregular	
<u>General Comments</u>	

[illegible]

USGS-NPS Vegetation Mapping Program
Pea Ridge National Military Park

Plot Code

[illegible]

Appendix C: Pea Ridge National Military Park Dichotomous Key to Mapped Current Vegetation Types

- 1a. Area with overstory canopy (at a height > 4m) greater than 50% 2
 - 2a. Eastern redcedar (*Juniperus virginiana*) with a canopy cover (including overstory and understory canopies) > 20%.....Eastern Redcedar Woodland and Forest
 - 2b. Eastern redcedar (*Juniperus virginiana*) with a canopy cover < 20% 3
 - 3a. Woodland dominated by silver maple (*Acer saccharinum*) and associated with clearing along powerline..... Silver Maple Forest
 - 3b. Woodland dominated by species other than silver maple (*Acer saccharinum*)..... 4
 - 4a. Combined absolute canopy cover of post oak (*Quercus stellata*), black hickory (*Carya texana*), and blackjack oak (*Quercus marilandica*) in the overstory (at a height > 4m) greater than 15%.....Dry Deciduous Woodland and Forest
 - 4b. Combined absolute canopy cover of these three species in the overstory < 15%. ..
..... 5
 - 5a. Combined absolute canopy cover of black walnut (*Juglans nigra*), American elm (*Ulmus americana*), red mulberry (*Morus rubra*), boxelder (*Acer negundo*), American sycamore (*Platanus occidentalis*), and slippery elm (*Ulmus rubra*) in the overstory (at a height > 4m) greater than 20%.....Bottomland Deciduous Woodland and Forest
 - 5b. Combined absolute canopy cover of those 6 species in the overstory less than 20%.....Typic Upland Deciduous Woodland and Forest
- 1b. Area lacking an overstory canopy (at a height > 4m), or with overstory canopy < 50% 6
 - 6a. Herbaceous wetlands surrounding ponds with species such as cattail (*Typha latifolia*), yellow pond-lily (*Nuphar lutea*), rice cutgrass (*Leersia oryzoides*), and/or bulrush (*Scirpus* spp.) present Marsh
 - 6b. Areas dominated by herbaceous species or shrubs, but not a herbaceous wetland characterized by the above species. 7
 - 7a. Grasslands with greater than 50% of the herbaceous cover by big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and/or Indian grass (*Sorghastrum nutans*) and with woody cover <15% Restored Tallgrass Prairie
 - 7b. Grasslands or shrublands with lesser amounts of the above tallgrass species 8

8a. Grasslands frequently mowed and dominated by non-native species such as tall fescue (*Schedonorus phoenix*), Italian ryegrass (*Lolium perenne* ssp. *multiflorum*), and/or orchardgrass (*Dactylis glomerata*) Mowed Grassland

8b. Grasslands and shrublands in various stages of regrowth
..... Ruderal Grassland and Shrubland

Appendix D: Example of Accuracy Assessment Form

Accuracy Assessment Form

NPS Vegetation Inventory

1. PLOT (WAYPOINT) #: _____ 2. DATE: _____

3. OBSERVER (DETERMINING ASSOCIATION) _____

4. Observer (assisting) _____

5. ACCURACY OF NAVIGATION (METERS) _____

6. How Determined: _____

7. UTM EASTING: _____ 8. UTM: _____

9. UTM Zone: _____ 10. Datum: _____

11. If GPS Position is an intentional offset from the waypoint, circle the explanation:

a.) Mosaicing scenario (too heterogeneous to key because of two or more clearly distinct types within observation area)

