National Park Service
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Natural Resource Stewardship and Science

National Park Service Vegetation Inventory Program

Cuyahoga Valley National Park, Ohio

Natural Resource Technical Report NPS/HTLN/NRTR—2013/792





ON THIS PAGE
Description: All photographs collected in Cuyahoga Valley National Park, Ohio. From upper left clockwise: mature shagbark hickory (*Carya ovata*); European Skipper (*Thymelicus lineola*) on red clover (*Trifolium pratense*); Blue Hen Falls; Eastern Ratsnake (*Elaphe alleghaniensis*); coral mushroom; grasshopper (order *Orthoptera*) on wingstem (*Verbesina alternifolia*) along the Cuyahoga Valley Scenic Railway.
Photograph by: All photos by Andrew Strassman (U.S. Geological Survey).

ON THE COVER
Description: Kendall Lake in Cuyahoga Valley National Park, Ohio.
Photograph by: Kevin Hop (U.S. Geological Survey).

National Park Service Vegetation Inventory Program

Cuyahoga Valley National Park, Ohio

Natural Resource Technical Report NPS/HTLN/NRTR—2013/792

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

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Executive Summary

The National Park Service (NPS) Vegetation Inventory Program (VIP) is an effort to classify, describe, and map existing vegetation of national park units for the NPS Natural Resource Inventory and Monitoring (I&M) Program. The NPS VIP is managed by the NPS Biological Resources Management Division and provides baseline vegetation information to the NPS Natural Resource I&M Program. The U.S. Geological Survey (USGS) Vegetation Characterization Program lends a cooperative role in the NPS VIP. The USGS Upper Midwest Environmental Sciences Center, NatureServe, and NPS Cuyahoga Valley National Park (CUVA) have completed vegetation classification and mapping of CUVA.

Mappers, ecologists, and botanists collaborated to identify and describe vegetation types within the National Vegetation Classification Standard (NVCS) and to determine how best to map them by using aerial imagery. The team collected data from 221 vegetation plots within CUVA to develop detailed descriptions of vegetation types. Data from 50 verification sites were also collected to test both the key to vegetation types and the application of vegetation types to a sample set of map polygons. Furthermore, data from 647 accuracy assessment (AA) sites were collected (of which 643 were used to test accuracy of the vegetation map layer). These data sets led to the identification of 45 vegetation types at the association level in the NVCS at CUVA.

A total of 44 map classes were developed to map the vegetation and general land cover of CUVA, including the following: 29 map classes represent natural/semi-natural vegetation types in the NVCS, 12 map classes represent cultural vegetation (agricultural and developed) in the NVCS, and 3 map classes represent non-vegetation features (open-water bodies). Features were interpreted from viewing color-infrared digital aerial imagery dated October 2010 (during peak leaf-phenology change of trees) via digital onscreen three-dimensional stereoscopic workflow systems in geographic information systems (GIS). The interpreted data were digitally and spatially referenced, thus making the spatial database layers usable in GIS. Polygon units were mapped to either a 0.5 ha or 0.25 ha minimum mapping unit, depending on vegetation type.

A geodatabase containing various feature-class layers and tables shows the locations of vegetation types and general land cover (vegetation map), vegetation plot samples, verification sites, AA sites, project boundary extent, and aerial photographic centers. The feature-class layer and relate tables for the CUVA vegetation map provides 4,640 polygons of detailed attribute data covering 13,288.4 ha, with an average polygon size of 2.9 ha.

Summary reports generated from the vegetation map layer show map classes representing natural/semi-natural types in the NVCS apply to 4,151 polygons (89.4% of polygons) and cover 11,225.0 ha (84.5%) of the map extent. Of these polygons, the map layer shows CUVA to be 74.4% forest (9,888.8 ha), 2.5% shrubland (329.7 ha), and 7.6% herbaceous vegetation cover (1,006.5 ha). Map classes representing cultural types in the NVCS apply to 435 polygons (9.4% of polygons) and cover 1,825.7 ha (13.7%) of the map extent. Map classes representing non-NVCS units (open water) apply to 54 polygons (1.2% of polygons) and cover 237.7 ha (1.8%) of the map extent.

A thematic AA study was conducted of map classes representing natural/semi-natural types in the NVCS. Results present an overall accuracy of 80.7% (kappa index of 79.5%) based on data

from 643 of the 647 AA sites. Most individual map-class themes exceed the NPS VIP standard of 80% with a 90% confidence interval.

The CUVA vegetation mapping project delivers many geospatial and vegetation data products in hardcopy and/or digital formats. These products consist of an in-depth project report discussing methods and results, which include descriptions and a dichotomous key to vegetation types, map classification and map-class descriptions, and a contingency table showing AA results. The suite of products also includes a database of vegetation plots, verification sites, and AA sites; digital pictures of field sites; field data sheets; aerial photographic imagery; hardcopy and digital maps; and a geodatabase of vegetation types and land cover (map layer), fieldwork locations (vegetation plots, verification sites, and AA sites), aerial photographic index, project boundary, and metadata. All geospatial products are projected in Universal Transverse Mercator, Zone 17, by using the North American Datum of 1983. Information on the NPS VIP and completed park mapping projects are located on the Internet at <http://science.nature.nps.gov/im/inventory/veg> and <http://www.usgs.gov/core_science_systems/csas/vip/index.html>.

Acknowledgments

The success of this complex project was dependent on the collaborative efforts of several individuals from various organizations. The dedicated folks who worked on this project collectively have a wide array of skill and expertise, essential in moving the National Park Service (NPS) Cuyahoga Valley National Park (CUVA) vegetation mapping project to its completion. We wish to acknowledge those individuals who have been vital in making this project a success.

We respectfully thank the NPS Vegetation Inventory Program (VIP) and the U.S. Geological Survey (USGS) Vegetation Characterization Program (VCP) staff for entrusting this project to us, including Karl Brown (NPS VIP Coordinator) for funding the CUVA vegetation mapping project, Tammy Cook (NPS VIP) for giving us guidance when we needed it, and Mike Mulligan (USGS VCP Coordinator) and Theresa Singh (USGS VCP) for posting digital products to the Internet. Thanks are also in order to the NPS CUVA staff for hosting this project, with its series of meetings, training sessions, and field efforts, in particular Kevin Skerl (now at Sleeping Bear Dunes National Lakeshore) and Chris Davis.

We finally thank our colleagues from within our own offices—the USGS Upper Midwest Environmental Sciences Center (UMESC) and NatureServe. Of the USGS, we acknowledge Janis Ruhser for producing stereo models for 3D mapping; Larry Robinson for organizing the collection of digital aerial imagery and for keeping 3D mapping stations functional; and JC Nelson and the GIS lab for the random-site selection for accuracy assessment (AA), metadata generation of the aerial imagery and the feature class layers within the geodatabase, database entry of verification sites, and a series of map graphics and composition. We also thank Heidi Langrehr of the Wisconsin Department of Natural Resources (UMESC Field Office) for her diligent support in the analysis with the AA study and Sara Lubinski (contractor) for coordinating and leading the training to collect AA field data. Of NatureServe, we acknowledge Mary Russo for getting classification data into and out of the central database of NatureServe with ease and speed and Don Faber-Langendoen for consulting with us on the vegetation classification. We would like to thank the field crews who sampled the vegetation plots and AA sites, as they collected the invaluable data we needed for so much of the project. Members of the field crews included Christopher DeChant, Erika Protos, William Martinus, and Leon “Chip” Schaddelee, for vegetation plot data collection, and Ken Hiser and Tyler Lawson, for AA site data collection.

This project required the cooperation and assistance of many individuals. Their diligence in working on this diverse project is highly regarded and appreciated because their labors went toward so many aspects of this project—from developing the vegetation classification to creating the spatial geodatabase.

Introduction

Cuyahoga Valley National Park Vegetation Mapping Project

The Cuyahoga Valley National Park (CUVA) vegetation mapping project is an initiative of the National Park Service (NPS) Vegetation Inventory Program (VIP), with cooperative support from the U.S. Geological Survey (USGS) Vegetation Characterization Program (VCP) to classify and map vegetation types of CUVA. (Note: "CUVA" is also referred to as "park" throughout this report.) The goals of the project are to adequately describe and the map vegetation types of the park and to provide the NPS Natural Resource Inventory and Monitoring (I&M) Program, resource managers, and biological researchers with useful baseline vegetation information.

The CUVA vegetation mapping project was officially inaugurated in spring 2010, with a scoping meeting wherein partners discussed project objectives, goals, and methods. Major collaborators at this meeting included staff from the NPS VIP, the NPS CUVA, the NPS Heartland Network, NatureServe, the USGS Upper Midwest Environmental Sciences Center, Cleveland Metroparks, and Metro Parks, Serving Summit County. Common to all NPS VIP projects, the three major components of the CUVA vegetation mapping project are as follows: (1) vegetation classification, (2) vegetation mapping, and (3) map accuracy assessment (AA). In this report, each of these fundamental components is discussed in detail.

The National Park Service Vegetation Inventory Program

The NPS VIP is an effort to classify, describe, and map existing vegetation of national park units. Managed by the NPS Biological Resources Management Division, the NPS VIP provides baseline vegetation information for the NPS Natural Resource I&M Program. The USGS VCP, which is part of the Core Science Analytics and Synthesis program under the USGS Core Science Systems Mission Area, lends a cooperative role in the NPS VIP, particularly with serving data on the Internet. Vegetation layers and associated information support a wide variety of resource assessment, park management, and planning needs. They also provide structure for framing and answering critical scientific questions about vegetation communities and their relation to environmental processes across the landscape.

Program scientists developed procedures for classification, mapping, and AA (The Nature Conservancy [TNC] and Environmental Systems Research Institute [ESRI] 1994a, 1994b, TNC et al. 1994, NatureServe 2004, Lea 2010). Ecology and mapping teams worked together to share knowledge and data and to resolve issues regarding classification and mapping procedures. The NPS VIP products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification and metadata and national standards for spatial accuracy and data transfer. Mapping standards include a minimum mapping unit (MMU) of 0.5 ha and a classification accuracy meeting or exceeding 80% (with a 90% confidence level) for map classes representing vegetation types in the National Vegetation Classification Standard (NVCS). All geospatial products are projected in Universal Transverse Mercator (UTM) and use the North American Datum of 1983 (NAD83).

The NPS VIP provides an array of mapping and vegetation data products. Mapping products include aerial photography and/or digital aerial imagery sets, spatial databases of vegetation (including metadata), a map classification description or key, hard-copy maps of vegetation, and

an AA of the vegetation map. Vegetation products include vegetation classification, a dichotomous field key to vegetation types, formal descriptions and ground photos of vegetation types, and field data in database format.

More information on the NPS VIP as well as products of completed park vegetation mapping projects are on the Internet at <http://science.nature.nps.gov/im/inventory/veg> and <http://www.usgs.gov/core_science_systems/csas/vip/index.html>.

Natural Resource Inventory and Monitoring Program

The NPS Natural Resource I&M Program is a long-term effort to acquire information needed to help maintain ecosystem integrity for all NPS units with significant natural resources. One of the long-term goals of the I&M Program is to produce baseline inventories of biological and geophysical natural resources. The NPS VIP provides detailed vegetation maps based on aerial photography and/or digital aerial imagery and meets specified thematic accuracy standards (80%) set by the I&M Program. More information on the I&M Program is available on the Internet at <http://science.nature.nps.gov/im/index.cfm>.

Vegetation Inventory Program Standards

The NPS VIP uses nationally defined standards, some of which are maintained by the FGDC. These include the following:

- National Vegetation Classification Standard (NVCS) (FGDC 2008),
- Content Standard for Digital Geospatial Metadata (FGDC 1998a),
- Spatial Data Transfer Standard (FGDC 1998b),
- United States National Map Accuracy Standards (U.S. Geological Survey 1999), and
- Integrated Taxonomic Information System[1] (U.S. Department of Agriculture).

Descriptions and links to websites for these standards can be accessed at <http://www.usgs.gov/core_science_systems/csas/vip/standards_and_protocols.html>.

The National Vegetation Classification Standard

In 1997, the FGDC adopted the Vegetation Classification Standard: FGDC-STD-005-1997 (FGDC 1997). Since then, the FGDC Vegetation Subcommittee has derived a major revision, the National Vegetation Classification Standard, Version 2: FGDC-STD-005-2008 (Version 2) (FGDC 2008). This revision was an effort to foster a cohesive view among Federal agencies in their approaches to classifying vegetation, thus reducing duplicative efforts among multiple agencies while promoting consistent classification of vegetation resources across regions. Version 2 replaced the original, addressed several issues known with the first version, and included a substantial reorganization of the classification hierarchical structure. The use of a national standard aids effective resource stewardship by augmenting compatibility and widespread use of the information throughout the NPS and other Federal and State agencies.

The NVCS classifies existing vegetation within a hierarchical structure. In brief, the classification is separated into two overriding categories: natural vegetation (including semi-natural) and cultural vegetation. From there, each category is further divided into three main

[1] The Integrated Taxonomic Information System can be accessed at < http://www.itis.gov>.

sections: (1) Upper (where physiognomy plays a predominant role), (2) Middle (where both floristics and physiognomy play a significant role), and (3) Lower (where floristics plays a predominant role). Within each section, additional levels are subset. Separate hierarchies are developed for cultural and natural vegetation types. Tables 1 and 2 show the hierarchical structures for both natural and cultural vegetation types. Definitions of these various levels are detailed within Section 2 of the NVCS (FGDC 2008); however, because of the emphasis given by the NPS VIP to natural/semi-natural vegetation types of the floristic levels (alliance and association) and the group level of the NVCS, the following brief definitions are provided.

- An association-level type is the finest level of the NVCS and is "defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions and physiognomy" (Jennings et al. 2006, as quoted in FGDC 2008:14). "Associations reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes" (FGDC 2008:14).
- An alliance-level type is hierarchically one level above the association and is "defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation" (Jennings et al. 2006, as quoted in FGDC 2008:14). "Alliances reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes" (FGDC 2008:14).
- A group-level type is hierarchically one level above the alliance (two levels above association) yet is also the lowest level of the middle section of the NVCS hierarchy. The group level is defined in Table 2.4 of the NVCS as "combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes" (FGDC 2008:17).

Table 1. Hierarchy for natural/semi-natural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008).

Level	Example
Upper: Physiognomy plays a predominant role.	
Formation Class	Forest to Open Woodland (1.)
Formation Subclass	Temperate & Boreal Forest (1.B.)
Formation	Cool Temperate Forest (1.B.2.)
Middle: Both floristics and physiognomy play a significant role.	
Division	Eastern North American Cool Temperate Forest (1.B.2.Na./D008.)
Macrogroup	Central Mesophytic Hardwood Forest (M153.)
Group	North-Central Beech - Maple - Basswood Forest (G021.)
Lower: Floristics plays a predominant role.	
Alliance	*Acer saccharum* - *Fagus grandifolia* Forest (A3226.)
Association	*Fagus grandifolia* - *Acer saccharum* Glaciated Midwest Forest (CEGL005013)

Table 2. Hierarchy for cultural vegetation (with examples) in the National Vegetation Classification Standard, Version 2 (FGDC 2008).

Level	Example
Upper: Physiognomy plays a predominant role.	
Cultural Class	Agricultural Vegetation
Cultural Subclass	Herbaceous Agricultural Vegetation
Cultural Formation	Pasture / Hay
Cultural Subformation	Permanent Pasture & Hayland
Middle: Both floristics and physiognomy play a significant role.	
Cultural Group [optional]	Temperate and Tropical Permanent Pasture & Hayland
Cultural Subgroup	Grass
Lower: Floristics plays a predominant role.	
Cultural Type	Co-dominance of tall fescue & perennial ryegrass
Cultural Subtype [optional]	

Content Standard for Digital Geospatial Metadata

Metadata are data that describe the content, quality, condition, and other characteristics of other data. As a standard product, the NPS VIP employs FGDC-compliant metadata files for each spatial data set it produces. In 1998, the FGDC approved the Content Standard for Digital Geospatial Metadata, FGDC-STD-001-1998 (FGDC 1998a). This metadata standard uses a common set of terminology and definitions to document digital geospatial data.

Cuyahoga Valley National Park[2]

CUVA is a national park unit of the NPS located in northeast Ohio within Cuyahoga and Summit counties and between the metropolitan areas of Akron and Cleveland, Ohio (Figure 1). The park is over 13,000 ha in area with nearly 60% in federal ownership, and the remaining area consists mostly of other public lands or easements, including Cleveland Metroparks and Metro Parks, Serving Summit County. The park is named for the wide valley of the Cuyahoga River, and over 35 km of the 145 km-long Cuyahoga River flows through the park lands. "Cuyahoga" comes from an American Indian word for "crooked river." Although the river enters Lake Erie in Cleveland, it begins only about 48 km east of Cleveland; the river flows southwest to Akron and then bends back northward to Cleveland, flowing in a wide U-shaped path. Tinkers Creek and Furnace Run are the major tributaries to the Cuyahoga River.

CUVA was first established as the Cuyahoga Valley National Recreation Area with legislation by the U.S. Congress in 1974. In 2000, the U.S. Congress changed the name to "Cuyahoga Valley National Park." The mission and purpose of the park, according to the 2001 strategic plan for CUVA, is listed below.

- Mission: "The Park will manage the national park through creative leadership and development of partnerships that will enable full realization of the Park's and Ohio & Erie National Heritage Canalway's scenic, natural, historic, recreational, and educational values for the benefit of the community, the visiting public, and future generations."

[2] Information within this section was largely gathered from both the NPS brochure and the Web site for the Cuyahoga Valley National Park; <http://www.nps.gov/cuva>.

- Purpose: "To preserve and protect for public use and enjoyment the historic, scenic, natural, and recreational values of the Cuyahoga River Valley and to maintain the open space necessary to the urban environment."

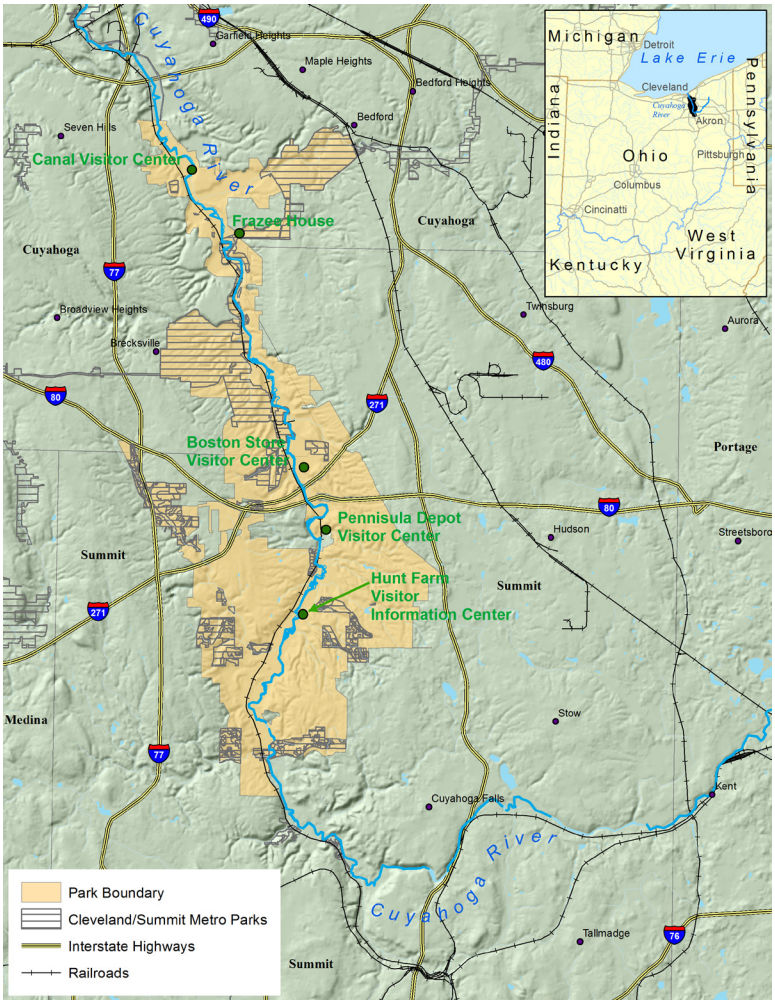


Figure 1. Location of Cuyahoga Valley National Park in Ohio.

The valley of the Cuyahoga River has been a major thoroughfare for transportation for some time. American Indians demarked the area as a safe travel route between tribes. European explorers, trappers, and settlers discovered the livelihood of the valley in the 17th and 18th centuries. The Ohio & Erie Canal (Figure 2), which opened in 1827, ran parallel to the Cuyahoga River between Cleveland and Akron and was a primary source of transportation until the railroad system (Figure 3) was established in the 1860s and took over as the primary mode of transportation.

Today CUVA provides a route of recreation and discovery for many visitors; approximately 2.5 million people visit the park on an annual basis. It offers historic and cultural activities, including hundreds of historical sites, hiking, biking, horseback riding, museums, and visitor centers with educational and interpretive programs. Integrating into the cultural setting are music and art centers, scout camps, ski resorts, and golf courses.



Figure 2. A lock of the historic Ohio & Erie Canal in the Cuyahoga Valley, preserved since the late 1820s.



Figure 3. The Cuyahoga Valley Scenic Railroad commemorates the historic railroad pathway first established in the Cuyahoga Valley in the 1860s.

In addition to the historical and cultural contributions that CUVA offers, the park is also highly diverse in vegetation, as the natural and cultural settings mix. Furthermore, the park is primarily located in the Appalachian Plateaus physiographic region, which covers most of eastern Ohio and is one of the glaciated portions of the Allegheny Plateau, with the northern most portion of the park located in the Till Plains physiographic region, which covers most of western Ohio and extends westward to Illinois. This environmental setting provides for rugged and steep landscapes high above the Cuyahoga River in the easternmost part of the park where the escarpment breaks (e.g., the Ledges, Figure 4) off to the rolling lowlands westward of the riparian forests deep within the valley of the Cuyahoga River. Yet, the forest lands have been fragmented in one way or another (Figure 5); many have been heavily logged and some converted to agricultural fields. Villages and towns are now well established, and significant fires and environmental disasters have occurred during the 20th century.



Figure 4. Rocky escarpment at the Ledges in Cuyahoga Valley National Park, Ohio.



Figure 5. Fragmented forest with fallow field within Cuyahoga Valley National Park, Ohio.

The forests of CUVA are largely made up of hardwood trees. The late-successional and mature forests (Figure 6) consist of northern red oak (*Quercus rubra*), white oak (*Q. alba*), black oak (*Q. velutina*), chinkapin oak (*Q. muehlenbergii*), hickory species (*Carya* spp.), sugar maple (*Acer saccharum*), and American beech (*Fagus grandifolia*). Red maple (*A. rubrum*), black cherry (*Prunus serotina*), tuliptree (*Liriodendron tulipifera*), and aspen species (*Populus* spp.) characterize the early-successional forests (Figure 7). Conifer forests are much less common than hardwood forests, with eastern hemlock (*Tsuga canadensis*)-mixed hardwood forests restricted to the Ledges area (Figure 8) and planted forests of various conifer species checkered across the landscape of the park (Figure 9). Riparian floodplain and bottomland forests (Figure 10) consist largely of silver maple (*A. saccharinum*), eastern cottonwood (*P. deltoides*), American sycamore (*Platanus occidentalis*), black walnut (*Juglans nigra*), green ash (*Fraxinus pennsylvanica*), common hackberry (*Celtis occidentalis*), red maple, and tuliptree. Rare occurrences of black ash (*F. nigra*) and swamp white oak (*Q. bicolor*) can also be found in some bottomland forest settings.



Figure 6. A late-successional, mature forest in Cuyahoga Valley National Park, Ohio.



Figure 7. An early-successional forest in Cuyahoga Valley National Park, Ohio.



Figure 8. An eastern hemlock (*Tsuga canadensis*)-mixed hardwood forest in Cuyahoga Valley National Park, Ohio.



Figure 9. A conifer-planted forest in Cuyahoga Valley National Park, Ohio.



Figure 10. A silver maple (*Acer saccharinum*) floodplain forest within the riparian setting of the Cuyahoga River in Cuyahoga Valley National Park, Ohio.

Wet meadows, beaver marshes, ponds, and small lakes intermingle herbaceous and shrub wetlands into the forested landscape (Figure 11). From the hardwood riparian lands deep within the valley floor of the Cuyahoga River to the rocky ledges of eastern hemlock high above, overlooking the river valley, CUVA offers a diverse landscape in vegetation as it interweaves with the cultural setting so prominent of the area, both historic and modern (Figure 12). Further reporting on the vegetation of the park from the CUVA vegetation mapping project is provided in the Vegetation Classification section of this report.



Figure 11. A shallow-water wetland complex consisting of trees, shrubs, and herbaceous vegetation in Cuyahoga Valley National Park, Ohio.



Figure 12. The Conrad Botzum Farmstead, part of the historic and cultural integration to the vegetation landscape at Cuyahoga Valley National Park, Ohio.

Project Overview

General Process

The objective for the Cuyahoga Valley National Park (CUVA) vegetation mapping project was to identify and map existing vegetation types of the park. To accomplish this goal, three main components to the CUVA vegetation mapping project were necessary: (1) vegetation classification, (2) vegetation mapping, and (3) map accuracy assessment (AA). Each of these main components is discussed in greater detail within this report; however, as with any vegetation mapping project, several intermediate steps are inherent to the process. Table 3 provides a timeline outlining the sequence of events, which are discussed in the following pages of this report section.

Table 3. Timeline by year and task of the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Note: Each year in the table is split into four blocks to better approximate when the bulk of a particular task effort was performed. These blocks represent January–March, April–June, July–September, and October–December.
[AA, Accuracy Assessment; Clsf, Classification; Recon, Reconnaissance]

Task	2009	2010	2011	2012	2013
Project Plan Data Review					
Scoping Meeting					
Vegetation Plots					
Aerial Imagery					
Vegetation Clsf					
Map Clsf Meeting					
Map Recon					
Map/Key Verification					
Mapping					
AA Field					
AA Analysis					
Product Development					
Close-out Meeting					

Project Planning and Data Review

In December 2009 and January 2010, a collaborative effort between staff from CUVA, the U.S. Geological Survey (USGS) Upper Midwest Environmental Science Center (UMESC), and NatureServe took place through a series of conference calls and a webinar meeting to make initial plans for the CUVA vegetation mapping project. From this effort, a timeline for the project was drafted, prospective roles and responsibilities were recognized, potential partners

were identified, and a review of existing datasets of the park was accomplished. Participating CUVA staff already had the datasets in hand and made them available to the rest of the team for review. The datasets under review covered various themes, including:

- Administration Features (e.g., park boundary, trails),
- Political Features (e.g., roads, landmarks, counties),
- Baseline (e.g., digital raster graphics),
- Topography/Geology (e.g., digital elevation models, geology layers)
- Hydrology (e.g., lakes, rivers, watersheds), and
- Vegetation (e.g., land cover/use maps, long-term ecological monitoring sites).

The team analyzed the vegetation datasets further to assess their usefulness to the CUVA vegetation mapping project. This analysis followed protocols specifically prepared by The Nature Conservancy (TNC, 2009) for the National Park Service (NPS) Vegetation Inventory Program (VIP). The goal of this analysis was to identify datasets that might be used for vegetation classification and mapping to reduce cost, time, and effort in collecting data from vegetation plots for vegetation classification development as well as assisting the mapping of vegetation types. The method uses seven key data quality factors and a flow chart to evaluate and place each dataset into one of five categories of utility for vegetation classification and mapping. Table 4 provides the five categories of utility and Table 5 shows the results of the analysis for the CUVA vegetation mapping project.

Table 4. Categories of "Utility for Existing Data Sets" (The Nature Conservancy [TNC] 2009) to assess existing vegetation datasets for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Category	Description
I	Samples are adequate for classification and mapping (i.e., the data are geo-referenced, represent existing vegetation, and contain sufficient structural, compositional and site information to place the sample within the standard classification framework).
II	Data are adequate to assist in photo interpretation, photographic signature key development, or map accuracy assessment (i.e., the vegetation and site information are of lower quality, but the samples represent existing vegetation and are geo-referenced with reasonable confidence).
III	Data can be used for vegetation classification and characterization of a vegetation type within the park, but not for mapping or analysis, because the sample is not adequately geo-referenced, contains inadequate detail in the vegetation information, and/or may not represent existing vegetation at the sample location.
IV	Data set was assessed and not found to be useful at any level.
V	Data set not was not available for assessment.

Table 5. Category results from assessment of existing vegetation datasets for the Cuyahoga Valley National Park, Ohio vegetation mapping project (using The Nature Conservancy [TNC] 2009).

[NPS, National Park Service; VIP, Vegetation Inventory Program]

Dataset	Category	Comments
1959 Landcover	III	Data is old; will help with historic perspective; good metadata.
1975 Landcover	IV	Little information on what was done; data is old, but appears to be detailed; will help with historic perspective.
2000–2 Landcover	III	Classification based Andersen et al. (1976); classification very general; little value for photointerpretation; may be good for stratifying plots; good metadata.
Rare Plants Database	IV	Data does not apply to a broader vegetation survey/map.

Dataset	Category	Comments
Deer Exclosure	IV	Sampled areas are smaller and the abundance metrics are different than NPS VIP standards.
LTEM sites	II	Able to assign vegetation-class names to these sites after classification development; unable to derive new classification from the sites; sampled areas are smaller and the abundance metrics are different than NPS VIP standards; may be able to assist with photointerpretation.
Invasive Plant Locations	IV	Data does not apply to a broader vegetation survey/map.
Wetlands	III	Will aid photointerpretation with identifying wetlands; can be used to stratify broadly different wetland types for plot sampling; contains classes PEM, PSS, PFO from Cowardin et al. (1979).

Scoping Meeting

A scoping meeting was held May 8–9, 2010, at the Boston Store Visitor Center of CUVA in Peninsula, Ohio. Various cooperators joined together to discuss the objectives and methods of the CUVA vegetation mapping project, receive assignments, and be introduced to the vegetation ecology of the park. Individuals from the NPS Vegetation Inventory Program (VIP), NPS CUVA, NPS Heartland Network, USGS UMESC, and NatureServe met to achieve the following objectives:

- Provide an overview of the NPS VIP and data applications,
- Present the major steps of a mapping project and view examples of final products,
- Learn about landscape, management/science, and specific interests of the park,
- Explore possible cooperation with neighbors and partners,
- Define the project boundary and confirm the minimum mapping unit (MMU) application,
- Discuss plans for data collection and functional and logistical support,
- Review project schedule, and
- View some vegetation types and the landscape of the park (Figure 13).



Figure 13. Participants from the scoping meeting for the Cuyahoga Valley National Park vegetation mapping project on a field tour for viewing vegetation types of the Cuyahoga Valley National Park, Ohio.

Representatives from Cleveland Metroparks and Metro Parks, Serving Summit County also attended the scoping meeting to learn of the CUVA vegetation mapping project for potential expansion that would include portions of these local park systems that are external to the administrative boundary of CUVA[3]. Although the interest in expansion was positive from each park system, the funds were not available.

Vegetation Sampling Data and Classification

During summer 2010 and spring 2011, botanists collected data from 221 vegetation plots for plant community characterization. The sampling data were entered into the NPS PLOTS Database Version 2.0 (NatureServe 2005) for analyses to characterize vegetation associations in the National Vegetation Classification Standard (NVCS). The plot data were eventually converted to the PLOTS Database Version 3.2 (Colorado Natural Heritage Program [CNHP] 2011) for the NPS. The vegetation analyses provided detailed ecological information to affirm plant communities at CUVA and document them with local descriptors. NatureServe also produced a field key to vegetation types recognized in the park at that time. The vegetation classification and key were continually refined as additional data from map reconnaissance, map and vegetation key verification, and AA were produced. A total of 45 natural/semi-natural vegetation types at the association level in the NVCS are resultant from the CUVA vegetation mapping project. Methods and results of vegetation classification are provided in greater detail in the Vegetation Classification section of this report.

Digital Aerial Imagery

Digital aerial imagery provides baseline data for mapping vegetation types and other land cover features. Vertical photographs (photographs taken with the aerial camera pointed straight down at the ground) collected with proper overlapping within each flight line permit an interpreter to study the photographs three-dimensionally with a stereoscope (Avery 1978) or, as with the CUVA vegetation mapping project, to view stereo models of digital aerial images in three dimensions (3D) using computer workstations. Because ecologic settings are taken into account when mapping vegetation types, the ability to view the aerial images in 3D assists the recognition of those ecologic settings.

For the CUVA vegetation mapping project, two sets of color-infrared (CIR) aerial imagery were collected of CUVA on October 16, 2010, using a plane-mounted digital camera; these images provided aerial views to conduct both fieldwork and mapping. The goal of fall-dated imagery was to capture peak leaf-phenology change of hardwood trees; thus, aiding mappers in viewing distinctions between various hardwood-forest types. Table 6 provides some baseline information about the digital aerial imagery collected for the CUVA vegetation mapping project.

Existing sets of aerial photographs of the park were reviewed prior to obtaining a new set of digital aerial imagery for the CUVA vegetation mapping project. Table 7 lists the photography sets that were reviewed. They range in resolution from 0.3 to 1 m/pixel and consist of black-and-white, true-color (TC), or CIR photography. It was recognized at the time of review that these aerial photography sets were not current enough yet could aid the classifier and mappers in understanding the historic land cover/land use of the park; however, they would not provide

[3] Portions of Cleveland Metroparks and Metro Parks, Serving Summit County fall within the CUVA administrative boundary and are inherently included with the CUVA vegetation mapping project; however, lands external the administrative boundary would require additional classification and mapping efforts.

benefit as the primary sets for mapping to capture current vegetation and land cover. Based on resource management needs of the park, it was determined that acquisition of a new set of fall-dated CIR aerial imagery was necessary. Nevertheless, the TC leaf-off photography dated 2006 from the State of Ohio might have complementary use to the newly obtained CIR imagery during the interpretation and mapping process.

Table 6. Digital aerial imagery sets collected for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Imagery Date	Imagery Type	Pixel Resolution	Footprint (pixels)	Footprint (m)	Area (ha)
10-16-2010	Color infrared	15.24 cm (6 inch)	7212 x 5408	1099 x 824	91
10-16-2010	Color infrared	20.32 cm (8 inch)	7212 x 5408	1465 x 1099	161

Table 7. List of existing aerial imagery sets reviewed for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Year	Photography Type	Pixel Resolution	Source	Leaf On / Leaf Off
1959	Black and White	1 m	U.S. Department of Agriculture	Leaf On
1994	Black and White	1 m	U.S. Geological Survey	Leaf Off
2000	True Color	0.5 m	Summit County, Ohio	Leaf Off
2000	Color Infrared	0.8 m	Unknown	Leaf On
2002	Black and White	0.5 m	Cuyahoga County, Ohio	Leaf Off
2006	True Color	0.3 m	State of Ohio	Leaf Off

The UMESC coordinated the collection of digital aerial imagery for the CUVA vegetation mapping project. Several parameters were put in place for this acquisition, including the following:

- Suitable for stereo viewing and having 60% forward lap and 30% side lap with the sun angle at least 30 degrees above the horizon (collection time between 10:45 am and 3:30 pm local time),
- Fall-dated CIR showing peak leaf-phenology change of trees,
- Pixel resolution of 6 inches,
- Include a minimum of 100-m buffer beyond the administrative boundary of the park,
- Collection orientation of north and south, and
- Coordinate with park staff the acquisition date to capture peak leaf-phenology change.

The UMESC collaborated with the regional pilot from the Region 3 office of the U.S. Fish and Wildlife Service (St. Paul, Minnesota). This regional office uses a plane-mounted 39-megapixel digital camera (Applanix DSS 439) with 7212 x 5408 pixel sensor—which is considered a medium-format system—that can collect 3-band CIR imagery (in 12-bit format). The camera system employs a sophisticated inertial measurement unit (IMU) and a sensitive global positioning system (GPS) to precisely track the horizontal and vertical location of the airplane at the instance of exposure. Image processing software uses this positional data to reference each image frame to the surface of the Earth within 1 m (Mostafa et al. 2007).

The flight mission to collect the digital aerial imagery for the CUVA vegetation mapping project set out to acquire one complete aerial imagery set of the park at a pixel resolution of 15.24 cm

(centimeter measurement calculated from a standard 6-inch measurement); however, an unacceptable amount of shadow from clouds was captured during the acquisition period, obscuring land cover and making those areas difficult to view and interpret by a mapper. The flight mission was immediately extended to collect a second set of imagery. This set was collected at a pixel resolution of 20.32 cm (centimeter measurement calculated from a standard 8-inch measurement) because of limited time left with the flight-mission parameters. This second set of digital aerial imagery captured sunlight conditions with only a few clouds present and would suffice to complement the first imagery set where clouds had obscured the landscape.

Figure 14 showcases a digital aerial image from the 15.24-cm/pixel resolution imagery set, including shadow from clouds partially obscuring the view of the ground. Figure 15 shows an aerial image from the 20.32-cm/pixel resolution imagery set, free of shadow from clouds and giving clear view of the ground. These two images show nearly the same area; however, the tradeoff for the mapper having the shadow-free view in Figure 15 is lower image resolution. Although the area covered (161 ha) by an image at the lower resolution (20.32-cm/pixel) is larger than the area covered (91 ha) by an image at the higher resolution (15.24-cm/pixel), a smaller area captured by the camera footprint equates to a higher image resolution for viewing. Therefore, it was decided to map CUVA using the higher resolution aerial imagery set and use the lower resolution set to map areas where obscured by cloud shadow.

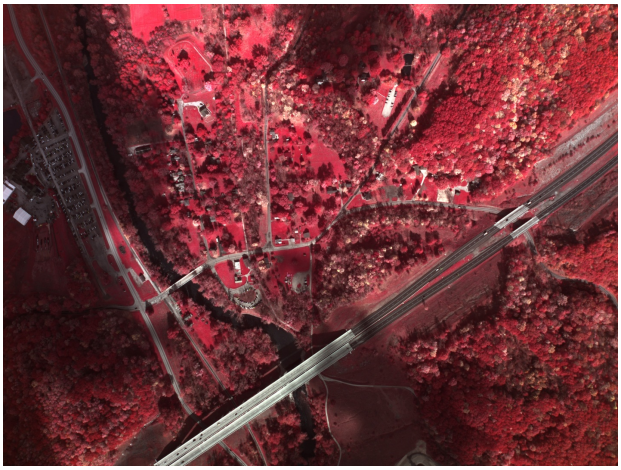


Figure 14. An image from the color-infrared digital aerial imagery obtained in October 2010, collected at 15.24-cm/pixel resolution for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

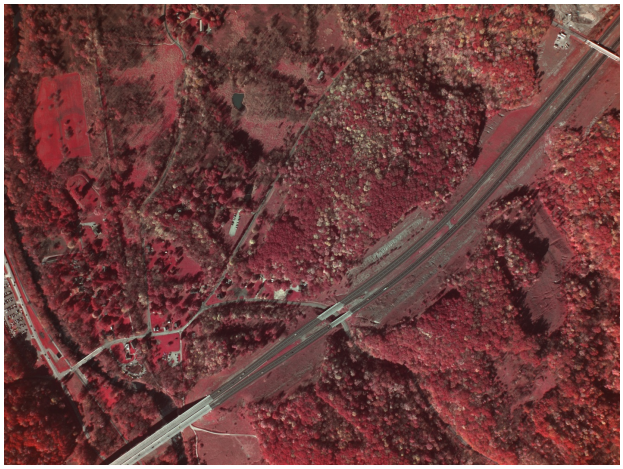


Figure 15. An image from the color-infrared digital aerial imagery obtained in October 2010, collected at 20.32-cm/pixel resolution for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Both sets of digital aerial imagery were reviewed to assure that, between the two sets, requirements for mapping purposes were met. Upon acceptance, exposures were adjusted for viewing and interpreting purposes. Each set of aerial imagery was then processed for both field and mapping purposes. This consisted of producing 1) a two-dimension (2D) orthorectified mosaic of each imagery set for background display in a geographic information system (GIS) and 2) stereo models to view images in 3D for mapping using a GIS and specialized 3D computer hardware and software.

Orthorectified Mosaic

Individual image tiles from both CIR digital aerial imagery sets obtained for the CUVA vegetation mapping project were converted to Tagged Image File Format (TIFF) format and referenced to the Earth using the GPS and IMU records generated by the camera. Since the IMU records the rotation values from the camera sensor in three directions (roll, pitch, and crab), and the GPS records the horizontal and vertical values from the sensor at the moment of exposure, specific software programs can place each digital aerial image precisely on the ground. The software programs take advantage of digital elevation models (DEM) to further increase the fit to the Earth by draping each aerial image over the landscape.

Once referenced, or orthorectified, the individual digital aerial images were color balanced and stitched together to form a single image mosaic; this was done to both the 15.24-cm/pixel and the 20.32 cm/pixel resolution imagery sets, producing an orthoimage mosaic for each imagery set. Each image mosaic was compressed into Joint Photographic Experts Group (JPEG) 2000 to accommodate computer hardware systems and GIS software with manageable file sizes. Each image mosaic was projected in the Universal Transverse Mercator (UTM), Zone 17, by using the North American Datum of 1983 (NAD83) and the North American Vertical Datum of 1988 (NAVD88).

Stereo Models

Digital aerial image tiles were collected with a 60% overlap along flight lines. This allowed for the making of stereo models for onscreen 3D viewing using a GIS and specialized computer hardware and software. Before digital aerial imagery can be viewed in 3D, block files must be generated for stereo models (a block file is a separate georeferencing file that a GIS uses to maintain the alignment of the stereo-pair imagery). These block files establish each aerial photo's relationship to its adjacent stereo pair, so that the overlap areas are always precisely aligned and the photo's overlapping areas can be viewed in stereo. Stereo models use processed but unreferenced, unrectified imagery, since photo displacement of features is required for 3D viewing. For the CUVA vegetation mapping project, stereo models were produced using LPS Core software (ERDAS, Inc.). For viewing in 3D and map interpretation, the stereo models were imported into Stereo Analyst for ArcGIS (ERDAS, Inc.). This allowed for georeferencing information of the associated block file to be read and the stereo pairs of aerial imagery to display in 3D and in the correct geospatial position. Since the stereo model contains georeferencing information, information delineated on-screen in the GIS by the mapper is also georeferenced as it is drawn. Additional information on the use of stereo models with specialized stereo viewing equipment for mapping is provided in the Vegetation Mapping section of this report.

In addition to orthoimage mosaic sets and stereo models, feature-class layers were produced for both the 15.24-cm/pixel and 20.32 cm/pixel resolution sets of CIR digital aerial imagery that were obtained in October 2010 for the CUVA vegetation mapping project. These feature-class layers provide the center locations of individual aerial images; Figure 16 shows the locations for the 15.24-cm/pixel resolution set, and Figure 17 shows the locations for the 20.32 cm/pixel resolution set. These feature classes are incorporated into the geodatabase for the CUVA vegetation mapping project. The digital aerial orthoimagery mosaic for both the 15.24-cm/pixel and the 20.32 cm/pixel resolution sets are also included as a product for the CUVA vegetation mapping project.

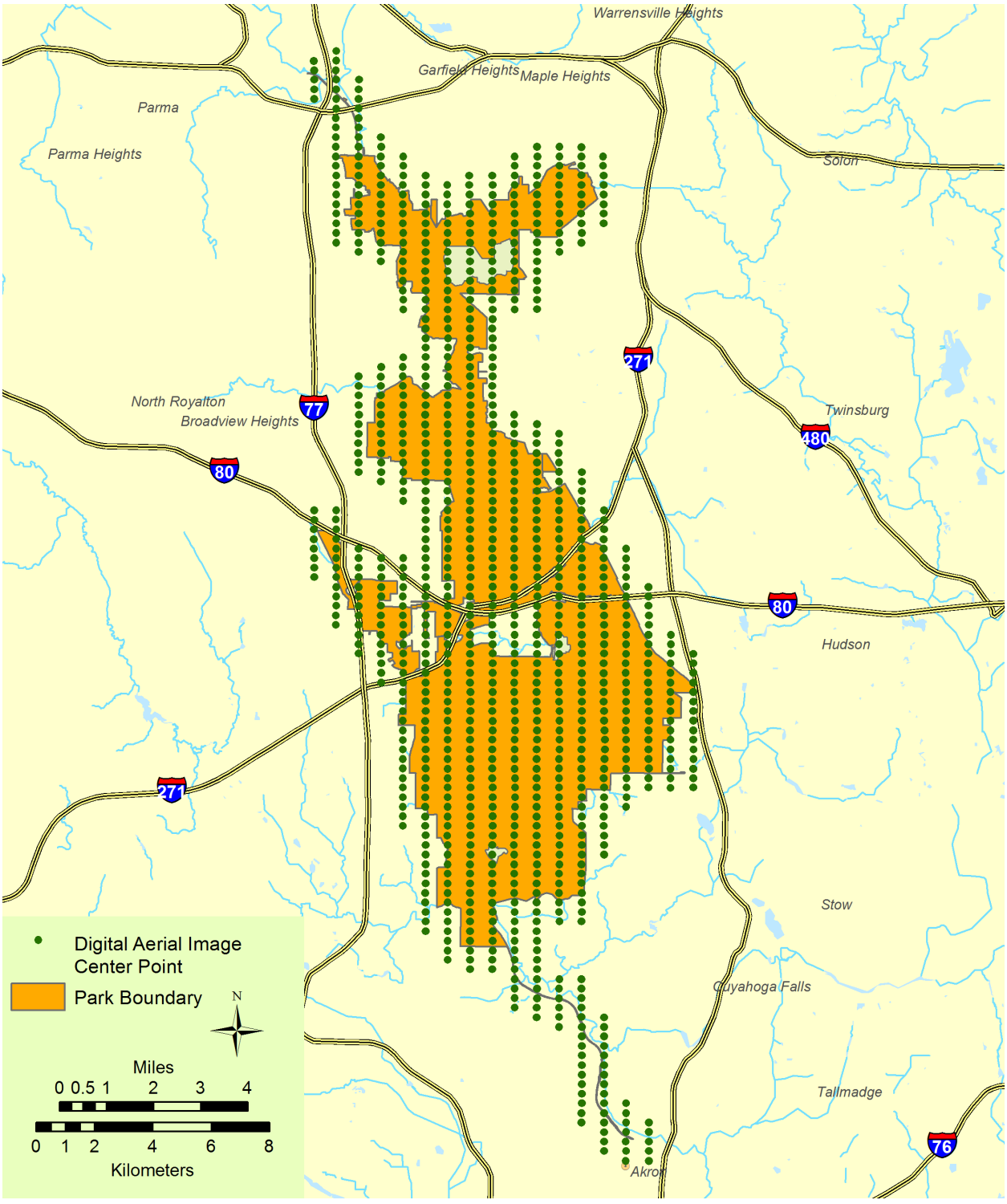


Figure 16. Center locations of color-infrared digital aerial imagery obtained in October 2010 at 15.24-cm/pixel resolution for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

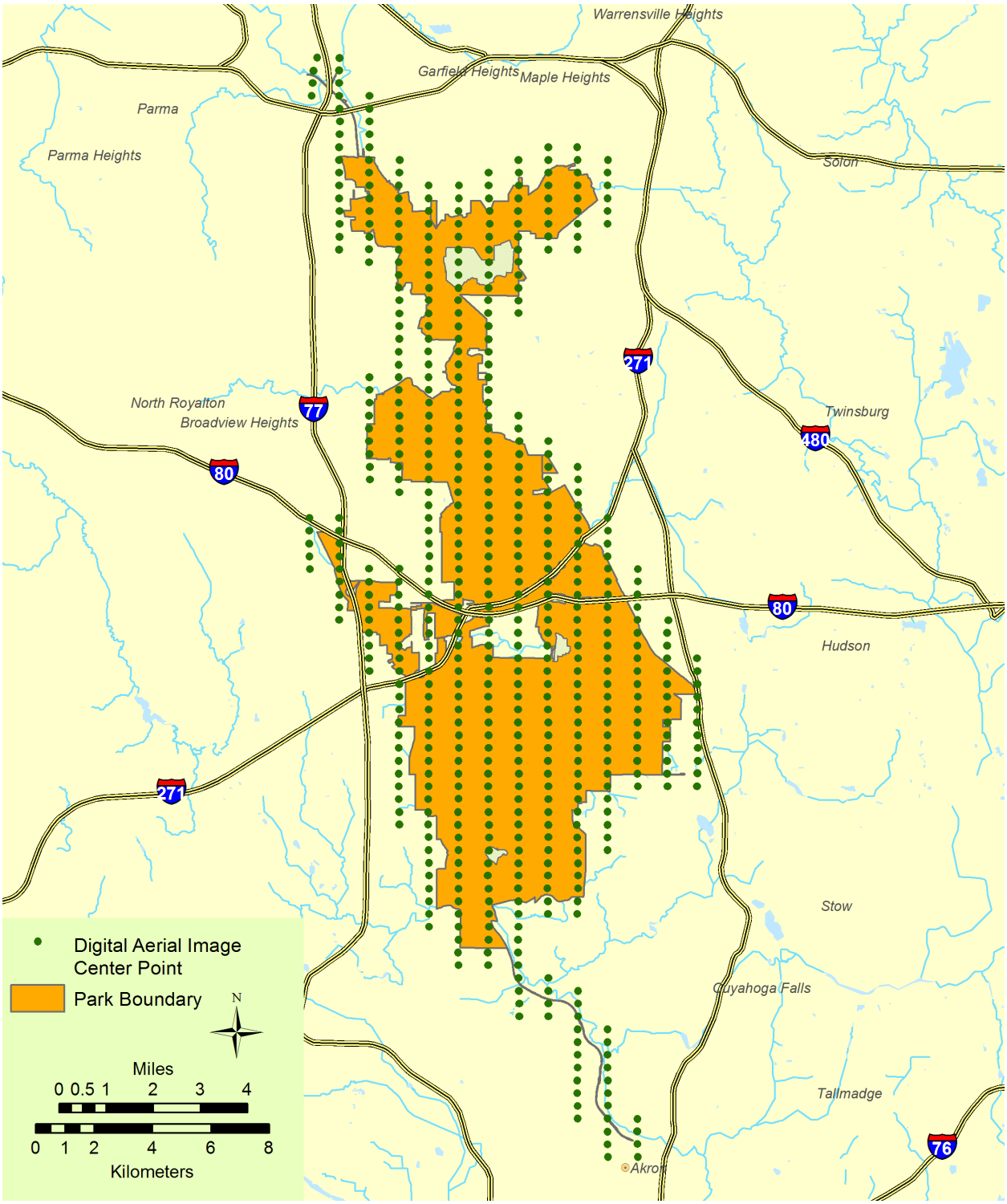


Figure 17. Center locations of color-infrared digital aerial imagery obtained in October 2010 at 20.32-cm/pixel resolution for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Map Classification, Field Work, and Vegetation Mapping

In May 2011, the classifier and mappers for the CUVA vegetation mapping project met to discuss the vegetation classification. This meeting prepared the mappers for field reconnaissance in the park. Three field efforts were completed during the summer of 2011 by the mappers with assistance by the classifier. The purpose of field reconnaissance was to visit the vegetation types in the field, discern their appearances in the aerial images, and establish mapping protocols. Between the second and third field efforts, preliminary maps of select locations were produced by the mappers. During the third field effort, the performance of both the map and vegetation key were tested. From the verification results, the map and vegetation key were adjusted accordingly.