b.) Physical constraints in reaching waypoint

c.) Other (explain as needed): _____

12. VEGETATION ASSOCIATION (Primary call): _____

13. Other possible associations (complexing scenario) (if applicable): _____

14. Explanation for # 13 (if applicable): _____

Appendix E: Species List for Pea Ridge National Military Park

Family	Scientific Name	Common Name
Acanthaceae	<i>Ruellia humilis</i> Nutt.	fringeleaf wild petunia
	<i>Ruellia pedunculata</i> Torr. ex A. Gray	stalked wild petunia
	<i>Ruellia strepens</i> L.	limestone wild petunia
Aceraceae	<i>Acer negundo</i> L.	boxelder
	<i>Acer rubrum</i> L.	red maple
	<i>Acer saccharinum</i> L.	silver maple
Anacardiaceae	<i>Rhus aromatica</i> Aiton	fragrant sumac
	<i>Rhus copallinum</i> L.	winged sumac
	<i>Rhus glabra</i> L.	smooth sumac
	<i>Toxicodendron radicans</i> (L.) Kuntze	eastern poison ivy
Annonaceae	<i>Asimina triloba</i> (L.) Dunal	pawpaw
Apiaceae	<i>Chaerophyllum tainturieri</i> Hook.	hairyfruit chervil
	<i>Osmorhiza claytonii</i> (Michx.) C.B. Clarke	Clayton's sweetroot
	<i>Sanicula canadensis</i> L.	Canadian blacksnakeroot
	<i>Sanicula odorata</i> (Raf.) K.M. Pryer & L.R. Phillippe	clustered blacksnakeroot
Apocynaceae	<i>Apocynum cannabinum</i> L.	Indianhemp
Aquifoliaceae	<i>Ilex opaca</i> Aiton	American holly
Araceae	<i>Arisaema dracontium</i> (L.) Schott	green dragon
Aristolochiaceae	<i>Aristolochia serpentaria</i> L.	Virginia snakeroot
	<i>Asarum canadense</i> L.	Canadian wildginger
Asclepiadaceae	<i>Asclepias quadrifolia</i> Jacq.	fourleaf milkweed
	<i>Asclepias tuberosa</i> L.	butterfly milkweed
	<i>Asclepias viridis</i> Walter	green antelopehorn
Aspleniaceae	<i>Asplenium platyneuron</i> (L.) Britton, Sterns & Poggenb.	ebony spleenwort
Asteraceae	<i>Achillea millefolium</i> L.	common yarrow
	<i>Ageratina altissima</i> (L.) King & H. Rob. var. <i>altissima</i>	white snakeroot
	<i>Ambrosia artemisiifolia</i> L.	annual ragweed
	<i>Antennaria plantaginifolia</i> (L.) Richardson	woman's tobacco
	<i>Arnoglossum atriplicifolium</i> (L.) H. Rob.	pale Indian plantain
	<i>Bidens bipinnata</i> L.	Spanish needles
	<i>Cirsium altissimum</i> (L.) Hill	tall thistle
	<i>Conyza canadensis</i> (L.) Cronquist	Canadian horseweed
	<i>Elephantopus carolinianus</i> Raeusch.	Carolina elephantsfoot
	<i>Erechtites hieraciifolia</i> (L.) Raf. ex DC.	American burnweed
	<i>Erigeron annuus</i> (L.) Pers.	eastern daisy fleabane
	<i>Erigeron strigosus</i> Muhl. ex Willd.	prairie fleabane
	<i>Eupatorium serotinum</i> Michx.	lateflowering thoroughwort
	<i>Helianthus hirsutus</i> Raf.	hairy sunflower
	<i>Heliopsis helianthoides</i> (L.) Sweet	smooth oxeye
	<i>Hieracium gronovii</i> L.	queendevil
	<i>Krigia biflora</i> (Walter) S.F. Blake	twoflower dwarf dandelion

Appendix E: Species List for Pea Ridge National Military Park

Family	Scientific Name	Common Name
Asteraceae	<i>Krigia dandelion</i> (L.) Nutt.	potato dwarf dandelion
	<i>Lactuca canadensis</i> L.	Canada lettuce
	<i>Lactuca floridana</i> (L.) Gaertn.	woodland lettuce
	<i>Leucanthemum vulgare</i> Lam.	oxeye daisy
	<i>Machaeranthera canescens</i> (Pursh) A. Gray ssp. <i>glabra</i> (A. Gray) B.L. Turner var. <i>glabra</i> A. Gray	hoary tansyaster
	<i>Packera aurea</i> (L.) A. Löve & D. Löve	golden ragwort
	<i>Packera obovata</i> (Muhl. ex Willd.) W.A. Weber & A. Löve	roundleaf ragwort
	<i>Polymnia canadensis</i> L.	whiteflower leafcup
	<i>Prenanthes altissima</i> L.	tall rattlesnakeroot
	<i>Pseudognaphalium obtusifolium</i> (L.) Hilliard & B.L. Burt ssp. <i>obtusifolium</i>	rabbit-tobacco
	<i>Rudbeckia hirta</i> L.	blackeyed Susan
	<i>Rudbeckia laciniata</i> L.	cutleaf coneflower
	<i>Solidago altissima</i> L.	Canada goldenrod
	<i>Solidago buckleyi</i> Torr. & A. Gray	Buckley's goldenrod
	<i>Solidago caesia</i> L.	wreath goldenrod
	<i>Solidago gigantea</i> Aiton	giant goldenrod
	<i>Solidago nemoralis</i> Aiton	gray goldenrod
	<i>Solidago ulmifolia</i> Muhl. ex Willd.	elmleaf goldenrod
	<i>Symphyotrichum anomalum</i> (Engelm.) G.L. Nesom	manyray aster
	<i>Symphyotrichum patens</i> (Aiton) G.L. Nesom var. <i>patens</i>	late purple aster
	<i>Symphyotrichum turbinellum</i> (Lindl.) G.L. Nesom	smooth violet prairie aster
	<i>Taraxacum officinale</i> F.H. Wigg.	common dandelion
	<i>Verbesina alternifolia</i> (L.) Britton ex Kearney	wingstem
	<i>Verbesina virginica</i> L.	white crownbeard
	<i>Vernonia arkansana</i> DC.	Arkansas ironweed
	<i>Vernonia baldwinii</i> Torr.	Baldwin's ironweed
Balsaminaceae	<i>Impatiens</i> sp.	touch-me-not
Berberidaceae	<i>Podophyllum peltatum</i> L.	mayapple
Betulaceae	<i>Carpinus caroliniana</i> Walter	American hornbeam
	<i>Corylus americana</i> Walter	American hazelnut
	<i>Ostrya virginiana</i> (Mill.) K. Koch	hophornbeam
Bignoniaceae	<i>Campsis radicans</i> (L.) Seem. ex Bureau	trumpet creeper
Boraginaceae	<i>Hackelia virginiana</i> (L.) I.M. Johnst.	beggarslice
	<i>Myosotis verna</i> Nutt.	spring forget-me-not
Brassicaceae	<i>Barbarea vulgaris</i> W.T. Aiton	garden yellowrocket
	<i>Cardamine parviflora</i> L.	sand bittercress