The mapping proceeded from fall of 2011 to spring of 2012, with mappers interpreting vegetation and land cover types as presented in the CIR digital aerial imagery collected for this project, dated October 16, 2010. The mappers viewed the aerial imagery stereoscopically by using computer workstations equipped with both 3D and GIS software. The vegetation map of CUVA was produced onscreen using the 3D and GIS software and according to map conventions that were set to maintain consistent mapping. A draft version of the vegetation map (a spatial database layer) was completed in spring of 2012, provided to park staff for review and comment, and then prepared for AA. Methods and results of vegetation mapping are provided in greater detail in the Vegetation Mapping section of this report.

Accuracy Assessment

An AA was performed on the draft version of the vegetation map layer. During the summer of 2012, a field crew collected data from 647 stratified and randomly selected sites for evaluating the accuracy of the vegetation map layer. The AA field data were then compared to the vegetation map data. Results from the AA study show an overall accuracy of 80.7% (kappa index of 79.5%) based on an analysis of data from 643 of the 647 AA sites. The results were tabulated into a contingency matrix. Methods and results of AA are provided in greater detail in the Accuracy Assessment section of this report.

Product Development

Ultimately, a geodatabase containing four feature classes, including the following, was produced: (1) vegetation and land cover polygons (showing locations of vegetation types and general land cover features), (2) vegetation points (showing locations of vegetation plots, verification sites, and AA sites), (3) locations of the CIR digital aerial imagery obtained in October 2010 (15.24-cm/pixel resolution set), and (4) project boundary extent (which is the administrative boundary for CUVA). Included in the geodatabase are relate tables providing a suite of support information, from classification crosswalks to detailed sampling data. All geospatial products within this project geodatabase are projected in the UTM, Zone 17, by using NAD83.

The suite of products produced and compiled for the CUVA vegetation mapping project are many and include the project geodatabase described above along with metadata documentation, a vegetation database with all the formal field data collected during this project, field data sheets and digital pictures of field sites, maps and graphics showing a representation of each feature class within the project geodatabase, and this NPS Natural Resource Technical Report.

Close-out Meeting

The objective of a close-out meeting for any particular NPS VIP vegetation mapping project is for the NPS (at the park unit, network, and national levels) to receive final products from the developers and to be provided briefings on the vegetation mapping project, including summaries of results and demonstration of products. These meetings provide a venue of questions and answers to occur between the recipients and developers; this ultimately enhances the understanding and use of products by the recipients.

At the time of this report, a close-out meeting for the CUVA vegetation mapping project is scheduled to take place at CUVA in September 2013. In addition to the function standard to a close-out meeting (as described in previous paragraph), the CUVA close-out meeting will include a field workshop where attendees will view firsthand a vegetation plot, a verification site, various AA sites, some classified polygons of the vegetation map layer, and make use of the descriptions and field key to vegetation types.

Project Boundary Extent

The project boundary extent for the CUVA vegetation mapping project coincides with the CUVA administrative boundary (Figure 18). The total map extent is 13,288.4 ha. As mentioned previously, a feature-class layer showing the extent of the project boundary was developed and incorporated into the geodatabase for the CUVA vegetation mapping project

Minimum Mapping Units

The NPS VIP standard minimum mapping unit (MMU) of 0.5 ha was applied for the mapping of forest types. For shrub, herbaceous, and cultural types, as well as non-vegetation features, an MMU of 0.25 ha was applied. Also, when vegetation types were found unique to their immediate surroundings (e.g., an herbaceous wetland within an upland forest), mapping below the MMU was allowed.

Classification Organization

Throughout this project report and the final products related to the CUVA vegetation mapping project (e.g., the geodatabase), the vegetation classification is organized by the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008). In the NVCS, separate categories are provided for natural and cultural vegetation. Typically, areas having 1% or more of their surface area with live vegetation cover are classified within the NVCS. The NVCS excludes non-vegetated and waters (e.g., lakes, rivers); for these, the classification provided by the 2001 National Land Cover Database (Homer et al. 2004) is used.

Throughout this report, the term “vegetation type” is used to reference vegetation classification units in general, at any level of the hierarchy within the NVCS. For example, the *Acer saccharinum* - *Ulmus americana* Forest Association and the Silver Maple - Green Ash - Sycamore - Hackberry Floodplain Forest Group are each treated as a vegetation type.

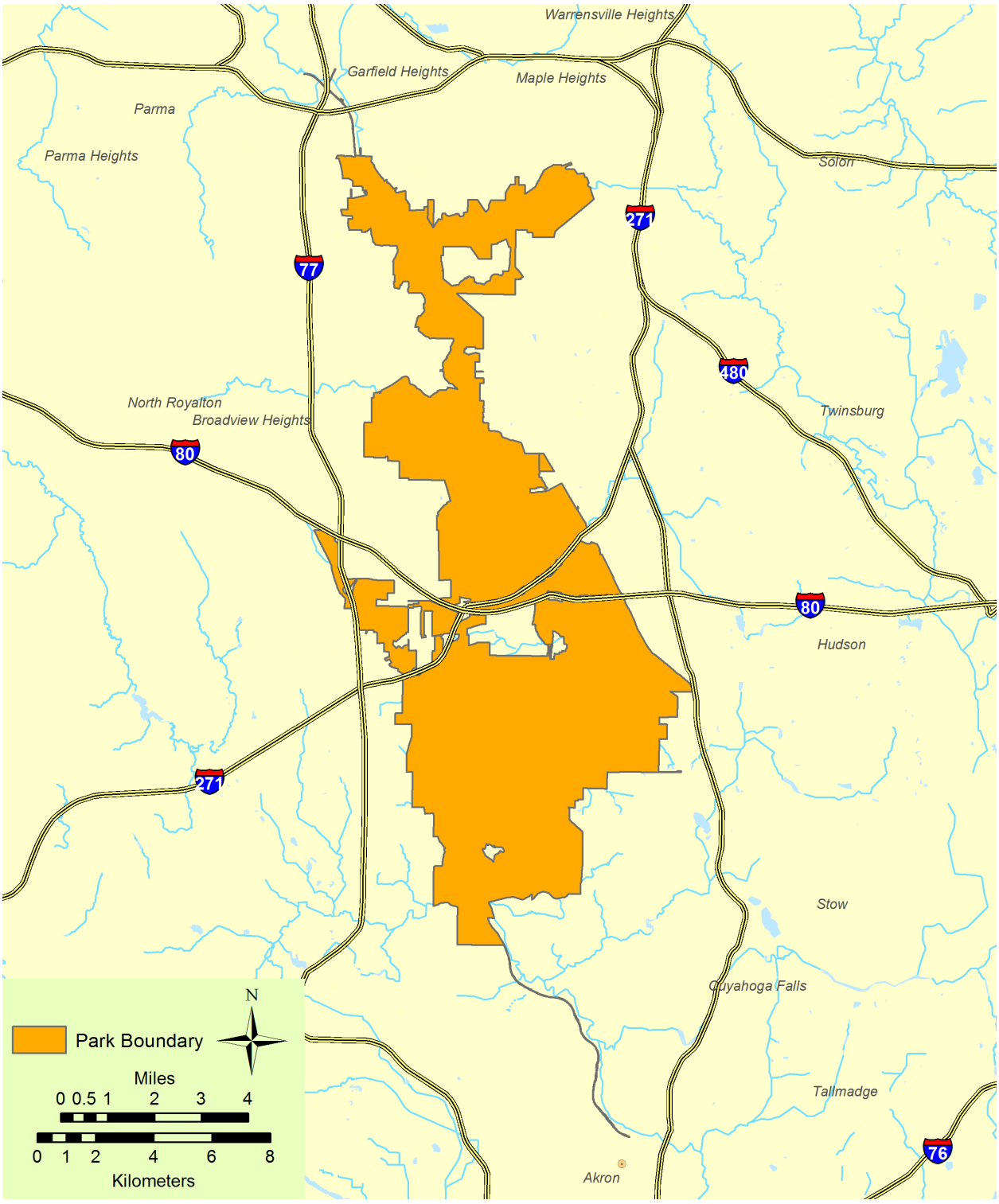


Figure 18. Project boundary for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Vegetation Classification

Methods

Preliminary Classification

The first step in classifying the natural/semi-natural vegetation types of Cuyahoga Valley National Park (CUVA) was to prepare a preliminary classification report prior to the May 2010 scoping meeting. That report was generated by reviewing all associations in the National Vegetation Classification Standard (NVCS) attributed to the Western Allegheny Plateau and North Central Tillplain Ecoregions in Ohio (The Nature Conservancy [TNC] 1999). This produced an initial listing of 106 vegetation associations and represented a much broader area than the CUVA administrative boundary, including many association types that were very unlikely to occur in the park. The initial list of association types was reviewed by NatureServe and CUVA staff to remove types thought not to occur in the park. The resulting preliminary classification report listed 46 vegetation associations as potentially occurring in the park. The list of association types from that report served as a rough guide to the number and kind of vegetation types the field crew might encounter during vegetation plot sampling and helped estimate how much data the field crews would need to collect to adequately survey and classify the vegetation of the park.

Data Collection Preparation

The protocols for the National Park Service (NPS) Vegetation Inventory Program (VIP) allow for the collection of approximately five plots per estimated vegetation type (from the preliminary classification report), on average. The preliminary classification listed 46 possible association types in the NVCS. Even though several association types on the preliminary list were unlikely to occur in the park, including some fen, native prairie, and oak savanna associations, from previous experience with other vegetation mapping projects additional vegetation types would likely be found that were not on the preliminary list. To retain flexibility to potentially sample those additional vegetation types and/or the unlikely associations from the preliminary classification, the number of sampling plots was not reduced. Thus, using the average of 5 plots per vegetation type, 230 plots were planned to characterize the estimated 46 associations in the NVCS.

Most of the association types in the preliminary classification were relatively well described across their range but some (e.g., upland forests with different land use histories) were expected to have variable composition from stand to stand, so 4–7 plots were targeted for those types. Other association types (e.g., water-lily marsh, reed canarygrass marsh) were compositionally simpler; therefore, 1–3 plots were targeted for those types. In addition to plot data specifically collected for the CUVA vegetation mapping project, existing vegetation datasets of the park were also reviewed for potential use to develop the vegetation classification. None of those existing datasets met the standards of the NPS VIP and could not be integrated into the analyses for vegetation classification. (For vegetation datasets that were reviewed, refer to Project Planning and Data Review in the Project Overview section of this report.)

All vegetation plots were sampled within the CUVA administrative boundary, which encompasses an area of over 13,000 ha. With an area the size of CUVA, the challenge was to find several representatives of each vegetation type that exists in the park without actually seeing the entire area; due to limitations of budget and timeline, a complete census of the park was not

feasible. Available data layers for use in a geographic information system (GIS), the preliminary vegetation classification, consultation with knowledgeable staff at the park, and the experience of the field crew were used to guide the sampling effort. The extensive road and trail network in and around the park area eased access, though this was counterbalanced to some degree by restrictions to movement due to private land both surrounding and within the CUVA administrative boundary and from parking limitations along many roads.

Field Sampling

The field sampling methodology was adapted from program standards (NatureServe 2004). Details are provided therein with a general summary here.

Vegetation plots for sampling were placed to represent the character of an entire stand of vegetation as well as possible. Plots were usually located at least 15 m from the boundary of another vegetation type to reduce the variability associated with the transition from one vegetation type to another. This was not always possible in the case of small or linear vegetation stands. It was sometimes difficult to determine what constituted the boundary of a unique vegetation type because two adjacent stands may be floristically very similar but are separated in the NVCS based on physiognomic criteria (e.g., amount of shrub or tree canopy cover).

Vegetation plots were square or rectangular in shape and were either 100 or 400 m^2 in size, depending on the dominant physiognomy (Table 8). Boundaries of plots were marked with flagging or measuring tapes.

Table 8. Plot sizes used for vegetation plot sampling for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Dominant Physiognomy	Plot size	Plot area
Forest: Trees have their crowns overlapping, usually forming 60-100% cover.	20 x 20 m or 40 x 10 m	400 m^2
Woodland: Open stands of trees with crowns usually not touching. Canopy tree cover 25-60%, OR exceeds shrub, dwarf-shrub, herb, and nonvascular cover.	20 x 20 m or 40 x 10 m	400 m^2
Shrubland: Shrubs greater than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeding tree, dwarf-shrub, herb, and nonvascular cover.	10 x 10 m or 20 x 5 m	100 m^2
Dwarf-shrubland (e.g., heath): Shrubs less than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeds tree, shrub, herb, and nonvascular cover.	10 x 10 m or 20 x 5 m	100 m^2
Herbaceous (e.g., grassland, meadow, marsh): Herbs dominant, usually forming more than 25% cover OR exceeds tree, shrub, dwarf-shrub, and nonvascular cover.	10 x 10 m or 20 x 5 m	100 m^2
Nonvascular (e.g., cliff): Nonvascular cover dominant, usually forming more than 25% cover.	10 x 10 m or 20 x 5 m	100 m^2
Sparse vegetation (e.g., blowout, beach): Less than 10% total vegetation cover.	10 x 10 m or 20 x 5 m	100 m^2

Within each vegetation plot, the vegetation was visually separated into strata. The canopy cover and average height of each stratum was estimated. Within each stratum, all taxa within the plot area were identified, and the foliar cover of each taxon was estimated by using cover classes. (See Table 9 for cover classes and strata.) The diameter at breast height (DBH) of trees greater than 10 cm was recorded as well.

Table 9. Cover classes and vegetation strata used during vegetation plot sampling for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Cover scales		Vegetation strata	
T	0–1%	T1	Emergent Canopy
P	>1–5%	T2	Main Canopy
1	>5–15%	T3	Subcanopy
2	>15–25%	S1	Tall Shrubs
3	>25–35%	S2	Short Shrubs
4	>35–45%	S3	Dwarf-shrubs
5	>45–55%	H	Herbaceous (field layer, including tree seedlings)
6	>55–65%	A1	Floating-leaved aquatics
7	>65–75%	A2	Submerged-leaved aquatics
8	>75–85%		
9	>85–95%		
10	>95%		

Environmental information, such as slope, aspect, soil texture, and evidence of disturbance, were recorded of the vegetation plot. Locational information, including spatial coordinates, was obtained by using a global positioning system (GPS), and written directions to the plot were provided. Digital pictures were collected of the plot to provide additional information and assist in classifying the plot. Field crews took pictures in each cardinal direction from the plot center and at least one other picture that best captured the character of the vegetation. Finally, the field crew gave the plot a provisional classification name. Figure 19 shows an example of a vegetation plot. For an example of a plot form, see Appendix A: Plot Sampling Form.

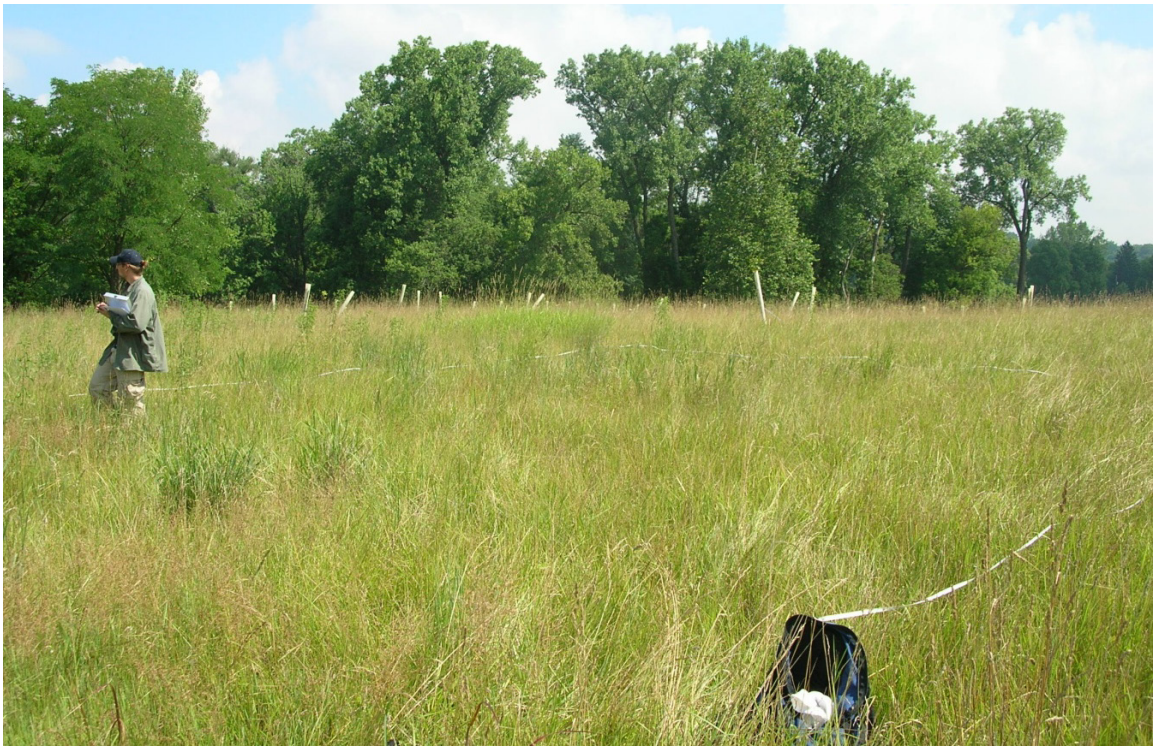


Figure 19. Example of a vegetation plot for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Data Analyses, Results, and Discussion

Field teams collected vegetation plot data in June and July of 2010 (156 plots) and again in May of 2011 (65 plots); thus, data from 221 vegetation plots were collected for the CUVA vegetation mapping project (Figure 20). The plot data were entered into the NPS PLOTS Database Version 2.0 (NatureServe 2005), a Microsoft Access database, to enter and store field data for the NPS VIP. It is noteworthy that the plot data set was later converted to the PLOTS Database Version 3.2 (Colorado Natural Heritage Program [CNHP] 2011) for product delivery to the NPS VIP.

To analyze vegetation patterns and classify natural/semi-natural vegetation to associations in the NVCS, the plot data were partitioned into groups using non-metric multi-dimensional scaling (NMS) ordination and Flexible Beta clustering techniques with PC-ORD 5.0 software (McCune and Mefford 1999). Potential groupings of plots were also compared using indicator species.

The analyses proceeded iteratively, starting with the entire dataset, then deriving data from several groups of vegetation plots based on quantitative analyses, examining the groups of plots to see if they matched the association-level concept in the NVCS, removing those that did, and then repeating the process on the remaining dataset until all plots had been assigned to an association type in the NVCS. Some association types were identified early on in the iterative process as a cohesive group of plots separated clearly and differently from the other groups within the larger dataset. Other association types separated much later in the process, indicating less difference between the groups of plots. Within several association types, some plots formed a cohesive sub-group that was later merged with other plots to represent the association type at CUVA. The plots were merged based on the judgment of NatureServe ecologists. Each group of plots that was identified by the quantitative analyses was also examined qualitatively by NatureServe ecologists to see how well the group might fit an existing or potentially new association concept. Based on the criteria of the NVCS, dominant canopy species were primary used to initially place forested vegetation types into groups, and the understory species were used to parse each group of forest types into individual forest associations. To better inform the results of the ordination and cluster analyses, the cover and frequency of all the overstory and understory species in each grouping were calculated. These calculations helped to further characterize and differentiate vegetation associations and were particularly useful for some of the variable forest types.