Appendix E: Species List for Pea Ridge National Military Park

Family	Scientific Name	Common Name
Campanulaceae	<i>Lobelia inflata</i> L.	Indian-tobacco
	<i>Lobelia spicata</i> Lam.	palespike lobelia
	<i>Triodanis perfoliata</i> (L.) Nieuwl.	clasping Venus' looking-glass
Caprifoliaceae	<i>Lonicera flava</i> Sims	yellow honeysuckle
	<i>Lonicera japonica</i> Thunb.	Japanese honeysuckle
	<i>Sambucus nigra</i> L. ssp. <i>canadensis</i> (L.) R. Bolli	American black elderberry
	<i>Symphoricarpos orbiculatus</i> Moench	coralberry
	<i>Viburnum rufidulum</i> Raf.	rusty blackhaw
Caryophyllaceae	<i>Cerastium fontanum</i> Baumg. ssp. <i>vulgare</i> (Hartm.) Greuter & Burdet	big chickweed
	<i>Stellaria media</i> (L.) Vill.	common chickweed
Celastraceae	<i>Euonymus alatus</i> (Thunb.) Siebold	burningbush
	<i>Euonymus fortunei</i> (Turcz.) Hand.-Maz.	winter creeper
Cistaceae	<i>Lechea tenuifolia</i> Michx.	narrowleaf pinweed
Clusiaceae	<i>Hypericum hypericoides</i> (L.) Crantz ssp. <i>hypericoides</i>	St. Andrew's cross
	<i>Hypericum punctatum</i> Lam.	spotted St. Johnswort
Commelinaceae	<i>Commelina communis</i> L.	Asiatic dayflower
	<i>Tradescantia ohiensis</i> Raf.	bluejacket
Convolvulaceae	<i>Ipomoea pandurata</i> (L.) G. Mey.	man of the earth
Cornaceae	<i>Cornus florida</i> L.	flowering dogwood
	<i>Nyssa sylvatica</i> Marsh.	blackgum
Cupressaceae	<i>Juniperus virginiana</i> L.	eastern redcedar
Cyperaceae	<i>Carex albicans</i> Willd. ex Spreng. var. <i>albicans</i>	whitening sedge
	<i>Carex amphibola</i> Steud.	eastern narrowleaf sedge
	<i>Carex annectens</i> (E.P. Bicknell) E.P. Bicknell	yellowfruit sedge
	<i>Carex blanda</i> Dewey	eastern woodland sedge
	<i>Carex bushii</i> Mack.	Bush's sedge
	<i>Carex cephalophora</i> Muhl. ex Willd.	oval-leaf sedge
	<i>Carex glaucodea</i> Tuck. ex Olney	blue sedge
	<i>Carex hirsutella</i> Mack.	fuzzy wuzzy sedge
	<i>Carex jamesii</i> Schwein.	James' sedge
	<i>Carex lurida</i> Wahlenb.	shallow sedge
	<i>Carex molesta</i> Mack. ex Bright	troublesome sedge
	<i>Carex muehlenbergii</i> Schkuhr ex Willd.	Muhlenberg's sedge
	<i>Carex nigromarginata</i> Schwein.	black edge sedge
	<i>Carex retroflexa</i> Muhl. ex Willd.	reflexed sedge
	<i>Carex rosea</i> Schkuhr ex Willd.	rosy sedge
	<i>Carex umbellata</i> Schkuhr ex Willd.	parasol sedge
	<i>Eleocharis</i> sp.	spikerush
	<i>Scirpus</i> sp.	bulrush
	<i>Scleria oligantha</i> Michx.	littlehead nutrush
Dioscoreaceae	<i>Dioscorea quaternata</i> J.F. Gmel.	fourleaf yam