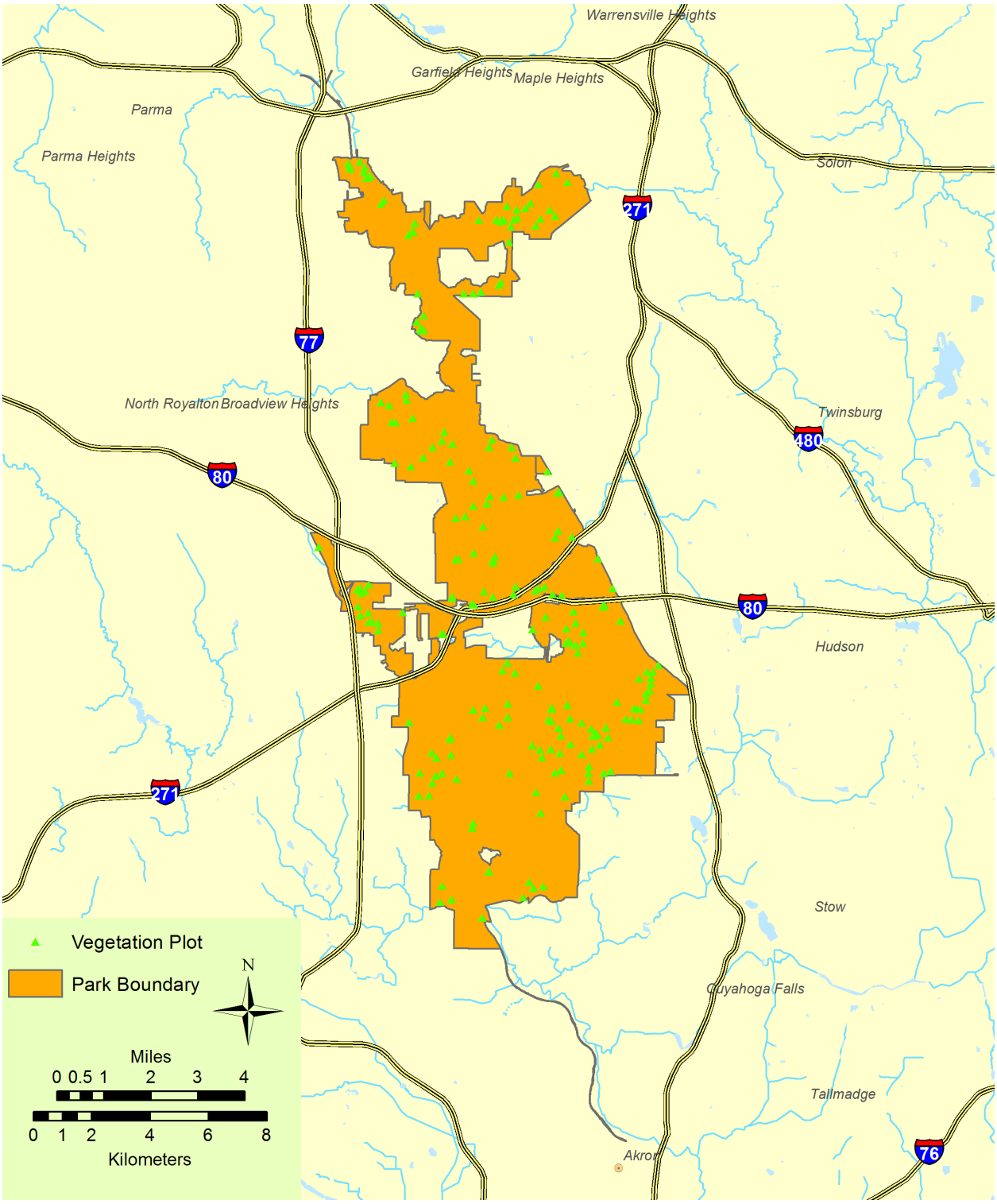


Figure 20. Locations of 221 vegetation plots for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

The first groups that split off toward association types in the NVCS were the eastern hemlock-American beech (*Tsuga canadensis-Fagus grandifolia*) forest group, the skunk cabbage (*Symplocarpus foetidus*) wetland group, and a marsh group dominated by yellow pond-lily (*Nuphar lutea*) and American white waterlily (*Nymphaea odorata*). Each of these groups was of habitats that were quite distinct and uncommon on the landscape. Nearly all the remaining plot groupings were not equal to just one association type in the NVCS. Of the 32 groups of plots created by the quantitative analytical algorithms, 56% were merged with other groups to form the final association and 9% were judged to be at the association level in the NVCS. The remaining 35% were split between two or more association types during the interpretation of the results. That is, the group of plots identified by the quantitative analyses as homogenous at some level was judged to best fit within more than one association type. The NVCS classification standards emphasize overstory species and physiognomy for creating units, especially at higher levels of the classification. Therefore the groups identified by the quantitative algorithms needed to be re-sorted with the NVCS standards in mind. This has happened to some degree in other NPS VIP classification efforts, but it was more common at CUVA. A hypothesis for why re-sorting was more common for the CUVA groups than for other NPS VIP studies is that the higher degree and longevity of disturbances in CUVA (e.g., deer browse, human land-use practices) has reduced the potential linkage between overstory and understory composition. At the park, some common species, either exotic or native aggressive species, tended to occur under a variety of tree canopies. For example, in wet-mesic to mesic settings, multiflora rose (*Rosa multiflora*) and garlic mustard (*Alliaria petiolata*) could be found under a variety of canopy trees and they tended to blur any potential distinctiveness. In upland mesic forests, the abundance of sugar maple (*Acer saccharum*) and/or American beech in the seedling and sapling strata could also blur the distinction between different forest types; for example, forest canopies dominated by oak species (*Quercus* spp.) rather than those dominated with sugar maple-American beech. The near ubiquity of some early-successional trees like red maple (*A. rubrum*) and tuliptree (*Liriodendron tulipifera*) also tended to bring together plots in the analyses.

By using the results of NMS and Flexible Beta clustering analyses and the qualitative assessment by ecologists, classification rules were generated to assign vegetation plots to associations in the NVCS. For example, where upland forests were strongly dominated by deciduous trees and dominated—or nearly dominated—by oak species and/or hickory species (*Carya* spp.), and where northern red oak (*Q. rubra*) was more abundant than black oak (*Q. velutina*) and/or blackgum (*Nyssa sylvatica*), vegetation plots were placed in the Midwestern White Oak - Red Oak Forest Association (CEGL002068). These classification rules were formalized, refined, and used to develop a draft version of a field key to the vegetation types for the mappers to use during the field reconnaissance and mapping efforts. The classification rules for the CUVA vegetation mapping project emphasize the tallest stratum in the vegetation because: (1) the understory vegetation in the park has been heavily disturbed, (2) of classification rules in the NVCS, and (3) typically fewer species are in the tallest stratum, and those species have relatively high amounts of cover and relatively high effect on the conditions within the plot; however, understory species were considered when making classification decisions. Summaries of the plot data for each association type (average, minimum, and maximum cover, and frequency for each species in each vegetation stratum) are available in the project database in the table entitled "_Community_Summary_Data."

Through the analyses of the vegetation plots for the CUVA vegetation mapping project, 32 groups of plots were eventually classified to the association level in the NVCS. Each association type was sampled at an average of almost seven plots. Individual vegetation types were sampled between 1 and 35 plots. Although the crews made a special effort to find uncommon vegetation types, rare and/or less variable types still tended to have been sampled in the fewest plots, while the most common and/or most variable types were sampled in the most plots. For example, over one-third of all plots were classified in three widespread and somewhat variable associations. Their variability is summarized as follows.

- The Midwestern White Oak - Red Oak Forest Association (CEGL002068) was sampled in 35 plots. This association is a very common dry-mesic to mesic deciduous forest with moderate to dense tree canopy and highly variable lower strata. The canopy has at least 40% oak species and/or hickories, but it ranges as high as almost 100% cover by those species. Associated canopy and sub-canopy trees can be red maple, sugar maple, American beech, tuliptree, black cherry (*Prunus serotina*), and others. The understory can be mostly open, but it can also have thickets of shrubs or small trees, most often sugar maple or American beech. The variability in the associated canopy trees and in the cover in the subcanopy and shrub strata led the field crews to sample many plots that were eventually combined into this one association. This association is very closely related to the Black Oak - White Oak - Hickory Forest Association (CEGL002076). The Midwestern White Oak - Red Oak Forest tends to be more mesic while the Black Oak - White Oak - Hickory Forest tends to favor somewhat drier settings, but the distinction between the two associations can be difficult to determine. It was not unusual to find a slope with more red oak on the lower portion and more black oak on the upper portion; however, placing the line between the two associations is difficult.
- The Successional Tuliptree - Red Maple Forest (CEPS006693) was sampled in 24 plots. This association is a very common dry-mesic to mesic (sometimes wet-mesic) deciduous forest with moderate to dense canopy. The canopy is variable but is dominated by early-successional trees of red maple, tuliptree, bigtooth aspen (*Populus grandifolia*), quaking aspen (*P. tremuloides*), and white ash (*Fraxinus americana*). Sugar maple and American beech can be found as tree canopy associates. Though this association is dominated by early-successional trees, the canopy can be very tall if enough mature tuliptree species are present. The understory has abundant aggressive exotic and native species including garlic mustard, multiflora rose, Jack in the pulpit (*Arisaema triphyllum*), Virginia creeper (*Parthenocissus quinquefolia*), and northern spicebush (*Lindera benzoin*). This association was newly created based on plot data for the CUVA vegetation mapping project, and it has not had extensive regional review. CEPS006693 is similar to the Successional Red Maple - Black Cherry Forest Association (CEPS006687), which was also created based on plot data for the CUVA vegetation mapping project, and they share some canopy dominants. The understories of the two associations differ, with the Successional Red Maple - Black Cherry Forest usually found on floodplains.
- The Beech - Maple Glaciated Forest Association (CEGL005013) was sampled in 22 plots. This association is a common mesic deciduous forest dominated or nearly dominated by sugar maple and American beech. Most stands were strongly dominated by these two species, but a few had significant amounts of red maple, tuliptree, white ash, or

cucumber-tree (*Magnolia acuminata*). Nearly all plots of this association were strongly dominated by native species in the understory.

From the field reconnaissance (summer 2011) to support vegetation mapping and the field site data collected for the accuracy assessment (AA) study (summer 2012), an additional 13 association types in the NVCS were discovered that had not been characterized by the plot data (Table 10). Nearly all of these associations were well described from a regional perspective and were compositionally fairly simple, so assigning them to association types in the NVCS was straightforward, even without the sampling data from vegetation plots. The Sugar Maple - Chinkapin Oak Forest Association (CEGL005010) is not well described across its range, and forest stands in CUVA were seen only in one area; these stands matched the range-wide information that is available, so they were assigned to that association.

Table 10. List of floristic vegetation types in the National Vegetation Classification Standard, Version 2 (FGDC, 2008) of Cuyahoga Valley National Park, Ohio that were identified after the collection of vegetation plots in 2011.

[CEGL, Community Element Global; NVCS, National Vegetation Classification Standard]

Association Name	NVCS Code
Larch Plantation	CEGL006408
Scotch Pine Plantation	CEGL006686
Red Pine Plantation	CEGL007177
Sugar Maple - Chinkapin Oak Forest	CEGL005010
Successional Black Locust Forest	CEGL007279
Red Maple - Black Ash Swamp	CEGL007441
Northern Buttonbush Swamp	CEGL002190
Gray Alder Swamp	CEGL002381
Japanese Knotweed Gravelbar	CEGL008472
Central Appalachian Cutgrass Marsh	CEGL006461
Bulrush - Cattail - Bur-reed Shallow Marsh	CEGL002026
Midwest Pondweed Submerged Aquatic Wetland	CEGL002282
Riverine Gravel Wash	CEGL002408

Eight of the 13 vegetation associations listed in Table 10 are classified as wetland or riparian. All eight of these occur as small stands and are uncommon to rare in CUVA. Although many of these eight vegetation types were large enough to sample and map, most are still small-scale relative to the landscape of the park and are easy to miss by the field crew when traversing the park. For instance, the Red Maple - Black Ash Swamp Association (CEGL007441) is known from only one stand and is <1.0 ha in area.

In all, a total of 45 natural/semi-natural associations in the NVCS were identified for the CUVA vegetation mapping project. Table 11 lists the vegetation associations and includes the number of times each association was sampled at a vegetation plot or an AA site. There are two associations, both being a type of conifer plantation association, with reportedly no observations. These two conifer plantation associations, along with all other conifer plantation associations (seven in total), were combined into one map class—the Successional Conifer Plantation Forest (FSCP) map class—for the CUVA vegetation mapping project. As part of the AA study for this project, field crews were sent to several locations that were mapped as FSCP and collected field

data for subsequent analysis of map accuracy. However, because multiple conifer plantation associations are part of the FSCP map class, no sites of the Scotch Pine Plantation Association (CEGL006686) or Larch Plantation Association (CEGL006408) were actually visited. It is also worth noting that there were approximately three times more AA sites sampled than there were vegetation plots (647 versus 221). Thus, most of the field observations were from AA sites. Data from AA sites provide important information on distribution and dominant species but do not have the detail of a full vegetation plot.

Table 11. List of vegetation association types in the National Vegetation Classification Standard, Version 2 (FGDC, 2008) of Cuyahoga Valley National Park, Ohio with number of field observations and whether the type was created based on project data.

Note: Vegetation types with likely anthropogenic origin are in italics and underlined.
[CEGL, Community Element Global; CEPS, Community Element Park Special; CUVA, Cuyahoga Valley National Park; NVCS, National Vegetation Classification Standard; Obs, Observations]

Group	Association Name	NVCS Code	Obs	Created at CUVA
Forest and Woodland Class				
North-Central Oak - Hickory Forest & Woodland				
	Midwestern White Oak - Red Oak Forest	CEGL002068	52	No
	Black Oak - White Oak - Hickory Forest	CEGL002076	25	No
Northern & Central Hardwood & Conifer Ruderal Forest				
	Conifer Plantation Breakup Forest	*CEGL005208*	*55*	*Yes*
	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)	*CEGL006304*	*10*	*No*
	Successional Black Locust Forest	*CEGL007279*	*3*	*No*
	Successional Red Maple - Black Cherry Forest	*CEPS006687*	*62*	*Yes*
	Successional Tuliptree - Red Maple Forest	*CEPS006693*	*42*	*Yes*
Northern & Central Conifer & Hardwood Plantation				
	Virginia Pine Plantation	*CEGL004730*	*2*	*No*
	Larch Plantation	*CEGL006408*	*0*	*No*
	Scotch Pine Plantation	*CEGL006686*	*0*	*No*
	Norway Spruce Plantation	*CEGL007167*	*3*	*No*
	Red Pine Plantation	*CEGL007177*	*3*	*No*
	White Pine Plantation	*CEGL007178*	*11*	*No*
Southern & Central Appalachian Northern Hardwoods - Hemlock Forest				
	East-Central Hemlock - Hardwood Forest	CEGL005043	22	No
North-Central Beech - Maple - Basswood Forest				
	Beech - Maple Glaciated Forest	CEGL005013	57	No
Appalachian Oak - Chestnut Forest				
	Black Oak - White Oak / Blueberry Forest	CEGL005030	6	No
Northeastern Chinkapin Oak - Red-cedar Forest & Woodland				
	Sugar Maple - Chinkapin Oak Forest	CEGL005010	3	No
Eastern Cottonwood - Black Willow Floodplain Forest				
	Midwestern Cottonwood - Black Willow Forest	CEGL002018	31	No
Silver Maple - Green Ash - Sycamore - Hackberry Floodplain Forest				
	Central Green Ash - Elm - Hackberry Forest	CEGL002014	5	No
	Silver Maple - Elm Forest	CEGL002586	12	No

Group	Association Name	NVCS Code	Obs	Created at CUVA
Northern & Central Ruderal Flooded & Swamp Forest				
	Tuliptree - Elm - Ash Forest	*CEPS006684*	*60*	*Yes*
	Sycamore - Walnut Forest	*CEPS006688*	*57*	*Yes*
	Successional Cottonwood Forest	*CEPS006689*	*18*	*Yes*
Central Flatwoods & Pond Forest				
	Northern (Great Lakes) Flatwoods	CEGL005037	5	No
Northern Conifer & Hardwood Alkaline Swamp				
	Red Maple - Black Ash Swamp	CEGL007441	2	No
Shrubland and Grassland Class				
Northern & Central Ruderal Meadow & Shrubland				
	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland	*CEGL005207*	*27*	*Yes*
	Timothy - Bluejoint Meadow	*CEGL005249*	*44*	*No*
	Successional Central Wet-Mesic Herbaceous Field	*CEPS006690*	*41*	*Yes*
	Restored Tallgrass Prairie	*CEPS006691*	*11*	*Yes*
	Successional Central Dry-Mesic Herbaceous Field	*CEPS006692*	*29*	*Yes*
Northern & Central Riverscour Wetland				
	Midwest Willow Sandbar Shrubland	CEGL005078	7	No
Eastern North American River Shoreline				
	Riverine Gravel Wash	CEGL002408	12	No
North-Central Appalachian, Interior & Prairie Fen				
	Skunk-cabbage Seepage Meadow	CEGL002385	3	No
Eastern North American Wet Meadow				
	Northern Buttonbush Swamp	CEGL002190	5	No
	Lake Sedge Wet Meadow	CEGL002256	2	No
	Central Appalachian Cutgrass Marsh	CEGL006461	0	No
Eastern North American Freshwater Marsh				
	Bulrush - Cattail - Bur-reed Shallow Marsh	CEGL002026	0	No
	Midwest Cattail Deep Marsh	CEGL002233	37	No
Northern & Central Shrub Swamp				
	Gray Alder Swamp	CEGL002381	4	No
	Dogwood - Willow - Wild Indigo Shrubland	CEGL005206	11	No
Northern & Central Ruderal Wet Meadow & Marsh				
	Eastern Reed Marsh	*CEGL004141*	*17*	*No*
	Reed Canarygrass Eastern Marsh	*CEGL006044*	*24*	*No*
	Japanese Knotweed Gravelbar	*CEGL008472*	*11*	*No*
Aquatic Vegetation Class				
Eastern North American Freshwater Aquatic Vegetation				
	Midwest Pondweed Submerged Aquatic Wetland	CEGL002282	10	No
	Water-lily Aquatic Wetland	CEGL002386	8	No

The land in CUVA has a long history of human use, and this is evident by the vegetation associations identified for the CUVA vegetation mapping project. Nearly half, or 22 of 45, of the associations identified from this vegetation mapping project are thought to result from anthropogenic disturbance. The NVCS is best developed for natural vegetation types and is thus the reason for the 10 new associations characterized by disturbance that were created for this project. Table 11 shows both the association types at CUVA that are likely of anthropogenic origin and those association types that were created based on data from this project. The extensive disturbance and the new assemblage of species present difficulties in classifying these

stands. There has not been extensive or region-wide data that represents these vegetation associations, and the recently disturbed stands are often more dynamic in their floristic and physiognomic changes than later successional vegetation.

All vegetation associations identified with the CUVA vegetation mapping project are described in Appendix B: Descriptions of Vegetation Types. These descriptions show the position of each association within the NVCS hierarchy, followed by information about environmental characteristics, vegetation, important species, classification issues, relationship to other classification systems, and distribution. Most fields in the description have a section with information on the range-wide characteristics (prefaced by "Global") and one on the local characteristics (prefaced by "Cuyahoga Valley National Park"). The global, or range-wide, information applies to the vegetation association across its entire range; this information has been gathered from scientific literature and other field data and is stored in NatureServe's central database. For the descriptive text fields, global information can be thought of as an average or modal expression of a relatively undisturbed stand of the association throughout its range. The local information (listed as "Cuyahoga Valley National Park") is derived from data and analyses from the classification phases of the CUVA vegetation mapping project, which consisted mostly of plot data from the plots sampled for this project; however, some information from AA field data and less formal field observations is also included. Vegetation associations that did not have plot data—that is, those types that were found after the plot sampling was finished—do have descriptions, but they are drawn only from global information; local information for these association types is not provided, as they are not supported by rigorous vegetation plot data. A key to vegetation types is provided in Appendix C: Field Key to Vegetation Types, which can be used in concert with the vegetation descriptions. A listing of plant species identified from the vegetation plot samples and AA sites are provided in Appendix D: List of Plant Species.

Vegetation Mapping

Methods

Mapping vegetation of Cuyahoga Valley National Park (CUVA) involved five primary steps: (1) a vegetation primer combined with preliminary map classification, (2) field reconnaissance, (3) map classification, (4) photointerpretation, and (5) and database development. Although these steps occurred sequentially, they overlap to some degree.

Preliminary Map Classification

Prior to field reconnaissance, it is advantageous for mappers to become familiar with the vegetation types expected to occur in the park. To accomplish this, the mappers met with the classifier and reviewed the vegetation classification and key. During this meeting the mappers and classifier discussed each vegetation association, what defines it, where it occurs in the park, and which other associations it is likely to be confused with.

Using this information and personal experience, the mappers formed an initial map classification. Having a map classification with initial mapping conventions in hand, as preliminary as it might be, promotes continuity from the classifier to the mapper at the onset of the vegetation mapping process. Additionally, this preliminary step puts in the hands of the mappers the foundations of a working map classification, one that will undoubtedly go through many updates and revisions throughout the vegetation mapping process.

Field Reconnaissance

Field reconnaissance efforts were initiated to prepare for mapping vegetation types in CUVA. These efforts involved the mappers and classifier visiting the park and comparing, with the aid of weatherized field computers, the ground conditions, as determined by the key and the classifier, to their signatures (appearances) on the digital color infrared (CIR) aerial imagery set that was obtained for the CUVA vegetation mapping. This process is necessary, as Hershey and Befort (1995) explain, because CIR photography (or imagery) is not consistent enough between photo sets to allow a species to be depicted precisely. Sun angle, light intensity, shadow, exposure, and difference in digital post-capture processing can all affect image appearance. Additionally, differences in site history, hydrologic regime, intraspecific variation, and seasonality can all vary the appearance of a single species across a single image. Hence, ground exploration of the aerial imagery is a critical endeavor. Ultimately, the field reconnaissance effort helped correlate imagery signatures of the vegetation with the vegetation classification on the ground (Figure 21).

Field reconnaissance also allowed mappers to become more familiar with the local ecology of vegetation types, which is always important when applying ecologic concepts to mapping. Where mappers discovered limitations to interpreting vegetation types by using digital aerial imagery, environmental models were tested to determine if vegetation types could be consistently separated by environmental elements. In CUVA, the history of disturbance that pervades the park prevented models from being a reliable tool for photointerpretation.



Figure 21. Field reconnaissance to correlate aerial photo signatures with ground vegetation for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

The mappers and classifier performed field reconnaissance during 2011. The field efforts for mapping were done during three separate trips in 2011: one in mid-June, a second in late-July/early-August, and a third in mid-September. The mappers and classifier worked as a team, rather than as individuals, to ensure correct assessment of vegetation types and, subsequently, to promote correct classification during mapping. The team became familiar with the vegetation and local ecology as they discussed the structural, floristic, and habitat characteristics of the vegetation encountered in the field and compared the vegetation types to their appearance in the photos. Through this process, they built an understanding of how to map the vegetation types, established a working map classification with mapping protocols, and helped the classifier to refine the key to vegetation and vegetation classification. A majority of the landscape of CUVA was covered by the mappers during the field reconnaissance, and much variability in the vegetation types was found. In some cases, it was determined by the classifier that some vegetation types existed that had not been represented by the vegetation plots. These vegetation types were accordingly added to the vegetation and map classifications.

Orthoimagery mosaic sets of the CIR digital aerial imagery obtained for the CUVA vegetation mapping project allowed for easy in-field use resulting from their much smaller file sizes, while maintaining the majority of the imagery signature. This imagery was accessed using ArcMap in ArcGIS (Version 10.0, Environmental Systems Research Institute), which also allowed the

mapping team to digitally collect notes on vegetation and imagery signatures in the field. Field notes might consist of the map-class assignment, if known. Other notes, to promote proper perspective of species composition (e.g., heterogeneous versus monotypic forest stand), might include comments regarding significant species. In addition, estimated tree heights and cover densities were occasionally recorded to give a perspective for applying physiognomic height and density modifiers during mapping.

Verification

Between the second and third field reconnaissance efforts, preliminary mapping was performed on areas of the park with both familiar and novel signatures. During the third field reconnaissance effort the mappers and classifier visited 50 sites to verify that the mapping was correct, that the key functioned correctly, and to fix any issues in key, map classification, or mapping conventions.

Four separate locations were visited for map verification in CUVA. These locations were chosen in an attempt to cover the suite of vegetation types encountered across the park. The CIR digital aerial imagery from October 2010 was interpreted by the mappers, who applied the mapping conventions from the first and second field reconnaissance efforts for mapping.

Actual map verification sites were selected in the field during the third field reconnaissance effort. Figure 22 shows the locations of the individual map verification sites. The mappers and classifier collected coordinate location information using field computers equipped with global positioning system (GPS) in conjunction with the digital aerial imagery. The field key (a September 2011 draft) to the vegetation types of CUVA was used to determine the vegetation type of the area. The vegetation type was compared to the map class assigned by the mapper and a datasheet was completed for each verification point. For an example of a verification form, see Appendix E: Verification Form. These data were entered into a feature-class layer with relate tables and incorporated into the geodatabase for the CUVA vegetation mapping project. The field data were also imported into the NPS PLOTS Database Version 3.2 (Colorado Natural Heritage Program [CNHP] 2011) for the mapping project.

Map Classification

A map class represents a definable feature (e.g., a vegetation type, a non-vegetated feature, an anthropogenic area) that can be distinguished on a digital aerial image and/or by use of an environmental model. The set of map classes that represents all the mapped features defines the map classification. The map classification and protocols that define the mappable features are based on existing classification systems. For the CUVA vegetation mapping project, map classes representing natural/semi-natural vegetation types were linked to associations in the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008), as identified by NatureServe. Map classes representing agriculture and developed vegetation were linked to the cultural vegetation portion of the NVCS. For developed vegetation (e.g., roads, residences, parks), map classes were further described with the classification from the National Land Cover Database (NLCD) 2001 (Homer et al. 2004).[4] Map classes representing non-vegetation features (e.g., open water bodies, barren areas) correspond closely with the classification from NLCD 2001.

[4] The NLCD 2001 is a land cover database produced by the Multi-Resolution Land Characterization 2001 Consortium.