Appendix E: Species List for Pea Ridge National Military Park

Family	Scientific Name	Common Name
Dryopteridaceae	<i>Polystichum acrostichoides</i> (Michx.) Schott	Christmas fern
	<i>Woodsia obtusa</i> (Spreng.) Torr.	bluntlobe cliff fern
Ebenaceae	<i>Diospyros virginiana</i> L.	common persimmon
Ericaceae	<i>Vaccinium pallidum</i> Aiton	Blue Ridge blueberry
	<i>Vaccinium stamineum</i> L.	deerberry
Euphorbiaceae	<i>Acalypha gracilens</i> A. Gray	slender threeseed mercury
	<i>Acalypha virginica</i> L.	Virginia threeseed mercury
	<i>Euphorbia corollata</i> L.	flowering spurge
Fabaceae	<i>Amphicarpaea bracteata</i> (L.) Fernald var. <i>bracteata</i>	American hogpeanut
	<i>Amphicarpaea bracteata</i> (L.) Fernald var. <i>comosa</i> (L.) Fernald	American hogpeanut
	<i>Cercis canadensis</i> L.	eastern redbud
	<i>Chamaecrista nictitans</i> (L.) Moench ssp. <i>nictitans</i> var. <i>nictitans</i>	sensitive partridge pea
	<i>Desmodium glutinosum</i> (Muhl. ex Willd.) Alph. Wood	pointedleaf ticktrefoil
	<i>Desmodium laevigatum</i> (Nutt.) DC.	smooth ticktrefoil
	<i>Desmodium marilandicum</i> (L.) DC.	smooth small-leaf ticktrefoil
	<i>Desmodium nudiflorum</i> (L.) DC.	nakedflower ticktrefoil
	<i>Desmodium nuttallii</i> (Schindl.) B.G. Schub.	Nuttall's ticktrefoil
	<i>Desmodium paniculatum</i> (L.) DC.	panickedleaf ticktrefoil
	<i>Desmodium perplexum</i> B.G. Schub.	perplexed ticktrefoil
	<i>Desmodium rotundifolium</i> DC.	prostrate ticktrefoil
	<i>Gleditsia triacanthos</i> L.	honeylocust
	<i>Lespedeza capitata</i> Michx.	roundhead lespedeza
	<i>Lespedeza cuneata</i> (Dum. Cours.) G. Don	sericea lespedeza
	<i>Lespedeza frutescens</i> (L.) Hornem.	shrubby lespedeza
	<i>Lespedeza procumbens</i> Michx.	trailing lespedeza
	<i>Lespedeza repens</i> (L.) W. Bartram	creeping lespedeza
	<i>Lespedeza violacea</i> (L.) Pers.	violet lespedeza
	<i>Lespedeza virginica</i> (L.) Britton	slender lespedeza
	<i>Mimosa nuttallii</i> (DC. ex Britton & Rose) B.L. Turner	Nuttall's sensitive-briar
	<i>Orbexilum pedunculatum</i> (Mill.) Rydb. var. <i>pedunculatum</i>	Sampson's snakeroot
	<i>Strophostyles helvola</i> (L.) Elliott	amberique-bean
	<i>Stylosanthes biflora</i> (L.) Britton, Sterns & Poggenb.	sidebeak pencilflower
	<i>Trifolium campestre</i> Schreb.	field clover
	<i>Vicia sativa</i> L.	garden vetch
Fagaceae	<i>Castanea pumila</i> (L.) Mill. var. <i>ozarkensis</i> (Ashe) Tucker	Ozark chinkapin
	<i>Quercus alba</i> L.	white oak
	<i>Quercus marilandica</i> Münchh.	blackjack oak

Appendix E: Species List for Pea Ridge National Military Park

Family	Scientific Name	Common Name
Fagaceae	<i>Quercus muehlenbergii</i> Engelm.	chinkapin oak
	<i>Quercus rubra</i> L.	northern red oak
	<i>Quercus stellata</i> Wangenh.	post oak
	<i>Quercus velutina</i> Lam.	black oak
Geraniaceae	<i>Geranium carolinianum</i> L.	Carolina geranium
Grossulariaceae	<i>Ribes missouriense</i> Nutt.	Missouri gooseberry
Hippocastanaceae	<i>Aesculus glabra</i> Willd.	Ohio buckeye
Hydrangeaceae	<i>Hydrangea arborescens</i> L.	wild hydrangea
Iridaceae	<i>Iris cristata</i> Aiton	dwarf crested iris
	<i>Iris virginica</i> L.	Virginia iris
	<i>Sisyrinchium campestre</i> E.P. Bicknell	prairie blue-eyed grass
Juglandaceae	<i>Carya alba</i> (L.) Nutt.	mockernut hickory
	<i>Carya cordiformis</i> (Wangenh.) K. Koch	bitternut hickory
	<i>Carya glabra</i> (Mill.) Sweet	pignut hickory
	<i>Carya ovata</i> (Mill.) K. Koch	shagbark hickory
	<i>Carya texana</i> Buckley	black hickory
	<i>Juglans nigra</i> L.	black walnut
Juncaceae	<i>Juncus tenuis</i> Willd.	poverty rush
	<i>Luzula bulbosa</i> (Alph. Wood) Smyth & Smyth	bulbous woodrush
Lamiaceae	<i>Cunila origanoides</i> (L.) Britton	common dittany
	<i>Glechoma hederacea</i> L.	ground ivy
	<i>Lamium purpureum</i> L.	purple deadnettle
	<i>Lycopus americanus</i> Muhl. ex W. Bartram	American water horehound
	<i>Monarda russeliana</i> Nutt. ex Sims	redpurple beebalm
	<i>Perilla frutescens</i> (L.) Britton	beefsteakplant
	<i>Prunella vulgaris</i> L.	common selfheal
	<i>Pycnanthemum albescens</i> Torr. & A. Gray	whiteleaf mountainmint
	<i>Pycnanthemum tenuifolium</i> Schrad.	narrowleaf mountainmint
	<i>Salvia lyrata</i> L.	lyreleaf sage
	<i>Scutellaria incana</i> Biehler	hoary skullcap
	<i>Scutellaria ovata</i> Hill	heartleaf skullcap
	<i>Scutellaria parvula</i> Michx.	small skullcap
	<i>Teucrium canadense</i> L.	Canada germander
Lauraceae	<i>Lindera benzoin</i> (L.) Blume	northern spicebush
	<i>Sassafras albidum</i> (Nutt.) Nees	sassafras
Liliaceae	<i>Allium canadense</i> L.	meadow garlic
	<i>Hypoxis hirsuta</i> (L.) Coville	common goldstar
	<i>Maianthemum racemosum</i> (L.) Link ssp. <i>racemosum</i>	feathery false lily of the valley
	<i>Uvularia grandiflora</i> Sm.	largeflower bellwort
Menispermaceae	<i>Menispermum canadense</i> L.	common moonseed
Moraceae	<i>Maclura pomifera</i> (Raf.) C.K. Schneid.	osage orange
	<i>Morus rubra</i> L.	red mulberry

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Family	Scientific Name	Common Name
Nymphaeaceae	<i>Nuphar lutea</i> (L.) Sm.	yellow pond-lily
Oleaceae	<i>Fraxinus americana</i> L.	white ash
	<i>Fraxinus pennsylvanica</i> Marsh.	green ash
	<i>Ligustrum vulgare</i> L.	European privet
Ophioglossaceae	<i>Botrychium dissectum</i> Spreng.	cutleaf grapefern
	<i>Botrychium virginianum</i> (L.) Sw.	rattlesnake fern
Orchidaceae	<i>Liparis liliifolia</i> (L.) Rich. ex Ker Gawl.	brown widelip orchid
Oxalidaceae	<i>Oxalis dillenii</i> Jacq.	slender yellow woodsorrel
	<i>Oxalis stricta</i> L.	common yellow oxalis
	<i>Oxalis violacea</i> L.	violet woodsorrel
Passifloraceae	<i>Passiflora lutea</i> L.	yellow passionflower
Phytolaccaceae	<i>Phytolacca americana</i> L.	American pokeweed
Plantaginaceae	<i>Plantago rugelii</i> Decne.	blackseed plantain
	<i>Plantago virginica</i> L.	Virginia plantain
Platanaceae	<i>Platanus occidentalis</i> L.	American sycamore
Poaceae	<i>Agrostis hyemalis</i> (Walter) Britton, Sterns & Poggenb.	winter bentgrass
	<i>Andropogon gerardii</i> Vitman	big bluestem
	<i>Andropogon virginicus</i> L.	broomsedge bluestem
	<i>Brachyelytrum erectum</i> (Schreb. ex Spreng.) P. Beauv.	bearded shorthusk
	<i>Bromus arvensis</i> L.	field brome
	<i>Bromus pubescens</i> Muhl. ex Willd.	hairy woodland brome
	<i>Chasmanthium latifolium</i> (Michx.) Yates	Indian woodoats
	<i>Dactylis glomerata</i> L.	orchardgrass
	<i>Danthonia spicata</i> (L.) P. Beauv. ex Roem. & Schult.	poverty oatgrass
	<i>Dichanthelium acuminatum</i> (Sw.) Gould & C.A. Clark var. <i>fasciculatum</i> (Torr.) Freckmann	western panicgrass
	<i>Dichanthelium boscii</i> (Poir.) Gould & C.A. Clark	Bosc's panicgrass
	<i>Dichanthelium clandestinum</i> (L.) Gould	deertongue
	<i>Dichanthelium commutatum</i> (Schult.) Gould	variable panicgrass
	<i>Dichanthelium dichotomum</i> (L.) Gould	cypress panicgrass
	<i>Dichanthelium latifolium</i> (L.) Gould & C.A. Clark	broadleaf rosette grass
	<i>Dichanthelium laxiflorum</i> (Lam.) Gould	openflower rosette grass
	<i>Dichanthelium linearifolium</i> (Scribn. ex Nash) Gould	slimleaf panicgrass
	<i>Dichanthelium malacophyllum</i> (Nash) Gould	softleaf rosette grass
	<i>Dichanthelium oligosanthos</i> (Schult.) Gould	Heller's rosette grass
	<i>Dichanthelium ravenelii</i> (Scribn. & Merr.) Gould	Ravenel's rosette grass