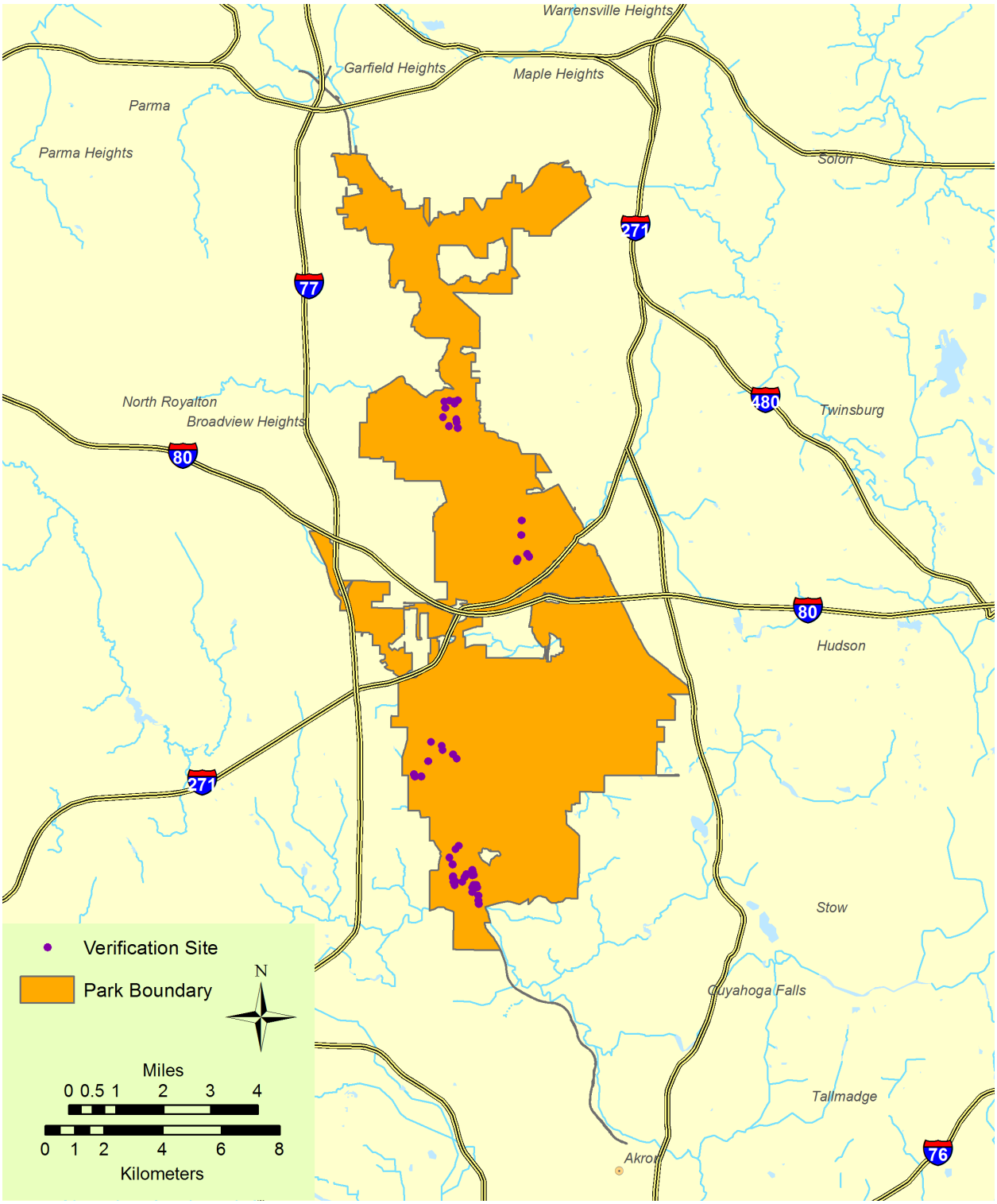


Figure 22. Locations of verification sites visited for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

After a draft of the map classification was developed, a "mapping tree" was created to facilitate the mapping process (Figure 23). The mapping tree is a diagram that divides the map classes into logical groups (e.g., Northern Hardwood Forest, Herbaceous Wetland, Shrub Dominated), then further divides the groups into subgroups (e.g., Grass Dominated, Agriculture, Oak Lowland / Wetland), with a final dichotomous tree of choices between the similar map classes in each subgroup. The choices in the mapping tree are meant to present the mappers with a limited and consistent set of options as they map, remind them of possible alternative map classes to consider, and show them the physiognomic modifier associated with each map class.

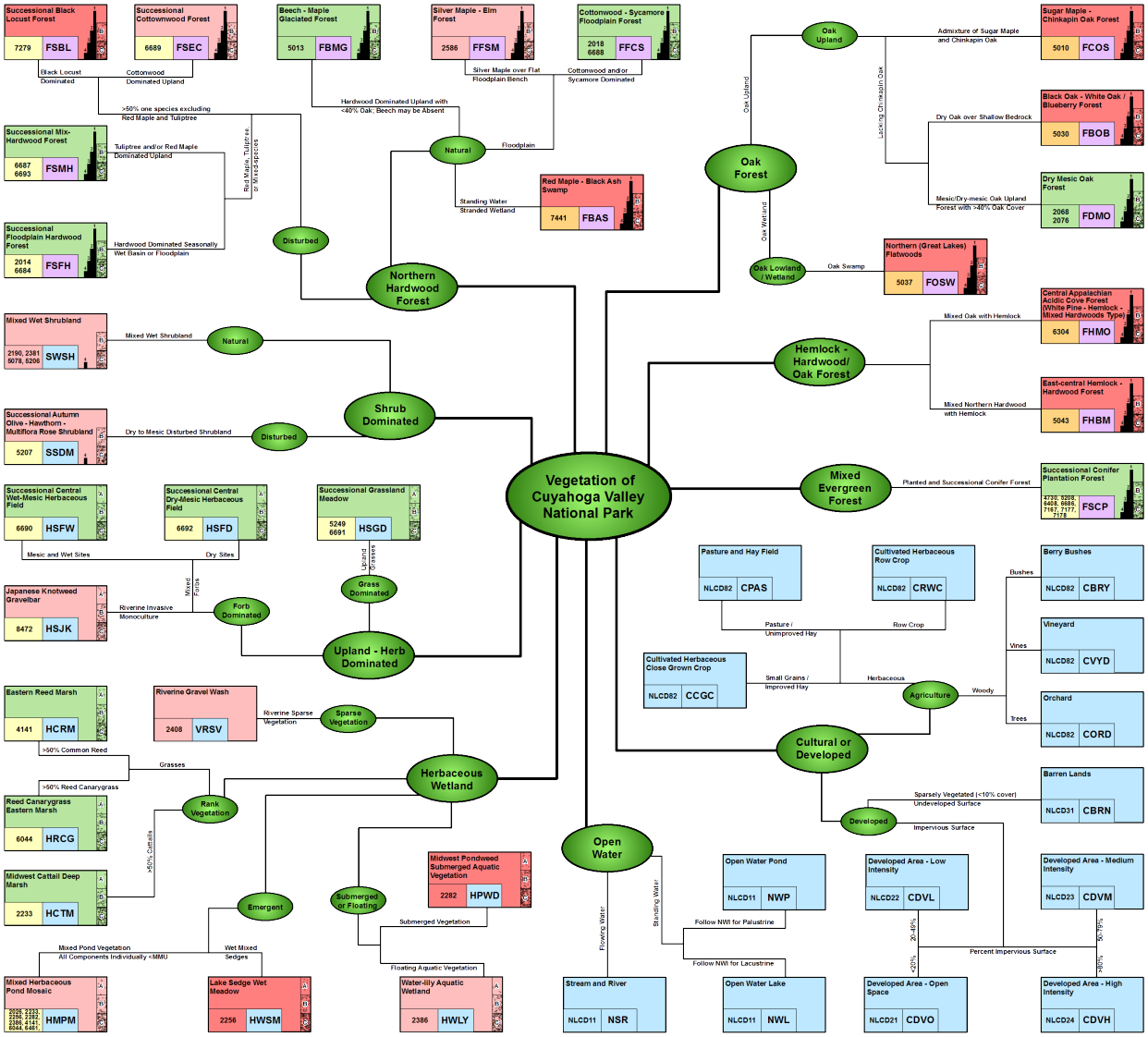


Figure 23. Vegetation mapping decision tree for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

For those map classes representing a single association in the NVCS, the association common name is used for the map-class name, as established in the classification database of NatureServe (e.g., Sugar Maple - Chinkapin Oak Forest). For those map classes representing more than one association type in the NVCS, a comparable name for the map class (e.g., the Cottonwood -

Sycamore Floodplain Forest map-class for the collective associations of Sycamore - Walnut Forest and the Midwestern Cottonwood - Black Willow Forest) was derived. For map classes representing non-vegetation features, generic names (e.g., Open Water Lake) were derived.

Throughout the project, the map classification remained fluid. Each field endeavor, including the accuracy assessment (AA) effort, revealed new information, prompting modification to the map classes and their definitions. Revisions were also made to the map classification as the vegetation classification matured. Furthermore, as aerial photos were interpreted, new issues arose, which forced redefinition, expansion, conjunction, or minor adjustment to map-class definitions. As individual map classes changed, these changes were consistently reapplied to areas that had already been mapped to ensure consistent mapping across the park.

A map-class code was derived for each map class for ease of assigning information to map polygons. A map-class code is made up of four alpha characters and represents an independent map class; each code begins with one of the following first alpha characters, which represent the major physiognomic characteristic:

- F = Forest (>25% tree cover),
- S = Shrubland (>25% shrub cover and <25% tree cover),
- H = Herbaceous Vegetation (>10% herbaceous cover and <25% tree and/or <25% shrub cover),
- V = Sparse Vegetation (vegetated are with <10% vegetation cover),
- C = Cultural (agricultural and developed landscapes), and
- N = Non-NVCS (open water).

The second character represents one of two scenarios: the first scenario is to denote a successional map-class with an “S”; the second scenario is to denote a significant term in the map-class name. The subsequent two or three alpha characters loosely represent the map-class name (e.g., FBOB for Black Oak - White Oak / Blueberry Forest, FSCP for Successional Conifer Plantation Forest, HCTM for Midwest Cattail Deep Marsh, CVYD for Vineyard).

Codes were also derived for physiognomic modifiers. These modifiers provide additional information describing physiognomic characteristics of vegetation within mapped polygons. The physiognomic modifiers used for the CUVA vegetation mapping project are listed in Table 12.

An example of codes assigned to a particular mapped polygon might be “FDMO” (map class), “C” (coverage-density modifier), and “2” (height modifier). The “FDMO” map-class code designates the polygon with the Dry-Mesic Oak Forest map class, which represents the *Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest Association (CEGL002068) and *Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest Association (CEGL002076) in the NVCS. The “C” modifier code indicates that the vegetation has a coverage density of 60–100%, and the “2” modifier code indicates that the average height of trees throughout the mapped polygon is 15–30 m. This series of map classification and physiognomic information can enhance the interpretation of the map layer for managers and researchers, particularly when other geospatial data sets are introduced.

Table 12. Physiognomic modifiers assigned to mapped polygons for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

[NVCS, National Vegetation Classification Standard]

Category	Modifier	Definition
Coverage density (Applied to map classes representing natural/semi-natural vegetation types in the NVCS*)	A	Dispersed-Sparse Canopy (10-25% cover)
	B	Open Canopy/Discontinuous (25-60% cover)
	C	Closed Canopy/Continuous (60-100% cover)
Height (Applied to map classes representing woody terrestrial natural/semi-natural vegetation types in the NVCS)	1	>30 m
	2	15-30 m
	3	5-15 m
	4	0.5-5 m

*Sparse vegetation types (those with <10% vegetation) do not receive a coverage density modifier.

Photointerpretation and Mapping

The vegetation mapping of CUVA was performed by mappers at the Upper Midwest Environmental Sciences Center (UMESC) using digital-onscreen three-dimensional (3D) mapping systems running geographic information system (GIS) software. The mapping team performed onscreen photointerpretation of digital imagery that was spatially referenced in GIS. The mapping tree was used to further assist the mapping process and enforce consistent application of the map classification. A draft version of the vegetation map—a spatial database layer—was then prepared for AA. The vegetation map was then adjusted according to the initial results from the analysis of the AA to meet accuracy criteria set by the National Park Service (NPS) Vegetation Inventory Program (VIP).

The digital aerial imagery used for the onscreen mapping was obtained on October 16, 2010, using a plane-mounted digital camera. (Refer to the Project Overview section in this report for more information on the digital aerial imagery collected for the CUVA vegetation mapping project.) Two individuals performed the mapping for the CUVA vegetation mapping project. They used systems that incorporated an active stereo method that uses special glasses to produce a 3D image on an LCD computer monitor. The glass uses a liquid crystal lens to turn on and off the view to each eye at 60 Hz (60 times per second) while the monitor switches images at 120 Hz. This allowed each eye to see a different and spatially offset image, thus providing the illusion of a 3D landscape on a flat computer screen. The stereo models were imported into Stereo Analyst for ArcGIS (ERDAS, Inc.) for 3D viewing and editing.

Mapping occurred from fall of 2011 to spring of 2012. Each mapper would map a single flight line and then give this draft work to the other mapper for quality assurance and quality control (QA/QC). The mapper conducting QA/QC would assess the draft work for errors in mapping and return it for review and modification. Areas with complex or confusing vegetation could be exchanged between mappers more than once. This ensured that all portions of CUVA were examined at least twice and by different individuals.

ArcGIS software was used as the GIS platform for the onscreen digital mapping. Because the 3D images were viewed directly in the GIS environment, vegetation could be mapped directly into

ArcGIS. The polygon vector data was stored using an ArcGIS file geodatabase, which was projected in in Universal Transverse Mercator (UTM), Zone 17, by using the North American Datum of 1983 (NAD83).

Standard image signature characteristics were applied—including texture, color, pattern, and position in the landscape—to guide placement of polygons during mapping. In addition to image signature characteristics, an understanding by the mappers of the environmental distribution of the vegetation types across the landscape helped them to identify types and properly place polygon boundaries. For each polygon, the appropriate codes for map classes and physiognomic modifiers were applied.

Numerous supplemental imagery and data sets were also used by the mappers to visualize and understand the landscape. These layers increased the mappers' ability to understand historical landscape change and use, determine wet and dry areas, and better visualize conifers, among other benefits. The supplemental imagery and data sets included digital aerial imagery and field data from the field reconnaissance efforts, vegetation plot and verification site data, the National Wetland Inventory (NWI) wetland delineation, a 1959 black-and-white 1:20,000-scale image for the Cuyahoga River watershed, and Ohio Statewide Imagery Program 2006 spring leaf-off imagery covering the Cuyahoga River watershed.

The standard minimum mapping unit (MMU) of 0.5 ha, set by the NPS VIP, was applied to the mapping of forest types. For shrub, herbaceous, and cultural types, as well as non-vegetation features, an MMU of 0.25 ha was applied. Also, when vegetation types were found unique to their immediate surroundings (e.g., perched herbaceous wetland in an otherwise contiguous forest), mapping below the MMU was allowed.

Map Layer Development

At this stage, the map layer would have only map-attribute codes assigned to each polygon. To assign meaningful information to each polygon (e.g., map-class names, modifier definitions, and links to NVCS types), a feature-class table and other supportive tables were produced, and ArcGIS was used to relate the tables of polygon information within a geodatabase. This geodatabase also links the map to other feature-class layers produced from this project, including vegetation sample plots, map verification sites, AA sites, aerial image locations, and project boundary extent. A geodatabase provides access to a variety of interlocking data sets, is expandable, and equips resource managers and researchers with a powerful GIS tool. All geospatial products are projected in UTM, Zone 17, by using the NAD83.

Results

Map Classes

After the AA analysis, 44 map classes, of which 29 are natural/semi-natural vegetation types in the NVCS, represent CUVA. At the time of mapping, 50 map classes existed for mapping the park, of which 37 map classes represented natural/semi-natural vegetation types in the NVCS. The AA study showed that several map classes had been confused with each other during the mapping process, those map classes had accuracy levels <80%, as set by the NPS VIP. Therefore, most of the map classes with low accuracies were merged with the map class(es) with which they were most often confused. Various reasons are recognized for the confusion between the map classes, including a breakdown of the mapping tree or ecological mapping conventions

and signatures that are inconsistent across and between map classes. Further details regarding this are provided in the AA section of this report and in individual map-class descriptions in Appendix F: Descriptions of Map Classes. These descriptions also explain the link between map classes and the types/units they represent. Ground photos showing representation of the map classes are provided where possible.

There are 29 map classes that represent 44 natural/semi-natural associations in the NVCS. From this vegetation mapping project, 45 associations in the NVCS were recognized for CUVA; 3 associations were not directly mapped within the park. Two of these three associations were not individually found at above an MMU and are represented by one map class that captures highly dynamic wetland systems. The remaining of association is not represented by any one map class, because it occurs below the MMU across the landscape and is otherwise integrated into the overarching map classes. Of the 29 map classes, 21 represent a single NVCS natural/semi-natural vegetation association (when it occurs above an MMU), and the remaining 8 represent 2 or more natural/semi-natural associations mapped together.

Ideally, the map classification would be presented in concert with the hierarchy of the NVCS, Version 2 (FGDC 2008). Yet because several map classes have association types that overarch logical hierarchical boundaries in the NVCS, it was not feasible to present the map classification in conjunction with the NVCS hierarchy. Instead, the map classification is presented primarily via an ad-hoc physiognomic and/or hydrologic presentation, and a crosswalk is provided to the vegetation types in the NVCS. Table 13 lists the map classification from a map class perspective. Further, to show how the map classes fit within the NVCS, Table 14 lists the map classes as they relate to the NVCS. Note, however, that map classes representing more than one vegetation type appear multiple times in Table 14.

Table 13. Map classification and crosswalk to vegetation types in the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Cuyahoga Valley National Park. Ohio vegetation mapping project.

Note: The bold headings within the table (above the map classes) are primarily ad-hoc physiognomic and/or hydrologic categories to help organize the map classes; this category system is an ad-hoc arrangement and not part of any recognized classification hierarchy; however, all map classes except for those under the Open Water category represent vegetation types within the National Vegetation Classification Standard.
[CEGL, Community Element Global; CEPS, Community Element Park Special; NVCS, National Vegetation Classification Standard]

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
Hemlock - Oak Forest			
FHMO - Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)			
	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)	*Liriodendron tulipifera* - *Pinus strobus* - *Tsuga canadensis* - *Quercus* (*rubra*, *alba*) / *Polystichum acrostichoides* Forest	CEGL006304
Oak - (Hardwood) Forest			
FBOB - Black Oak - White Oak / Blueberry Forest			
	Black Oak - White Oak / Blueberry Forest	*Quercus velutina* - *Quercus alba* / *Vaccinium* (*angustifolium*, *pallidum*) / *Carex pensylvanica* Forest	CEGL005030
FDMO - Dry-Mesic Oak Forest			
	Midwestern White Oak - Red Oak Forest	*Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest	CEGL002068
	Black Oak - White Oak - Hickory Forest	*Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest	CEGL002076
FCOS - Sugar Maple - Chinkapin Oak Forest			
	Sugar Maple - Chinkapin Oak Forest	*Acer saccharum* - *Quercus muehlenbergii* Forest	CEGL005010
Northern Hardwood Forest			
FBMG - Beech - Maple Glaciated Forest			
	Beech - Maple Glaciated Forest	F*agus grandifolia* - *Acer saccharum* Glaciated Midwest Forest	CEGL005013
Hemlock - Hardwood Forest			
FHBM - East-Central Hemlock - Hardwood Forest			
	East-Central Hemlock - Hardwood Forest	*Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest	CEGL005043
Successional Conifer - (Hardwood) Forest			
FSCP - Successional Conifer Plantation Forest			
	Norway Spruce Plantation	*Picea abies* Planted Forest	CEGL007167
	Larch Plantation	*Larix* (*laricina*, *decidua*) Planted Forest	CEGL006408
	Red Pine Plantation	*Pinus resinosa* Planted Forest	CEGL007177
	White Pine Plantation	*Pinus strobus* Planted Forest	CEGL007178
	Scotch Pine Plantation	*Pinus sylvestris* Planted Forest	CEGL006686
	Virginia Pine Plantation	*Pinus virginiana* Planted Forest	CEGL004730
	Conifer Plantation Breakup Forest	*Pinus* spp. - *Picea abies* - *Acer rubrum* - *Liriodendron tulipifera* Ruderal Forest	CEGL005208
Successional Hardwood Forest			
FSBL - Successional Black Locust Forest			
	Successional Black Locust Forest	*Robinia pseudoacacia* Semi-natural Forest	CEGL007279

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
FSMH - Successional Mixed Hardwood Forest			
	Successional Red Maple - Black Cherry Forest	*Acer rubrum* - *Prunus serotina* / *Rosa multiflora* Forest [Park Special]	CEPS006687
	Successional Tuliptree - Red Maple Forest	*Liriodendron tulipifera* - *Acer rubrum* - *Populus* spp. Forest [Park Special]	CEPS006693
FSEC - Successional Cottonwood Forest			
	Successional Cottonwood Forest	*Populus deltoides* Early-Successional Semi-natural Forest [Park Special]	CEPS006689
Bottomland Hardwood Forest			
FOSW - Northern (Great Lakes) Flatwoods			
	Northern (Great Lakes) Flatwoods	*Quercus palustris* - *Quercus bicolor* - *Acer rubrum* Flatwoods Forest	CEGL005037
FBAS - Red Maple - Black Ash Swamp			
	Red Maple - Black Ash Swamp	*Fraxinus nigra* - *Acer rubrum* / *Rhamnus alnifolia* / *Carex leptalea* Forest	CEGL007441
Riparian Hardwood Forest			
FFSM - Silver Maple - Elm Forest			
	Silver Maple - Elm Forest	*Acer saccharinum* - *Ulmus americana* Forest	CEGL002586
FFCS - Cottonwood - Sycamore Floodplain Forest			
	Sycamore - Walnut Forest	*Platanus occidentalis* - *Juglans nigra* - (*Fraxinus americana*) Forest [Park Special]	CEPS006688
	Midwestern Cottonwood - Black Willow Forest	*Populus deltoides* - *Salix nigra* Forest	CEGL002018
Successional Bottomland - Riparian Hardwood Forest			
FSFH - Successional Floodplain Hardwood Forest			
	Tuliptree - Elm - Ash Forest	*Liriodendron tulipifera* - *Ulmus* spp. - *Fraxinus pennsylvanica* Forest [Park Special]	CEPS006684
	Central Green Ash - Elm - Hackberry Forest	*Fraxinus pennsylvanica* - *Ulmus* spp. - *Celtis occidentalis* Forest	CEGL002014
Successional Shrub Field			
SSDM - Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland			
	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland	*Elaeagnus umbellata* - *Crataegus* spp. - *Rosa multiflora* Ruderal Shrubland	CEGL005207
Shrub Wetland			
SWSM - Mixed Wet Shrubland			
	Midwest Willow Sandbar Shrubland	*Salix interior* - *Salix eriocephala* Sandbar Shrubland	CEGL005078
	Gray Alder Swamp	*Alnus incana* Swamp Shrubland	CEGL002381
	Northern Buttonbush Swamp	*Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland	CEGL002190
	Dogwood - Willow - Wild Indigo Shrubland	*Cornus racemosa* - *Salix* spp. - *Baptisia australis* Shrubland	CEGL005206
Successional Herbaceous Field			
HSFD - Successional Central Dry-Mesic Herbaceous Field			
	Successional Central Dry-Mesic Herbaceous Field	*Daucus carota* - *Leucanthemum vulgare* Semi-natural Herbaceous Vegetation [Park Special]	CEPS006692

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
HSFW - Successional Central Wet-Mesic Herbaceous Field			
	Successional Central Wet-Mesic Herbaceous Field	*Impatiens capensis* - *Solidago* spp. - *Verbesina alternifolia* Semi-natural Herbaceous Vegetation [Park Special]	CEPS006690
HSGD - Successional Grassland Meadow			
	Timothy - Bluejoint Meadow	*Phleum pratense* - (*Calamagrostis canadensis*) Semi-Natural Herbaceous Vegetation	CEGL005249
	Restored Tallgrass Prairie	*Schizachyrium scoparium* - *Andropogon gerardii* - *Poa* spp. Semi-natural Herbaceous Vegetation [Park Special]	CEPS006691
Emergent Herbaceous Wetland			
HCTM - Midwest Cattail Deep Marsh			
	Midwest Cattail Deep Marsh	*Typha* spp. Midwest Herbaceous Vegetation	CEGL002233
HWSM - Lake Sedge Wet Meadow			
	Lake Sedge Wet Meadow	*Carex lacustris* Herbaceous Vegetation	CEGL002256
Successional Emergent Herbaceous Wetland			
HRCG - Reed Canarygrass Eastern Marsh			
	Reed Canarygrass Eastern Marsh	*Phalaris arundinacea* Eastern Herbaceous Vegetation	CEGL006044
HCRM - Eastern Reed Marsh			
	Eastern Reed Marsh	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation	CEGL004141
HSJK - Japanese Knotweed Gravelbar			
	Japanese Knotweed Gravelbar	*Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation	CEGL008472
Aquatic Herbaceous Wetland			
HWLY - Water-lily Aquatic Wetland			
	Water-lily Aquatic Wetland	*Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation	CEGL002386
HPWD - Midwest Pondweed Submerged Aquatic Wetland			
	Midwest Pondweed Submerged Aquatic Wetland	*Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation	CEGL002282
Herbaceous Wetland Mosaic			
HMPM - Mixed Herbaceous Pond Mosaic			
	Midwest Cattail Deep Marsh	*Typha* spp. Midwest Herbaceous Vegetation	CEGL002233
	Bulrush - Cattail - Bur-reed Shallow Marsh	*Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation	CEGL002026
	Lake Sedge Wet Meadow	*Carex lacustris* Herbaceous Vegetation	CEGL002256
	Central Appalachian Cutgrass Marsh	*Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation	CEGL006461
	Reed Canarygrass Eastern Marsh	*Phalaris arundinacea* Eastern Herbaceous Vegetation	CEGL006044
	Eastern Reed Marsh	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation	CEGL004141

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
	Water-lily Aquatic Wetland	*Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation	CEGL002386
	Midwest Pondweed Submerged Aquatic Wetland	*Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation	CEGL002282
River Scour Sparse Vegetation			
VRSV - Riverine Gravel Wash			
	Riverine Gravel Wash	Midwest Gravel Wash River Sparse Vegetation	CEGL002408
Cultural Agriculture			
CORD - Orchard			Cultural Class 7
CVYD - Vineyard			Cultural Class 7
CBRY - Berry Crop Field			Cultural Class 7
CCTF - Christmas Tree Farm			Cultural Class 7
CRWC - Cultivated Herbaceous Row Crop			Cultural Class 7
CCGC - Cultivated Herbaceous Close Grown Crop			Cultural Class 7
CPAS - Pasture and Hay Field			Cultural Class 7
Cultural Developed			
CDVO - Developed Area - Open Space			Cultural Class 8
CDVL - Developed Area - Low Intensity			Cultural Class 8
CDVM - Developed Area - Medium Intensity			Cultural Class 8
CDVH - Developed Area - High Intensity			Cultural Class 8
CBRN - Barren Land			Cultural Class 8
Open Water (Non-NVCS)			
NSR - Stream & River			Not applicable
NWL - Open Water Lake			Not applicable
NWP - Open Water Pond			Not applicable

Table 14. Map classification set into the hierarchy of the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Cuyahoga National Park (Ohio) vegetation mapping project.