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Family	Scientific Name	Common Name
Poaceae	<i>Elymus virginicus</i> L.	Virginia wildrye
	<i>Elymus virginicus</i> L. var. <i>virginicus</i>	Virginia wildrye
	<i>Festuca subverticillata</i> (Pers.) Alexeev	nodding fescue
	<i>Hordeum pusillum</i> Nutt.	little barley
	<i>Leersia oryzoides</i> (L.) Sw.	rice cutgrass
	<i>Leersia virginica</i> Willd.	whitegrass
	<i>Lolium perenne</i> L. ssp. <i>multiflorum</i> (Lam.) Husnot	Italian ryegrass
	<i>Microstegium vimineum</i> (Trin.) A. Camus	Nepalese browntop
	<i>Muhlenbergia schreberi</i> J.F. Gmel.	nimblewill
	<i>Muhlenbergia sobolifera</i> (Muhl. ex Willd.) Trin.	rock muhly
	<i>Panicum anceps</i> Michx.	beaked panicgrass
	<i>Phleum pratense</i> L.	timothy
	<i>Poa annua</i> L.	annual bluegrass
	<i>Poa chapmaniana</i> Scribn.	Chapman's bluegrass
	<i>Poa compressa</i> L.	Canada bluegrass
	<i>Poa pratensis</i> L.	Kentucky bluegrass
	<i>Poa sylvestris</i> A. Gray	woodland bluegrass
	<i>Schedonorus phoenix</i> (Scop.) Holub	tall fescue
	<i>Schizachyrium scoparium</i> (Michx.) Nash	little bluestem
	<i>Sorghastrum nutans</i> (L.) Nash	Indiangrass
	<i>Sphenopholis obtusata</i> (Michx.) Scribn.	prairie wedgescale
	<i>Sporobolus compositus</i> (Poir.) Merr. var. <i>compositus</i>	composite dropseed
	<i>Tridens flavus</i> (L.) Hitchc.	purpletop tridens
Polemoniaceae	<i>Phlox divaricata</i> L.	wild blue phlox
	<i>Polemonium reptans</i> L.	Greek valerian
Polygonaceae	<i>Polygonum</i> sp.	knotweed
	<i>Polygonum scandens</i> L.	climbing false buckwheat
	<i>Polygonum virginianum</i> L.	jumpseed
	<i>Rumex acetosella</i> L.	common sheep sorrel
	<i>Rumex crispus</i> L.	curly dock
Primulaceae	<i>Lysimachia lanceolata</i> Walter	lanceleaf loosestrife
Ranunculaceae	<i>Anemone virginiana</i> L.	tall thimbleweed
	<i>Ranunculus abortivus</i> L.	littleleaf buttercup
	<i>Ranunculus fascicularis</i> Muhl. ex Bigelow	early buttercup
	<i>Ranunculus hispidus</i> Michx.	bristly buttercup
	<i>Ranunculus micranthus</i> Nutt.	rock buttercup
	<i>Ranunculus recurvatus</i> Poir.	blisterwort
	<i>Thalictrum thalictroides</i> (L.) Eames & B. Boivin	rue anemone
Rhamnaceae	<i>Frangula caroliniana</i> (Walter) A. Gray	Carolina buckthorn

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Family	Scientific Name	Common Name
Rosaceae	<i>Agrimonia pubescens</i> Wallr.	soft agrimony
	<i>Agrimonia rostellata</i> Wallr.	beaked agrimony
	<i>Amelanchier arborea</i> (Michx. f.) Fernald	common serviceberry
	<i>Fragaria virginiana</i> Duchesne	Virginia strawberry
	<i>Geum canadense</i> Jacq.	white avens
	<i>Geum vernum</i> (Raf.) Torr. & A. Gray	spring avens
	<i>Potentilla recta</i> L.	sulphur cinquefoil
	<i>Potentilla simplex</i> Michx.	common cinquefoil
	<i>Prunus americana</i> Marsh.	American plum
	<i>Prunus mexicana</i> S. Watson	Mexican plum
	<i>Prunus serotina</i> Ehrh.	black cherry
	<i>Rosa carolina</i> L.	Carolina rose
	<i>Rosa multiflora</i> Thunb.	multiflora rose
	<i>Rosa setigera</i> Michx.	climbing rose
	<i>Rubus flagellaris</i> Willd.	northern dewberry
	<i>Rubus occidentalis</i> L.	black raspberry
	<i>Rubus pensilvanicus</i> Poir.	Pennsylvania blackberry
Rubiaceae	<i>Galium aparine</i> L.	stickywilly
	<i>Galium arkansanum</i> A. Gray	Arkansas bedstraw
	<i>Galium circaezans</i> Michx.	licorice bedstraw
	<i>Galium pilosum</i> Aiton	hairy bedstraw
	<i>Galium virgatum</i> Nutt.	southwestern bedstraw
	<i>Houstonia purpurea</i> L.	Venus' pride
Salicaceae	<i>Salix nigra</i> Marsh.	black willow
Sapotaceae	<i>Sideroxylon lanuginosum</i> Michx.	gum bully
Scrophulariaceae	<i>Agalinis tenuifolia</i> (Vahl) Raf.	slenderleaf false foxglove
	<i>Penstemon digitalis</i> Nutt. ex Sims	talus slope penstemon
	<i>Verbascum thapsus</i> L.	common mullein
	<i>Veronica arvensis</i> L.	corn speedwell
Smilacaceae	<i>Smilax bona-nox</i> L.	saw greenbrier
	<i>Smilax ecirrhata</i> (Engelm. ex Kunth) S. Watson	upright carrionflower
	<i>Smilax pulverulenta</i> Michx.	downy carrionflower
	<i>Smilax tamnoides</i> L.	bristly greenbrier
Solanaceae	<i>Physalis heterophylla</i> Nees	clammy groundcherry
	<i>Physalis virginiana</i> Mill.	Virginia groundcherry
	<i>Solanum carolinense</i> L.	Carolina horsenettle
Tiliaceae	<i>Tilia americana</i> L.	American basswood
Typhaceae	<i>Typha latifolia</i> L.	broadleaf cattail
Ulmaceae	<i>Celtis occidentalis</i> L.	common hackberry
	<i>Ulmus alata</i> Michx.	winged elm
	<i>Ulmus americana</i> L.	American elm
	<i>Ulmus rubra</i> Muhl.	slippery elm

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Family	Scientific Name	Common Name
Urticaceae	<i>Boehmeria cylindrica</i> (L.) Sw.	smallspike false nettle
	<i>Laportea canadensis</i> (L.) Weddell	Canadian woodnettle
	<i>Parietaria pensylvanica</i> Muhl. ex Willd.	Pennsylvania pellitory
	<i>Pilea pumila</i> (L.) A. Gray	Canadian clearweed
Valerianaceae	<i>Valerianella radiata</i> (L.) Dufr.	beaked cornsalad
Verbenaceae	<i>Phryma leptostachya</i> L.	American lopseed
Violaceae	<i>Hybanthus concolor</i> (T.F. Forst.) Spreng.	eastern greenviolet
	<i>Viola bicolor</i> Pursh	field pansy
	<i>Viola sororia</i> Willd.	common blue violet
	<i>Viola triloba</i> Schwein.	three-lobed violet
Vitaceae	<i>Parthenocissus quinquefolia</i> (L.) Planch.	Virginia creeper
	<i>Vitis aestivalis</i> Michx.	summer grape
	<i>Vitis rupestris</i> Scheele	sand grape
	<i>Vitis vulpina</i> L.	frost grape

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Natural Resource Stewardship and Science

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

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