[CEGL, Community Element Global; CEPS, Community Element Park Special; NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database]

Map-class Code	Map-class Name
1. FOREST TO OPEN WOODLAND CLASS	
1.B.2.Na. Eastern North American Cool Temperate Forest Division	
M502. Appalachian & Northeastern Oak - Hardwood & Pine Forest Macrogroup	
G015. Appalachian Oak - Chestnut Forest Group	
Quercus velutina - *Quercus alba* / *Vaccinium* (*angustifolium*, *pallidum*) / *Carex pensylvanica* Forest Association (CEGL005030)	
FBOB	Black Oak - White Oak / Blueberry Forest
G016. Northeastern Chinkapin Oak - Red-cedar Forest & Woodland Group	
Acer saccharum - *Quercus muehlenbergii* Forest Association (CEGL005010)	
FCOS	Sugar Maple - Chinkapin Oak Forest
M153. Central Mesophytic Hardwood Forest Macrogroup	
G021. North-Central Beech - Maple - Basswood Forest Group	
Fagus grandifolia - *Acer saccharum* Glaciated Midwest Forest Association (CEGL005013)	
FBMG	Beech - Maple Glaciated Forest
M013. Eastern North American Ruderal Forest & Plantation Macrogroup	
G032. Northern & Central Conifer & Hardwood Plantation Group	
Picea abies Planted Forest Association (CEGL007167)	
FSCP*	Successional Conifer Plantation Forest
Larix (*laricina*, *decidua*) Planted Forest Association (CEGL006408)	
FSCP*	Successional Conifer Plantation Forest
Pinus resinosa Planted Forest Association (CEGL007177)	
FSCP*	Successional Conifer Plantation Forest
Pinus strobus Planted Forest Association (CEGL007178)	
FSCP*	Successional Conifer Plantation Forest
Pinus sylvestris Planted Forest Association (CEGL006686)	
FSCP*	Successional Conifer Plantation Forest
Pinus virginiana Planted Forest Association (CEGL004730)	
FSCP*	Successional Conifer Plantation Forest
G030. Northern & Central Hardwood & Conifer Ruderal Forest Group	
Robinia pseudoacacia Semi-natural Forest Association (CEGL007279)	
FSBL	Successional Black Locust Forest
Acer rubrum - *Prunus serotina* / *Rosa multiflora* Forest Association [Park Special] (CEPS006687)	
FSMH*	Successional Mixed Hardwood Forest
Liriodendron tulipifera - *Acer rubrum* - *Populus* spp. Forest Association [Park Special] (CEPS006693)	
FSMH*	Successional Mixed Hardwood Forest
Liriodendron tulipifera - *Pinus strobus* - *Tsuga canadensis* - *Quercus* (*rubra*, *alba*) / *Polystichum acrostichoides* Forest Association (CEGL006304)	
FHMO	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)

Map-class Code	Map-class Name
Pinus spp. - *Picea abies* - *Acer rubrum* - *Liriodendron tulipifera* Ruderal Forest Association (CEGL005208)	
FSCP*	Successional Conifer Plantation Forest
M012. North-Central Oak - Hardwood & Pine Forest Macrogroup	
G649. North-Central Oak - Hickory Forest & Woodland Group	
Quercus alba - *Quercus rubra* - *Carya ovata* Glaciated Forest Association (CEGL002068)	
FDMO*	Dry-Mesic Oak Forest
Quercus velutina - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest Association (CEGL002076)	
FDMO*	Dry-Mesic Oak Forest
M014. Northern Mesic Hardwood & Conifer Forest Macrogroup	
G742. Southern & Central Appalachian Northern Hardwoods - Hemlock Forest Group	
Tsuga canadensis - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest Association (CEGL005043)	
FHBM	East-Central Hemlock - Hardwood Forest
1.B.3.Na. Eastern North American Flooded & Swamp Forest Division	
M503. Central & Appalachian Swamp Forest Macrogroup	
G597. Central Flatwoods & Pond Forest Group	
Quercus palustris - *Quercus bicolor* - *Acer rubrum* Flatwoods Forest Association (CEGL005037)	
FOSW	Northern (Great Lakes) Flatwoods
M302. Eastern North American Ruderal Flooded & Swamp Forest Macrogroup	
G552. Northern & Central Ruderal Flooded & Swamp Forest Group	
Liriodendron tulipifera - *Ulmus* spp. - *Fraxinus pennsylvanica* Forest Association [Park Special] (CEPS006684)	
FSFH*	Successional Floodplain Hardwood Forest
Platanus occidentalis - *Juglans nigra* - (*Fraxinus americana*) Forest Association [Park Special] (CEPS006688)	
FFCS*	Cottonwood - Sycamore Floodplain Forest
Populus deltoides Early-Successional Semi-natural Forest Association [Park Special] (CEPS006689)	
FSEC	Successional Cottonwood Forest
M029. Northern & Central Floodplain Forest & Scrub Macrogroup	
G041. Eastern Cottonwood - Black Willow Floodplain Forest Group	
Populus deltoides - *Salix nigra* Forest Association (CEGL002018)	
FFCS*	Cottonwood - Sycamore Floodplain Forest
G652. Silver Maple - Green Ash - Sycamore - Hackberry Floodplain Forest Group	
Acer saccharinum - *Ulmus americana* Forest Association (CEGL002586)	
FFSM	Silver Maple - Elm Forest
Fraxinus pennsylvanica - *Ulmus* spp. - *Celtis occidentalis* Forest Association (CEGL002014)	
FSFH*	Successional Floodplain Hardwood Forest
M504. Northern Swamp Forest Macrogroup	
G046. Northern Conifer & Hardwood Alkaline Swamp Group	
Fraxinus nigra - *Acer rubrum* / *Rhamnus alnifolia* / *Carex leptalea* Forest Association (CEGL007441)	
FBAS	Red Maple - Black Ash Swamp

Map-class Code	Map-class Name
2. SHRUBLAND & GRASSLAND CLASS	
2.B.2.Nc. Eastern North American Grassland, Meadow & Shrubland Division	
M123. Eastern North American Ruderal Shrubland & Grassland Macrogroup	
G059. Northern & Central Ruderal Meadow & Shrubland Group	
Daucus carota - Leucanthemum vulgare Semi-natural Herbaceous Vegetation Association [Park Special] (CEPS006692)	
HSFD	Successional Central Dry-Mesic Herbaceous Field
Elaeagnus umbellata - Crataegus spp. - *Rosa multiflora* Ruderal Shrubland Association (CEGL005207)	
SSDM	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland
Impatiens capensis - Solidago spp. - *Verbesina alternifolia* Semi-natural Herbaceous Vegetation Association [Park Special] (CEPS006690)	
HSFW	Successional Central Wet-Mesic Herbaceous Field
Phleum pratense - (*Calamagrostis canadensis*) Semi-Natural Herbaceous Vegetation Association (CEGL005249)	
HSGD*	Successional Grassland Meadow
Schizachyrium scoparium - Andropogon gerardii - Poa spp. Semi-natural Herbaceous Vegetation Association [Park Special] (CEPS006691)	
HSGD*	Successional Grassland Meadow
2.B.4.Na. Eastern North American Dune & Coastal Grassland & Shrubland Division	
M176. Eastern North American Lake & River Shoreline Vegetation Macrogroup	
G343. Eastern North American River Shoreline [Placeholder] Group	
Midwest Gravel Wash River Sparse Vegetation Association (CEGL002408)	
VRSV	Riverine Gravel Wash
G194. Northern & Central Riverscour Wetland Group	
Salix interior - Salix eriocephala Sandbar Shrubland Association (CEGL005078)	
SWSM*	Mixed Wet Shrubland
2.B.5.Na. North American Bog & Fen Division	
M061. Appalachian, Interior Plateau & Prairie Fen Macrogroup	
G183. North-Central Appalachian, Interior & Prairie Fen Group	
Symplocarpus foetidus Herbaceous Vegetation Association (CEGL002385)	
N/A	Skunk-cabbage Seepage Meadow
2.B.6.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh Division	
M303. Eastern North American Ruderal Wet Meadow & Marsh Macrogroup	
G556. Northern & Central Ruderal Wet Meadow & Marsh Group	
Phalaris arundinacea Eastern Herbaceous Vegetation Association (CEGL006044)	
HRCG / HMPM*	Reed Canarygrass Eastern Marsh / Mixed Herbaceous Pond Mosaic
Phragmites australis Eastern North America Temperate Semi-natural Herbaceous Vegetation Association (CEGL004141)	
HCRM / HMPM*	Eastern Reed Marsh / Mixed Herbaceous Pond Mosaic
Polygonum cuspidatum Temporarily Flooded Herbaceous Vegetation Association (CEGL008472)	
HSJK	Japanese Knotweed Gravelbar

Map-class Code	Map-class Name
M069. Eastern North American Wet Meadow & Marsh Macrogroup	
G125. Eastern North American Freshwater Marsh Group	
Schoenoplectus tabernaemontani - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026)	
N/A / HMPM*	Bulrush - Cattail - Bur-reed Shallow Marsh / Mixed Herbaceous Pond Mosaic
Typha spp. Midwest Herbaceous Vegetation Association (CEGL002233)	
HCTM / HMPM*	Midwest Cattail Deep Marsh / Mixed Herbaceous Pond Mosaic
G112. Eastern North American Wet Meadow Group	
Carex lacustris Herbaceous Vegetation Association (CEGL002256)	
HWSM / HMPM*	Lake Sedge Wet Meadow / Mixed Herbaceous Pond Mosaic
Cephalanthus occidentalis / *Carex* spp. Northern Shrubland Association (CEGL002190)	
SWSM*	Mixed Wet Shrubland
Leersia oryzoides - *Sagittaria latifolia* Herbaceous Vegetation Association (CEGL006461)	
N/A / HMPM*	Central Appalachian Cutgrass Marsh / Mixed Herbaceous Pond Mosaic
M160. Northern & Central Tall Shrub Wetland Macrogroup	
G167. Northern & Central Shrub Swamp Group	
Alnus incana Swamp Shrubland Association (CEGL002381)	
SWSM*	Mixed Wet Shrubland
Cornus racemosa - *Salix* spp. - *Baptisia australis* Shrubland Association (CEGL005206)	
SWSM*	Mixed Wet Shrubland
5. AQUATIC VEGETATION CLASS	
5.B.2.Na. North American Freshwater Aquatic Vegetation Division	
M108. Eastern North American Freshwater Aquatic Vegetation Macrogroup	
G114. Eastern North American Freshwater Aquatic Vegetation Group	
Nuphar advena - *Nymphaea odorata* Herbaceous Vegetation Association (CEGL002386)	
HWLY / HMPM*	Water-lily Aquatic Wetland / Mixed Herbaceous Pond Mosaic
Potamogeton spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282)	
HPWD / HMPM*	Midwest Pondweed Submerged Aquatic Wetland / Mixed Herbaceous Pond Mosaic
7. AGRICULTURAL VEGETATION CULTURAL CLASS (NLCD 2001; 82)	
Woody Agricultural Vegetation Subclass (L2)	
Woody Horticultural Crop Formation (L3)	
Orchard (tree) Subformation (L4)	
Fruit - Orchards Subgroup (L6)	
CORD	Orchard
Vineyard (vine) Subformation (L4)	
Vineyard Subgroup (L6)	
CVYD	Vineyard
Bush Fruit & Berries (shrub) Subformation (L4)	
Bush-fruit Subgroup (L6)	
CBRY	Berry Crop Field

Map-class Code	Map-class Name
Other Woody Farmland / Rural Vegetation Subformation (L4)	
Other Land In Farms Subgroup (L6)	
CCTF	Christmas Tree Farm
Herbaceous Agricultural Vegetation Subclass (L2)	
Cultivated Crop Formation (L3)	
Row Crop Subformation (L4)	
CRWC	Cultivated Herbaceous Row Crop
Close Grown Crop Subformation (L4)	
CCGC	Cultivated Herbaceous Close Grown Crop
Pasture / Hay Formation (L3)	
Permanent Pasture & Hayland Subformation (L4)	
CPAS	Pasture and Hay Field
8. DEVELOPED VEGETATION CULTURAL CLASS	
Herbaceous & Woody Developed Vegetation Cultural Subclass (L2)	
Other Developed Urban / Built Up Vegetation Formation (L3)	
Other Urban / Build Up Vegetation Subformation (L4)	
Developed Area (NLCD 2001; 21-24)	
CDVO	Developed Area - Open Space
CDVL	Developed Area - Low Intensity
CDVM	Developed Area - Medium Intensity
CDVH	Developed Area - High Intensity
Barren Land (NLCD 2001; 31)	
CBRN	Barren Land
NON-NVCS UNITS	
Non-Vegetated Land & Water (<1% vegetated)	
Non-Vegetated Land	
Non-Vegetated Water	
Open Water (NLCD 2001; 11)	
NSR	Stream & River
NWL	Open Water Lake
NWP	Open Water Pond

*Map class also represents other vegetation types.

Summary Report of the Map Layer

Table 15 provides a summary report of the spatial-data layer (vegetation map) by individual map class at the most detailed level of polygon attribution (map class with physiognomic modifiers). The table summarizes frequency, area, and average polygon size for each map class. Within the map layer, some polygons might be adjacent to each other and have the same map class, but not the same physiognomic modifiers (thus the polygons are unique to each other by physiognomy, but not by map class). If a summary table was produced of the map layer with the modifier detail simplified to the map classes, it would likely present slightly lower frequencies in number of polygons for some of the map classes as well as for the map layer in its entirety.

Table 15. Frequencies and areas of map classes at the most detailed level of physiognomic and special modifier attribution that are represented in the vegetation map layer for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Note: The bold headings within the table (above the map classes) are primarily ad-hoc physiognomic and/or hydrologic categories to help organize the map classes; this category system is an ad-hoc arrangement and not part of any recognized classification hierarchy; however, all map classes except for those under the Open Water category represent vegetation types within the National Vegetation Classification Standard.
[Freq, Frequency; Ha, Hectare; Ave, Average; NVCS, National Vegetation Classification Standard]

Map Class	Map-class Name	Freq	Area (Ha)	Ave (Ha)
Hemlock - Oak Forest				
FHMO	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)	3	2.7	0.9
Oak - (Hardwood) Forest				
FBOB	Black Oak - White Oak / Blueberry Forest	1	7.3	7.3
FDMO	Dry-Mesic Oak Forest	785	3,088.3	3.9
FCOS	Sugar Maple - Chinkapin Oak Forest	2	9.9	5.0
Northern Hardwood Forest				
FBMG	Beech - Maple Glaciated Forest	339	1570.8	4.6
Hemlock - Hardwood Forest				
FHBM	East-Central Hemlock - Hardwood Forest	17	28.7	1.7
Successional Conifer - (Hardwood) Forest				
FSCP	Successional Conifer Plantation Forest	259	378.8	1.5
Successional Hardwood Forest				
FSBL	Successional Black Locust Forest	7	7.9	1.1
FSMH	Successional Mixed Hardwood Forest	1,095	3,496.2	3.2
FSEC	Successional Cottonwood Forest	11	31.0	2.8
Bottomland Hardwood Forest				
FOSW	Northern (Great Lakes) Flatwoods	9	10.3	1.1
FBAS	Red Maple - Black Ash Swamp	1	0.8	0.8
Riparian Hardwood Forest				
FFSM	Silver Maple - Elm Forest	9	11.4	1.3
FFCS	Cottonwood - Sycamore Floodplain Forest	390	944.8	2.4
Successional Bottomland - Riparian Hardwood Forest				
FSFH	Successional Floodplain Hardwood Forest	117	299.8	2.6
Successional Shrub Field				
SSDM	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland	245	293.3	1.2
Shrub Wetland				
SWSM	Mixed Wet Shrubland	53	36.4	0.7
Successional Herbaceous Field				
HSFD	Successional Central Dry-Mesic Herbaceous Field	169	302.7	1.8
HSFW	Successional Central Wet-Mesic Herbaceous Field	134	160.7	1.2
HSGD	Successional Grassland Meadow	175	226.9	1.3

Map Class	Map-class Name	Freq	Area (Ha)	Ave (Ha)
Emergent Herbaceous Wetland				
HCTM	Midwest Cattail Deep Marsh	46	58.4	1.3
HWSM	Lake Sedge Wet Meadow	10	5.8	0.6
Successional Emergent Herbaceous Wetland				
HRCG	Reed Canarygrass Eastern Marsh	99	128.0	1.3
HCRM	Eastern Reed Marsh	51	36.1	0.7
HSJK	Japanese Knotweed Gravelbar	33	18.5	0.6
Aquatic Herbaceous Wetland				
HWLY	Water-lily Aquatic Wetland	6	7.1	1.2
HPWD	Midwest Pondweed Submerged Aquatic Wetland	16	14.6	0.9
Herbaceous Wetland Mosaic				
HMPM	Mixed Herbaceous Pond Mosaic	27	31.7	1.2
River Scour Sparse Vegetation				
VRSV	Riverine Gravel Wash	42	16.0	0.4
Cultural Agriculture				
CORD	Orchard	1	2.4	2.4
CVYD	Vineyard	1	2.4	2.4
CBRY	Berry Crop Field	1	2.1	2.1
CCTF	Christmas Tree Farm	1	8.0	8.0
CRWC	Cultivated Herbaceous Row Crop	40	159.3	4.0
CCGC	Cultivated Herbaceous Close Grown Crop	5	33.7	6.7
CPAS	Pasture and Hay Field	42	118.7	2.8
Cultural Developed				
CDVO	Developed Area - Open Space	150	506.3	3.4
CDVL	Developed Area - Low Intensity	120	664.6	5.5
CDVM	Developed Area - Medium Intensity	49	219.3	4.5
CDVH	Developed Area - High Intensity	21	88.2	4.2
CBRN	Barren Land	4	20.5	5.1
Open Water (Non-NVCS)				
NSR	Stream & River	14	193.8	13.8
NWL	Open Water Lake	1	8.6	8.6
NWP	Open Water Pond	39	35.3	0.9
	Totals	**4,640**	**13,288.4**	**2.9**

Brief Analysis and Discussion

Collectively the spatial-database layer (vegetation map) produced for the CUVA vegetation mapping project is composed of 4,640 polygons covering 13,288.4 ha, with an average polygon size of 2.9 ha. Map classes representing natural/semi-natural types in the NVCS apply to 89.4% of polygons (4,151 polygons; average size of 2.7 ha) and cover 84.5% of the park (11,225.0 ha). Further broken down, these natural/semi-natural types shows the park to be 74.4% forest (9,888.8 ha), 2.5% shrubland (329.7 ha), and 7.6% herbaceous cover (1,006.5 ha). Map classes representing cultural types in the NVCS apply to 9.4% of polygons (435 polygons; average size of 4.2 ha) and cover 13.7% of the park (1,825.7 ha). Map classes representing non-NVCS units

(open and flowing water) apply to 1.2% of polygons (54 polygons; average size of 4.4 ha) and cover 1.8% of the park (237.7 ha).

Overall, map classes representing successional forest types account for 32.1% (1,489) of the mapped polygons and 31.7% (4,213.7 ha) of the CUVA area, while map classes representing non-successional forest types account for 33.5% (1,556) of the polygons, but 42.7% (5,675.1 ha) of the park area. This demonstrates that non-successional forest is generally found in larger, more homogenous and contiguous blocks. These non-successional forest coverage figures also discount the value of large blocks of contiguous forest composed of numerous different non-successional map classes.

The major component of non-successional forest in CUVA falls into two map-classes: Dry-Mesic Oak Forest (FDMO) and Beech - Maple Glaciated Forest (FBMG). These two map classes dominate the landscape at 23.2% (3,088.3 ha) and 11.8% (1,570.8 ha) of the park area, respectively, and often intergrade as topography and soil changes the relative dominance of oaks to northern hardwoods and back. Additionally, non-successional floodplain forest is a major and important component of the park's landscape with the Cottonwood - Sycamore Floodplain Forest (FFCS) map class comprising 7.1% (944.8 ha) of the park.

The successional forest types are dominated by one map-class: Successional Mixed Hardwood Forest (FSMH). This map class covers 26.3% (3,496.2 ha) of CUVA and dominates the landscape in certain sections. This map class was originally two separate successional forest map classes that were condensed during AA when it was determined that the ecological overlap between the two map classes was insufficient to reliably map to NPS VIP standards. This map class is the most variable in the park resulting from the grouping of separate map classes, the inherent ecological variability of the NVCS associations within the map class, and the interaction of site history with the species in each polygon. Forest quality in this map class ranges from highly-disturbed forests comprised primarily of young monocultures of successional trees to 250+ year old mesophytic forests succeeding to non-successional types. This map class warrants further investigation by staff at the park as a primary target of active management and invasive species mitigation, noting that it cannot be treated as one homogenous forest.

The Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland (SSDM) map class covers 2.2% (293.3) of CUVA and is primarily composed of highly-invasive and non-native species. Active management of this map class with the intention of removing it from the landscape whenever possible should be a serious consideration. It should be noted, however, that this map class is also out-of-date and may over-represent the actual extent of SSDM within the park. Several areas of active eradication of SSDM were found during the 2011 field season, which were not evident on our 2010 imagery set. Because mapping protocol dictates that the park is mapped to the "date of imagery", areas mapped over sites with active eradication programs, such as the Terra Vista Natural Study Area, will not accurately reflect the more current ground conditions.

Taken individually, the nine herbaceous wetland map classes of CUVA each cover an insignificant area. However, these wetlands most often occur together and, when looked at in total, they cover 2.4% (316.2 ha) of the park. They also provide a disproportionate amount of ecological service to the park and surrounding community through groundwater recharge, runoff

attenuation, biological diversity, and critical habitat for a large number of plants and animals. Within this group of map classes a concerted effort should be made to fully integrate the extensive wetland dataset the park already maintains. Mapping the small-scale and dynamic nature of the wetlands within the park was beyond the mission and mandate of this project, but would be an excellent step forward as the map and other vegetation mapping products are grown forward.

Map Layer Presentation

Figure 24 presents the map layer produced for the CUVA vegetation mapping project. The finest level of the map (polygons consisting of map classes and physiognomic modifiers) is too detailed to present at a park-wide scale; therefore, the map in Figure 24 is generalized with map classes aggregated primarily into ad-hoc physiognomic and/or hydrologic categories. These categories are the same as the bolded categories provided in Table 13 and Table 15.

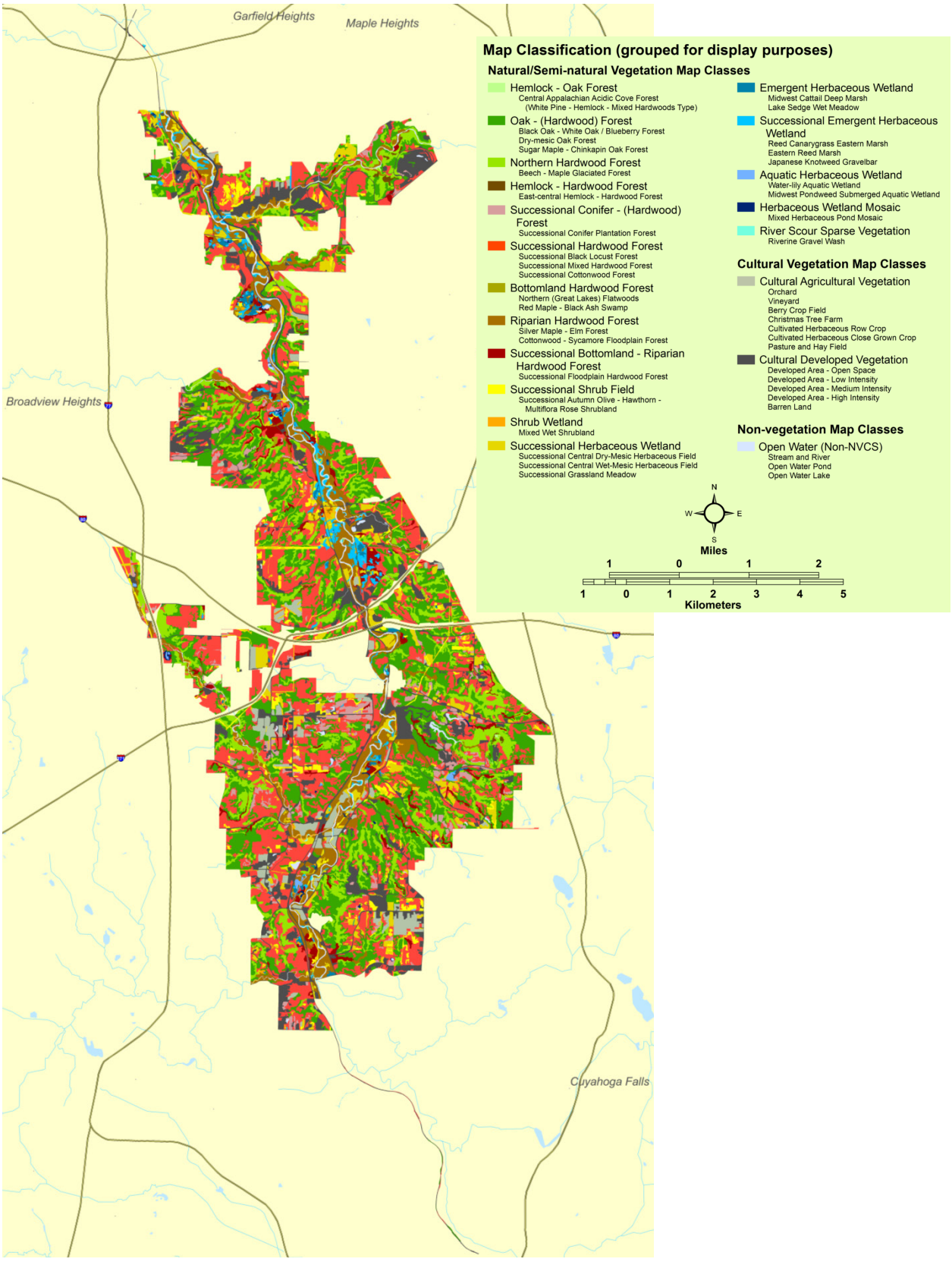


Figure 24. Vegetation of the Cuyahoga Valley National Park, Ohio.

Accuracy Assessment

Methods

Purpose

The objective of an accuracy assessment (AA) is to measure the probability that a particular location has been assigned its correct map class. An AA estimates thematic errors in the data, giving users the information needed to determine data suitability for a particular application. At the same time, data producers are able to learn more about the nature of errors in the data. Thus, the two views of an AA are "users' accuracy," which is the probability that the map actually represents what was found on the ground, and "producers' accuracy," which is the probability that an AA site has been mapped correctly. An error in mapping from a users' perspective is one of commission where a map class was mapped that did not exist at the site of assessment. An error in mapping from a producers' perspective is one of omission where a map class was not mapped that existed at the site of assessment. Both producers' and users' accuracies can be obtained from the same set of data by using different analyses. Errors occur when map classes are not the same as the classes observed in the field. A major assumption of AA is that the process of mapping and the process of the assessment (e.g., the application of the classification system) are identical, so that a "false error" is not detected because of procedural differences. In actuality, the process of AA is based on field observance, and the process of mapping is based on aerial photointerpretation with different perspectives of scale and observation.

Sampling Design

A stratified random sampling approach was used to select AA sites in Cuyahoga Valley National Park (CUVA). All locations within the park administrative boundary, excluding areas specified by park personnel (Figure 25), were included in the sampling design. All map classes representing natural/semi-natural vegetation types in the National Vegetation Classification Standard (NVCS) were included as the individual themes to randomly selected sites.

The number of samples needed for each map class (theme) was determined by using National Park Service (NPS) Vegetation Inventory Program (VIP) recommendations (Lea 2010), as suggested in the following scenarios.

- Scenario A: The class is abundant. It covers more than 50 ha in total area. The map class receives the maximum sample size of 30.
- Scenario B: The class is relatively abundant. It covers at least 8.33 ha but no more than 50 ha in total area. The map class receives a sample size of 0.6 observations per hectare of the map class (= one observation for every 1.67 ha of map class area). (This ratio allocates observations at a density rate equal to 30 observations per 50 ha).
- Scenario C: The class is relatively rare. It covers less than 8.33 ha in total area. The map class receives 5 observations (the recommended minimum sample size).

Each sampling site was buffered from the polygon boundary to ensure that the field classification of the observed area (a circular area approximately the size of the minimum mapping unit [MMU]) would not be confused with vegetation types represented in adjacent polygons. Confusion and error could have been attributed to several causes: (1) confusion as to whether the observation area was wholly contained within the map class, (2) positional error caused by global positioning system (GPS) error, and (3) allowable positional error included in

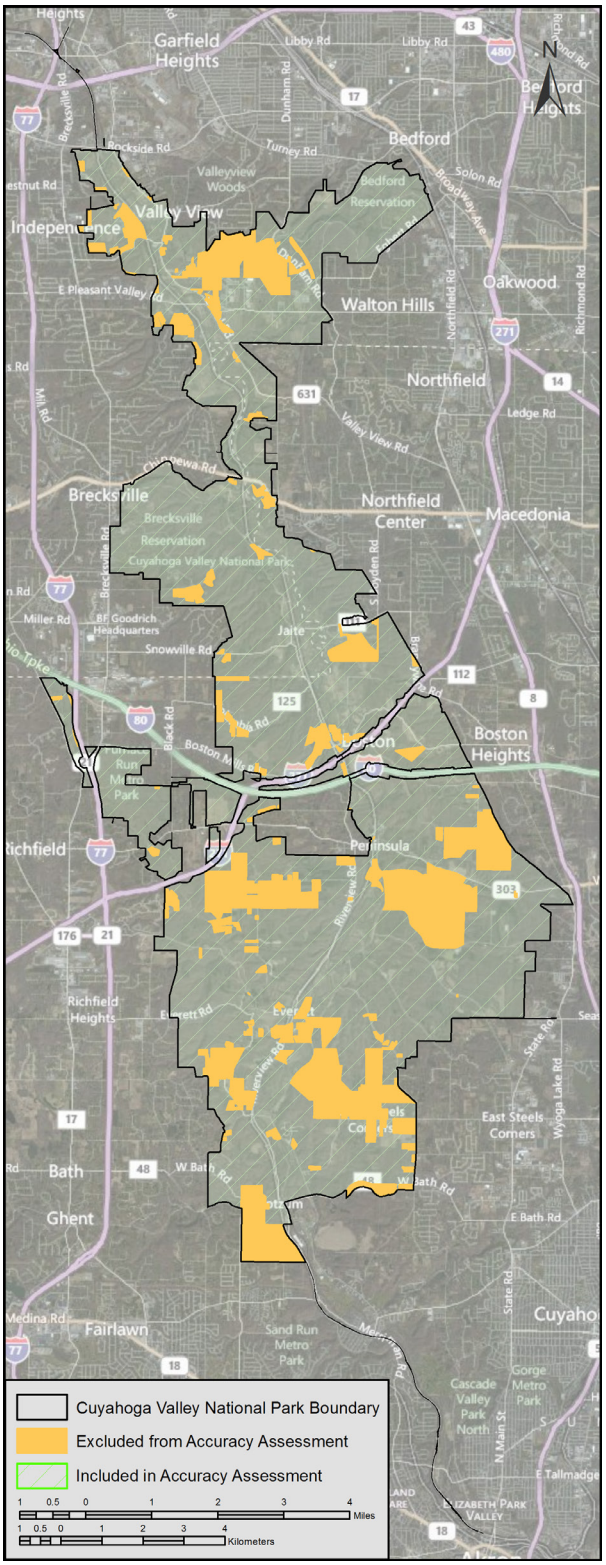


Figure 25. Areas included and excluded in the accuracy assessment field effort for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

the map data. The National Map Accuracy Standard requirement for positional accuracy of 1:24,000-scale products is 12.2 meters (FGDC 1998).

To calculate the required buffer distance, the square root of the sum squares of these error sources was calculated with the following formula:

$$\text{Buffer Distance} = \sqrt{R^2 + F^2 + M^2}$$

where R is the radius distance of the observation area, F is the expected (e.g., 90th percentile) GPS error distance, and M is the standard requirement (maximum positional error distance in the map) for positional accuracy.

The MMU that were used to map the park were 0.5 ha and 0.25 ha, depending on the map class. Given these MMU, the radius length of a circular area of 0.5 ha is 40 m and of 0.25 ha is 28 m; these represent the value of R. The value of F is generalized to 15 meters, and the value of M is generalized to 12 meters. Therefore, a buffer distance of either 44 m or 34 m (depending on the MMU designated for a particular map class) was applied to the interior polygon boundaries. For some map-class themes, because they were characteristically shaped as narrow and linear, the buffer needed to be reduced as the target number of AA sites could not otherwise be attained. This was done on a case-by-case basis. The buffer size was reduced incrementally until the target number of sites could be selected for a particular theme; this trial and error process promoted the maximum distance in buffer while still attaining the targeted number of sites.

Multiple observations in a polygon were possible, provided they did not overlap in area. In instances where the site selection process was not able to select sites

adequately distant from other vegetation polygons, because the vegetation type was in a very small or linear polygon, the hard-copy maps included boundary lines that marked the interpreted boundaries between two map classes alongside points demarking locations of the AA sites.

When the number of sites was determined and the buffer applied, random AA site locations were generated for each map class using Hawth's Tools for ArcGIS (Beyer 2004). These AA site coordinates were projected in the Universal Transverse Mercator, Zone 17, by using the North American Datum of 1983 and then provided to the field crews to upload into GPS receivers. The UMESC provided the field crews with 1:16,000-scale hard-copy maps displaying the locations of the AA sites overlaid on USGS digital raster graphics (DRG). Polygon boundaries were shown only for those areas that were unable to accommodate the required buffer distance.

Field Data Collection

Field observation data was collected by botanists hired for the season and trained in AA procedures by ecologists from NatureServe. Field crews navigated to the pre-selected AA sites using GPS and hard-copy maps. The field crews selected the appropriate vegetation class by using a field key (draft version of June 2012) to the vegetation types of CUVA. Field crews assessed a circular area approximately the size of the MMU (i.e., a circle with a 40 m radius for an MMU of 0.5 ha). It was important for the crews to do this assessment in a single vegetation type (i.e., not crossing into another vegetation type). In very narrow polygons (as indicated on the DRG maps with pink boundary lines), the field crews considered the location of the point in relation to polygon boundaries and gave more attention to vegetation occurring along the axis of the polygon.

Within the targeted assessment area, crews recorded field data, including the GPS coordinate location, dominant and indicator species, environmental data, and pertinent comments. (For an example of a field form, see Appendix G: Accuracy Assessment Form) The field key to vegetation types directed field crews to the vegetation association that best fit the AA site. When the association type was uncertain (e.g., a vegetation type that expressed a variation not supported by the key, an ecotone between two vegetation types), the crews still made a single "best call" but took extra notes on the circumstance. In several instances an "alternate field call" was recorded, thus providing a second vegetation type to classify a specific site. When two vegetation types were recognized, the crews were instructed to note the vegetation type that contained the most area within the radius of an MMU.

Data Analyses

Field data for 647 AA sites were collected and entered into the NPS PLOTS Database Version 2.0 (NatureServe 2005). It is worth noting that the AA data set was later converted to the PLOTS Database Version 3.2 (Colorado Natural Heritage Program [CNHP] 2011) for product delivery to the NPS VIP. Of the 647 AA collection sites, two were dropped due to GPS errors and, additionally, two others were dropped due to irresolvable mapping/field data conflicts. Thus, 643 AA sites were used in the analysis (Figure 26).

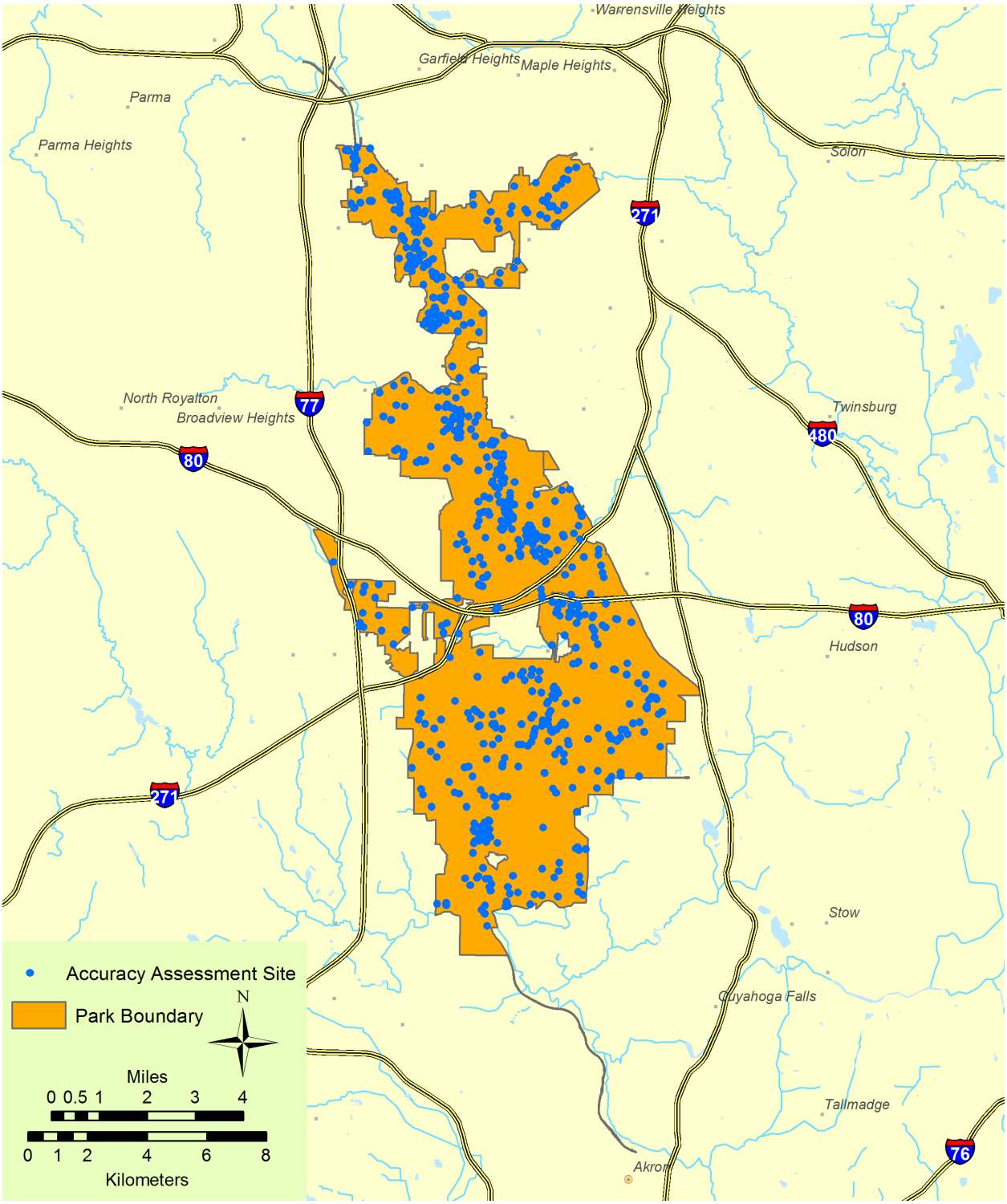


Figure 26. Locations of accuracy assessment sites used to validate the vegetation map layer for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

The database of AA site data was subsequently reviewed for data entry errors. The analysis of map accuracy included the following steps:

- Initial comparative analysis of the field and map data,
- Review of all disagreements and correction of false errors as necessary,
- Individual map-class analysis,
- Final output of results into a contingency matrix, and
- Final output of the analyses and results into a spatial database for use in a geographic information system (GIS).

Initial Comparative Analysis

A spatial join of the AA field-site data and the map-polygon data was prepared. This allowed each AA field-site call (vegetation type) and the corresponding map-polygon call (map class representing vegetation type) to be compared to each other. ArcGIS (Version 10.0, Environmental Systems Research Institute) was used to compare and tabulate the field-site call to the map-polygon call. The comparison accounted for alternate field calls indicated on the field data sheets by accepting map-polygon calls as correct when they matched the alternate calls. The initial comparison revealed that only 55% of the AA sites matched the corresponding polygons.

Review of Disagreements

All mismatches (disagreements) were subsequently reviewed for false errors. A false error is defined as a mismatch between the AA field-site call and the map-polygon call if the mismatch was caused by an accuracy error in the GPS field-site coordinates, by a missing or misapplied field-site call, or by a field-site assessment of an area smaller than the MMU (an inclusion). This review process involved using ArcGIS to locate and view the AA sites, and their corresponding polygons, on a computer screen by using digital aerial photography and Stereo Analyst (Version 11.0.3, Intergraph Corporation). The field data sheets were also reviewed to gain a fuller sense of the context of the ground data. From this process, it was determined whether an initial disagreement was either a true error or a false error, which would be a match. The following paragraphs explain the process further.

Spatial Error

A spatial error might occur in one of two of the following ways: (1) the GPS device acquired inaccurate field coordinates, or (2) a geospatial error existed within the vegetation map layer (called a "map-layer shift"). Either of these spatial errors could displace the newly acquired field coordinate to an adjacent polygon on the map layer. By selecting sites more than 10 m from polygon edges, we were able to minimize spatial errors in GPS coordinates, yet occasionally GPS accuracy could fall outside this parameter.

Questionable Field Call

A field assessment call might be questioned during the analysis, especially when the perspective from the ground was limited by poor vantage points, such as heavy vegetation cover or wet soils, thus preventing the field worker from walking around the MMU. If the MMU area was diverse, with more than one map class represented, it was possible to miss or not recognize other vegetation types present. These situations were reviewed by checking the aerial imagery for diversity at the site and by inspecting the field data sheets for possible problems.

Inclusion
The area assessed in the field during the AA might fall below the MMU for mapping and so be termed an inclusion. It was concluded in several instances where, after a review of the aerial imagery, the site in question contained vegetation that was an inclusion to the surrounding map class. Certain vegetation features were quite distinct from each other in the aerial imagery (e.g., open woodland versus dense forest), which thereby allowed easy assessment of site inclusions in the lab. An inclusion also occurred when an area in the field was a valid MMU, but the assessed area overlapped into an adjacent polygon. It was sometimes difficult to determine if the assessed area actually fell within the intended polygon, particularly in the case of smaller polygons adjacent to polygons with similar vegetation types.

Individual Map-class Analysis
Individual map-class accuracies that fell below standards of the NPS VIP were reviewed to determine which were in confusion with each other. If repeated confusion was evident, a decision needed to be made whether to merge the map classes to gain higher accuracy or to leave the map classes as they were, regardless if to do so would decrease accuracy. Certain map classes were left with lower accuracies, because the benefit was determined to be greater for separate map classes with lower accuracies than for merged map classes with higher accuracies. These decisions were made with input from staff at CUVA.

Final Output
The results of the final analyses were transferred into a contingency table (matrix), where percentages were calculated of users' and producers' accuracies for each map class. The matrix shows both the frequency of agreement and the placement of disagreements.

AA Spatial Database
For use in a GIS, a feature-class layer was produced of the AA site locations, as well as supporting tables, and the layer and tables were incorporated into the geodatabase for the CUVA vegetation mapping project. The field data for AA are also included in the PLOTS Database for the project.

Results
Of the 643 sites used in the analysis, the initial comparison revealed only 55% of the AA sites matched the corresponding polygons that represented natural/semi-natural vegetation types in the NVCS. Through the review process of correcting false errors and, subsequently, of combining some map classes because of low accuracies, the overall accuracy was eventually increased to 80.7%. A kappa adjustment for chance agreements resulted in an overall accuracy of 79.5%. The contingency matrix for the AA results is provided in Appendix H: Accuracy Assessment Contingency Table. The matrix shows the accuracy of each map class (along with 90% confidence intervals), with the users' accuracy reflecting errors of inclusion (commission errors) and the producers' accuracy reflecting errors of exclusion (omission errors). The width of each confidence interval has been affected by the sample size used to derive the point estimate.

The overall AA met the accuracy requirement of 80% established by the NPS VIP. The most important factors affecting accuracy were disagreements between mappers and field crews in percent-cover estimates of the strata; difficulties distinguishing swamp white oak from eastern cottonwood and/or black willow during the mapping; difficulties distinguishing oak species from

beech and maple species during the mapping; and failure to distinguish native herbaceous communities from ruderal/exotic herbaceous communities. In regard to cover estimates, past experience indicates that estimates in the field are generally lower than estimates from an aerial survey; thus some mismatches were from a result of two different perspectives.

Some individual map class accuracies did not meet the 80% requirement (taking into account 90% confidence intervals). In general, errors of omission (producers' accuracy) occurred in fewer map classes than did errors of commission (users' accuracy). The following are map classes for which the mapping project did not meet the required rates of accuracy, in terms of either the actual percentage or the confidence intervals.

Users' Accuracy (Errors of Commission)

The users' accuracy for the Northern (Great Lakes) Flatwoods (FOSW) map class was 33%, with a 90% confidence interval of -7–73%. Of the six polygons mapped as FOSW, four AA sites within those polygons were found to contain different vegetation types, with errors attributed as follows:

- Two Successional Mixed Hardwood Forest (FSMH) sites were mapped as FOSW, because eastern cottonwood (*Populus deltoides*) and black willow (*Salix nigra*) were misidentified in the tree canopy as swamp white oak (*Quercus bicolor*);
- Two Cottonwood - Sycamore Floodplain Forest (FFCS) sites were mapped as FOSW, because black cherry (*Prunus serotina*) and/or red maple (*Acer rubrum*) were misidentified in the tree canopy as Swamp White Oak.

Producers' Accuracy (Errors of Omission)

The producers' accuracy for the Beech - Maple Glaciated Forest (FBMG) map class was 64%, with a 90% confidence interval of 50–78%. Of the 39 AA sites classified in the field as FBMG, 14 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- Five polygons were mapped as Dry-Mesic Oak Forest (FDMO), because American beech (*Fagus grandifolia*) and/or red maple were misidentified in the tree canopy as oak species (*Quercus* spp.);
- One polygon was mapped as Sugar Maple - Chinkapin Oak Forest (FCOS), because American beech and/or red maple were misidentified in the tree canopy as oak species;
- One polygon was mapped as Successional Black Locust Forest (FSBL), because of a difference in interpreting the percent amount of black locust (*Robinia pseudoacacia*) present in the tree canopy;
- Five polygons were mapped as Successional Mixed Hardwood Forest (FSMH), because American beech and/or red maple were misidentified in the tree canopy as red maple and/or tuliptree (*Liriodendron tulipifera*);
- Two polygons were mapped as Successional Floodplain Hardwood Forest (FSFH), because sugar maple (*A. saccharum*), red maple and/or white ash (*Fraxinus americana*) were misidentified in the tree canopy as American elm (*Ulmus americana*), slippery elm (*U. rubra*), and/or tuliptree.

The producers' accuracy for the Successional Grassland Meadow (HSGD) map class was 65%, with a 90% confidence interval of 52–78%. Of the 43 AA sites classified as HSGD, 15 sites fell within polygons that were mapped as other vegetation types, with errors attributed as follows:

- Five polygons were mapped as Successional Central Dry-Mesic Herbaceous Field (HSFD), because native graminoid/herbaceous species were misidentified as ruderal or exotic species;
- Three polygons were mapped as Successional Central Wet-Mesic Herbaceous Field (HSFW), because native graminoid/herbaceous species were misidentified as ruderal or exotic species and because of a difference in interpreting upland versus wetland hydrology at the sites;
- One polygon was mapped as Lake Sedge Wet Meadow (HWSM), because of a difference in interpreting the percent amount of sedge species (*Carex* spp.) present at the site;
- Five polygons were mapped as Reed Canarygrass Eastern Marsh (HRCG), because of a difference in interpreting the percent amount of reed canarygrass (*Phalaris arundinacea*) present at the sites;
- One polygon was mapped as Eastern Reed Marsh (HCRM), because numerous hydrophytic vegetation types were misidentified as reed canarygrass at the site.

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Appendix A: Plot Sampling Form

NATIONAL PARK VEGETATION MAPPING PROGRAM: PLOT SURVEY FORM

IDENTIFIERS/LOCATORS

Plot Code__CUVA_____ Polygon Code_____

Provisional Community Name_____

State _OH_ Park Name__Cuyahoga Valley NP_____ Park Site Name_____

Quad Name_____ Quad Code_____

Waypoint_____ Field UTM X_ _ _ _ _ _ _ _ m E Field UTM Y_ _ _ _ _ _ _ _ m N

Zone_17_ Datum_____ Error +/-_____ m Elevation _____

Survey Date_____/2010 Surveyors_____

Directions to Plot:

Plot length ___ (m) Plot width ____ (m) Camera _____ # of images _____ Time of First Photo _____

Photos should be at 0, 90, 180, and 270 degrees from the center point and one or more "landscape" photos.

Plot representativeness: - Is the surrounding
~1 hectare area all the same? __yes ___no.
Please draw a map of plot here with plot shape,
where plot photos were taken, potential community
boundary breaks, and important landmarks.

ENVIRONMENTAL DESCRIPTION

Slope _____ (degrees) Aspect_____ (degrees)

Topographic Position

Cowardin System
___Upland
___Riverine
___Palustrine
___Lacustrine

Non-Tidal
___Permanently Flooded
___Semipermanetly Flooded
___Seasonally/Temporarily Flooded
___Saturated
___Seasonally Flooded/Saturated
___Intermittently Flooded

Water Depth
___ Meters

Environmental Comments:

Ground Surface: *(percent – total should equal 100%)*
___ Bedrock
___ Litter, duff
___ Wood (> 1 cm)
___ Large rocks (cobbles, boulders > 10 cm)
___ Small rocks (gravel, 0.2-10 cm)
___ Sand (0.1-2 mm)
___ Bare soil
___Plant Stems
___ Other:_____

PLOT Code: CUVA_____

Soil Texture	Soil Drainage
___ sand ___ loamy sand ___ sandy loam ___ loam	___ Rapidly drained ___ Somewhat rapidly drained
___ silt loam ___ silt ___ clay loam ___ silty clay	___ Moderately well drained ___ Well drained
___ silty clay loam ___ clay ___ peat ___ muck	___ Poorly drained ___ Somewhat poorly drained
	___ Very poorly drained

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	Height Scale for Strata		Cover Scale for Strata	
Trees and Shrubs			P		P	5%
___Evergreen	___Broad-leaved	___Forest	01	<0.5 m	01	10%
___Cold-deciduous	___Needle-leaved	___Woodland	02	0.5-1m	02	20%
___Drought-deciduous	___Microphyllous	___Shrubland	03	1-2 m	03	30%
___Mixed evergreen - cold-deciduous	___Graminoid	___Dwarf Shrubland	04	2-5 m	04	40%
	___Forb	___Herbaceous	05	5-10 m	05	50%
___Mixed evergreen - drought-deciduous	___Pteridophyte	___Nonvascular	06	10-15 m	06	60%
Herbs		___Sparsely Vegetated	07	15-20 m	07	70%
___Annual			08	20-35 m	08	80%
___Perennial			09	35 - 50 m	09	90%
			10	>50 m	10	100%

Strata	Height Class	Cover Class	Diagnostic species (if known)
T1 Emergent			
T2 Canopy			
T3 Sub-canopy			
S1 Tall shrub			
S2 Short Shrub			
S3 Dwarf-Shrub			
H Herbaceous			
A1 FltngLvdAquatic			
A2 Submrged Aquatic			
N Non-vascular			
V Vine/liana			

please see above table for height and cover scales

Animal Use Evidence

Natural and Anthropogenic Disturbance Comments

Comments

Plot Code_CUVA_____
Species/percent cover: List all species with cover class for each species in the stratum. On a separate line below each tree species, list the DBH of all trees above 10 cm diameter. Separate measurements with a comma.

Species Name	T1	T2	T3	S1	S2	S3	H	A1	A2	N

Strata: T1=Tree supercanopy (~2X height of main canopy), T2=Main Canopy: the main layer of tree canopy, composed of trees whose crowns from the upper predominant canopy, T3= trees greater than 5 m in height that do not reach the main canopy, S1=Tall Shrub: 2-5 m shrubs and saplings, S2=Short Shrub: 0.5-2 m shrubs, S3= Dwarf-shrubs: Shrubs that will never exceed <0.5 m, H=Herbaceous, A1=Floating-leaved aquatics, A2=Submergent aquatics, N=Nonvascular

Cover Scale for Species: T=<1%; P=1-5%; 01=5-15%; 02=15-25%; 03=25-35%; 04=35-45%; 05=45-55%; 06=55-65%; 07=65-75%; 08=75-85%; 09=85-95%; 10=>95%

Appendix B: Descriptions of Vegetation Types

U.S. NATIONAL VEGETATION CLASSIFICATION

Associations of
Cuyahoga Valley National Park

14 January 2013

by

NatureServe

1101 Wilson Blvd., 15th floor
Arlington, VA 22209

P.O. Box 9354
St. Paul, MN 55109

This subset of the International Ecological Classification Standard covers vegetation associations attributed to Cuyahoga Valley National Park. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC <mary_russo@natureserve.org> and Jim Drake, Regional Vegetation Ecologist, Minneapolis, MN <jim_drake@natureserve.org>.



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[1] NatureServe is an international organization including NatureServe regional offices, a NatureServe central office, U.S. State Natural Heritage Programs, and Conservation Data Centres (CDC) in Canada and Latin America and the Caribbean. Ecologists from the following organizations have contributed the development of the ecological systems classification:

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Central NatureServe Office, Arlington, VA; Eastern Regional Office, Boston, MA; Midwestern Regional Office, Minneapolis, MN; Southeastern Regional Office, Durham, NC; Western Regional Office, Boulder, CO; Alabama Natural Heritage Program, Montgomery AL; Alaska Natural Heritage Program, Anchorage, AK; Arizona Heritage Data Management Center, Phoenix AZ; Arkansas Natural Heritage Commission Little Rock, AR; Blue Ridge Parkway, Asheville, NC; California Natural Heritage Program, Sacramento, CA; Colorado Natural Heritage Program, Fort Collins, CO; Connecticut Natural Diversity Database, Hartford, CT; Delaware Natural Heritage Program, Smyrna, DE; District of Columbia Natural Heritage Program/National Capital Region Conservation Data Center, Washington DC; Florida Natural Areas Inventory, Tallahassee, FL; Georgia Natural Heritage Program, Social Circle, GA; Great Smoky Mountains National Park, Gatlinburg, TN; Gulf Islands National Seashore, Gulf Breeze, FL; Hawaii Natural Heritage Program, Honolulu, Hawaii; Idaho Conservation Data Center, Boise, ID; Illinois Natural Heritage Division/Illinois Natural Heritage Database Program, Springfield, IL; Indiana Natural Heritage Data Center, Indianapolis, IN; Iowa Natural Areas Inventory, Des Moines, IA; Kansas Natural Heritage Inventory, Lawrence, KS; Kentucky Natural Heritage Program, Frankfort, KY; Louisiana Natural Heritage Program, Baton Rouge, LA; Maine Natural Areas Program, Augusta, ME; Mammoth Cave National Park, Mammoth Cave, KY; Maryland Wildlife & Heritage Division, Annapolis, MD; Massachusetts Natural Heritage & Endangered Species Program, Westborough, MA; Michigan Natural Features Inventory, Lansing, MI; Minnesota Natural Heritage & Nongame Research and Minnesota County Biological Survey, St. Paul, MN; Mississippi Natural Heritage Program, Jackson, MI; Missouri Natural Heritage Database, Jefferson City, MO; Montana Natural Heritage Program, Helena, MT; National Forest in North Carolina, Asheville, NC; National Forests in Florida, Tallahassee, FL; National Park Service, Southeastern Regional Office, Atlanta, GA; Navajo Natural Heritage Program, Window Rock, AZ; Nebraska Natural Heritage Program, Lincoln, NE; Nevada Natural Heritage Program, Carson City, NV; New Hampshire Natural Heritage Inventory, Concord, NH; New Jersey Natural Heritage Program, Trenton, NJ; New Mexico Natural Heritage Program, Albuquerque , NM; New York Natural Heritage Program, Latham, NY; North Carolina Natural Heritage Program, Raleigh, NC; North Dakota Natural Heritage Inventory, Bismarck, ND; Ohio Natural Heritage Database, Columbus, OH; Oklahoma Natural Heritage Inventory, Norman, OK; Oregon Natural Heritage Program, Portland, OR; Pennsylvania Natural Diversity Inventory, PA; Rhode Island Natural Heritage Program, Providence, RI; South Carolina Heritage Trust, Columbia, SC; South Dakota Natural Heritage Data Base, Pierre, SD; Tennessee Division of Natural Heritage, Nashville, TN; Tennessee Valley Authority Heritage Program, Norris, TN; Texas Conservation Data Center, San Antonio, TX; Utah Natural Heritage Program, Salt Lake City, UT; Vermont Nongame & Natural Heritage Program, Waterbury, VT; Virginia Division of Natural Heritage, Richmond, VA; Washington Natural Heritage Program, Olympia, WA; West Virginia Natural Heritage Program, Elkins, WV; Wisconsin Natural Heritage Program, Madison, WI; Wyoming Natural Diversity Database, Laramie, WY

Canada
Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean
Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

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1. FOREST TO OPEN WOODLAND

1.B.2. Cool Temperate Forest

1.B.2.Na. Eastern North American Cool Temperate Forest

M502. Appalachian & Northeastern Oak - Hardwood & Pine Forest

G015. Appalachian Oak - Chestnut Forest

Black Oak - White Oak / Blueberry Forest
***Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest**
Black Oak - White Oak / (Lowbush Blueberry, Hillside Blueberry) / Pennsylvania Sedge Forest
Identifier: CEGL005030

ELEMENT CONCEPT

Global Summary: This black oak - white oak-dominated forest community is found in the southern Great Lakes region of the United States and Canada. Stands occur on sandy, relatively flat, dry-mesic sites. The tree canopy is typically closed, with greater than 80% cover. *Quercus velutina* (black oak) and *Quercus alba* (white oak) are the dominant species. The shrub layer contains *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry), at least in Ohio. The herbaceous layer can be strongly dominated by *Carex pensylvanica* (Pennsylvania sedge).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This white oak forest was sampled twice in the park. The sites had well-drained sand soil. The unvegetated surface is dominated by exposed bedrock, leaf litter and bare soil with trace downed wood. Evidence of disturbance includes heavy human use (trails, picnic area), possible mowing, and the presence of exotic species.
Global Environment: Soils are well-drained (water moves through readily, but not rapidly), sandy and free of mottling. Horizons may be brownish, yellowish, grayish, or reddish. The soils may be mottled deep in the C horizon or below depths of 0.6 m. Stands are limited to areas of sand deposits.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate canopy (50% cover), 20-35 m tall, is dominated by *Quercus alba* (white oak) and *Acer rubrum* (red maple); additional species found at low cover include *Betula alleghaniensis* (yellow birch) and *Tsuga canadensis* (eastern hemlock). Understory layers are very sparse. Trace shrubs include *Amelanchier arborea* (common serviceberry), *Cornus florida* (flowering dogwood), *Sassafras albidum* (sassafras), and dwarf-shrub *Vaccinium angustifolium* (lowbush blueberry). Herbs are absent.
Global Vegetation: The tree canopy is typically closed, with greater than 80% cover. *Quercus velutina* (black oak) and *Quercus alba* (white oak) are the dominant species. The shrub layer contains *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry), at least in Ohio. The herbaceous layer can be strongly dominated by *Carex pensylvanica* (Pennsylvania sedge) (White and Madany 1978, Anderson 1996).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Quercus alba* (white oak)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Acer rubrum* (red maple), *Quercus alba* (white oak)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate

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Cuyahoga Valley National Park Comments: This community was sampled on a sandstone ledge. This environment is not the same as that described for the global type; thus this association may not be the best placement for the sites at Cuyahoga Valley NP.
Global Comments: This type is found on sands, but tends to be dry-mesic, thereby increasing the relative contribution of *Quercus alba* (white oak) in the type. The concept is initially derived from Illinois' "dry-mesic sand forest" (White and Madany 1978), where it can be found in Mason County, and may occur in close proximity to pure *Quercus velutina* (black oak) stands, *Quercus velutina / Carex pensylvanica* Forest (CEGL002078), which may be on dry sand ridges. Type may be in northern Indiana on sand. This type may historically have had a more woodland structure. In Michigan, type may be equivalent to Manistee National Forest ecological land types ELTP 10, 11, 12, if not too far north (Cleland et al. 1994). In Ohio this type represents acid Oak Openings region forest.
Global Similar Associations:

- *Quercus (velutina, alba) / Vaccinium pallidum* High Allegheny Plateau, Western Allegheny Plateau Forest (CEGL006018)
- *Quercus coccinea - Quercus velutina / Sassafras albidum / Vaccinium pallidum* Forest (CEGL006375)
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462) is not as dry and is further north.
- *Quercus velutina - (Quercus alba) - Quercus ellipsoidalis / Schizachyrium scoparium - Lupinus perennis* Wooded Herbaceous Vegetation (CEGL002492) is the more open oak barrens type (including woodland physiognomy).
- *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076) is not typically found on sands, but is dry because of other substrate, topographic, or disturbance factors.
- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078) is more dry and scrubby.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at Kendall Ledges - Ledges Trail Overlook.
Global Range: This oak-dominated forest community is found in the southern Great Lakes region of the United States and Canada, ranging from the northern parts of Illinois and Indiana to Michigan, Ohio and Ontario.
Nations: CA, US
States/Provinces: IL:S2, IN, MI, OH, ON:S3
TNC Ecoregions: 36:C, 45:C, 48:C, 49:C
USFS Ecoregions (1994/95): 212Ht:PPP, 212Hu:PPP, 212Hw:PP?, 212Hx:PPP, 221Fa:CCC, 222Ig:CCC, 222Ja:CC?, 222Ji:CCC, 222Jj:CCC, 222Kj:CCC, 251Cf:CCC
Federal Lands: NPS (Cuyahoga Valley); USFS (Huron-Manistee, Huron?, Manistee)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FHMO
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (2 plots): CUVA.022, CUVA.199.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Anderson 1996, Chapman et al. 1989, Cleland et al. 1994, Homoya et al. 1988, Midwestern Ecology Working Group n.d., ONHD unpubl. data, White and Madany 1978

G016. Northeastern Chinkapin Oak - Red-cedar Forest & Woodland

Sugar Maple - Chinkapin Oak Forest

***Acer saccharum - Quercus muehlenbergii* Forest**
Sugar Maple - Chinkapin Oak Forest
Identifier: CEGL005010

ELEMENT CONCEPT

Global Summary: This dry-mesic forest community is found in the northeastern seaboard to the central United States and Canada on calcareous substrates. Stands occur on upper slopes or summits of limestone or marble ridges with dry soils. Limestone outcrops or boulders are often present. The tree canopy is typically dominated by *Quercus muehlenbergii* (chinkapin oak), the diagnostic species, and *Acer saccharum* (sugar maple), although relative percents vary widely. Oaks in general comprise at least 50% of the stand and sugar maple at least 20%. Other oak associates include *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and, locally, *Quercus shumardii* (Shumard oak). Other hardwoods include *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Fraxinus americana* (white ash), *Fraxinus quadrangulata* (blue ash), and *Tilia americana* (American basswood). *Betula* (birch) spp., *Pinus strobus* (eastern white pine), and *Prunus serotina* (black cherry) are occasional. Shrub and small tree species include *Amelanchier sanguinea* (roundleaf serviceberry), *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), *Cornus alternifolia* (alternateleaf dogwood), *Cornus florida* (flowering dogwood), *Cornus racemosa* (gray dogwood), *Diervilla lonicera* (northern bush honeysuckle), *Hamamelis virginiana* (American witch-hazel), *Hydrangea arborescens* (wild

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hydrangea), *Lindera benzoin* (northern spicebush), *Ostrya virginiana* (hophornbeam), *Ribes americanum* (American black currant), *Staphylea trifolia* (American bladdernut), *Viburnum prunifolium* (blackhaw), and *Zanthoxylum americanum* (common pricklyash). Sparse to well-developed herb layer includes *Asclepias quadrifolia* (fourleaf milkweed), *Carex eburnea* (bristleleaf sedge), *Carex platyphylla* (broadleaf sedge), *Clematis occidentalis* (western blue virginsbower), *Packera obovata* (roundleaf ragwort), *Phryma leptostachya* (American lopseed), *Sanicula marilandica* (Maryland sanicle), *Saxifraga virginiensis* (early saxifrage), *Arabis laevigata* (smooth rockcress), and *Triosteum aurantiacum* (orangefruit horse-gentian), among many others. This type is not well described across its range; often grades into woodland. Similar types include *Acer saccharum - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL006017) in unglaciated areas to the south.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community is found on a steep, south-facing hill with apparently base-rich soil. Bedrock outcrops are present but small and scattered.

Global Environment: Stands occur on upper slopes or summits of limestone or marble ridges with thin, dry soils. Limestone outcrops, boulders, or talus are often present.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The canopy of this forest is dominated by a mix of *Quercus muehlenbergii* (chinkapin oak), *Quercus alba* (white oak), and *Acer saccharum* (sugar maple). The shrub layer is moderate and contains *Sassafras albidum* (sassafras), *Lindera benzoin* (northern spicebush), *Cornus florida* (flowering dogwood), and *Carpinus caroliniana* (American hornbeam).

Global Vegetation: The tree canopy is typically dominated by *Quercus muehlenbergii* (chinkapin oak), the diagnostic species, and *Acer saccharum* (sugar maple), although relative percents vary widely. Oaks in general comprise at least 50% of the stand and sugar maple at least 20%. Other oak associates include *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and, locally, *Quercus shumardii* (Shumard oak). Other hardwoods include *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Fraxinus americana* (white ash), *Fraxinus quadrangulata* (blue ash), and *Tilia americana* (American basswood). *Betula* (birch) spp., *Pinus strobus* (eastern white pine), and *Prunus serotina* (black cherry) are occasional. Shrub and small tree species include *Amelanchier sanguinea* (roundleaf serviceberry), *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), *Cornus alternifolia* (alternateleaf dogwood), *Cornus florida* (flowering dogwood), *Cornus racemosa* (gray dogwood), *Diervilla lonicera* (northern bush honeysuckle), *Hamamelis virginiana* (American witch-hazel), *Hydrangea arborescens* (wild hydrangea), *Lindera benzoin* (northern spicebush), *Ostrya virginiana* (hophornbeam), *Ribes americanum* (American black currant), *Staphylea trifolia* (American bladdernut), *Viburnum prunifolium* (blackhaw), and *Zanthoxylum americanum* (common pricklyash). Sparse to well-developed herb layer includes *Asclepias quadrifolia* (fourleaf milkweed), *Carex eburnea* (bristleleaf sedge), *Carex platyphylla* (broadleaf sedge), *Clematis occidentalis* (western blue virginsbower), *Packera obovata* (roundleaf ragwort), *Phryma leptostachya* (American lopseed), *Sanicula marilandica* (Maryland sanicle), *Saxifraga virginiensis* (early saxifrage), *Arabis laevigata* (smooth rockcress), and *Triosteum aurantiacum* (orangefruit horse-gentian), among many others.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.

Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.

Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Oct-1996).

CLASSIFICATION

Status: Standard

Classification Confidence: 3 - Weak

Cuyahoga Valley National Park Comments: Information not available.

Global Comments: Anderson (1996) provides further references for Ohio. He notes that it occurs mainly in northern Ohio, where it is primarily a calcareous substrate type but can also represent a transition from oak stands around prairies to beech - maple forests. In Illinois, this type may have occurred as a mesic sand forest subtype, e.g., around Peoria, where both sugar maple and chinquapin oak are noted in the General Land Office (presettlement) Survey notes. Stands on thin soil over dolomite may overlap with limestone woodlands (e.g., in New York *Quercus alba - Quercus macrocarpa / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005121)). *Acer saccharum - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL006017) is a related type found in unglaciated areas to the south of this type.

Global Similar Associations:

- *Acer saccharum - Quercus muehlenbergii / Carex platyphylla* Forest (CEGL006162)

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- *Acer saccharum - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL006017)
- *Quercus alba - Quercus macrocarpa / Andropogon gerardii* Wooded Herbaceous Vegetation (CEGL005121)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community is found at one location in the park, on a slope just south of I-80 near Boston Mills Rd. It may occur elsewhere but is rare.
Global Range: This dry-mesic forest community is found in the north-central United States and adjacent Canada on calcareous substrates.
Nations: CA, US
States/Provinces: IL?, MI?, NY, OH, ON
TNC Ecoregions: 45:C, 48:C
USFS Ecoregions (1994/95): 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222I:CC, 231:C, M221:C
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FCOS
Cuyahoga Valley National Park Inventory Notes: This community was found during the photo reconnaissance stage and thus has no plots. It was visited during Accuracy Assessment, so there are data on dominants.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen, mod. L. Sneddon, mod. S.L. Neid
References: Anderson 1996, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, ONHD unpubl. data, White and Madany 1978

M153. Central Mesophytic Hardwood Forest

G021. North-Central Beech - Maple - Basswood Forest

Beech - Maple Glaciated Forest

***Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest**
American Beech - Sugar Maple Glaciated Midwest Forest
Identifier: CEGL005013

ELEMENT CONCEPT

Global Summary: This upland forest is found in the southern Great Lakes area of the United States and Canada. Stands occur on flat to rolling topography. In the southern parts of its range, it is more likely to be found on steeper slopes than in the northern portion. The soils are predominantly silt loam, loam, or sandy loam and develop over glacial till of Wisconsin age. The community is characterized by a dense to moderately dense canopy of deciduous trees, an absent to sparse shrub layer, and a moderately to well-developed herbaceous layer. The canopy is composed primarily of *Acer saccharum* (sugar maple) and *Fagus grandifolia* (American beech). *Liriodendron tulipifera* (tuliptree) is sometimes codominant, and *Carpinus caroliniana* (American hornbeam), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood), and *Ulmus americana* (American elm) are often present in the canopy or subcanopy. *Diervilla lonicera* (northern bush honeysuckle), *Euonymus obovatus* (running strawberry bush), *Lonicera canadensis* (American fly honeysuckle), *Sambucus racemosa var. racemosa* (red elderberry), and *Viburnum* (viburnum) spp. are typical shrubs. The herbaceous layer is often diverse, typically including spring ephemerals. Common species include *Arisaema triphyllum* (Jack in the pulpit), *Dryopteris intermedia* (intermediate woodfern), *Maianthemum canadense* (Canada mayflower) (in northern stands), *Maianthemum racemosum* (feathery false lily of the valley), *Osmorhiza claytonii* (Clayton's sweetroot), *Podophyllum peltatum* (mayapple), *Polygonatum biflorum* (smooth Solomon's seal), *Trillium grandiflorum* (white trillium), and *Viola* (violet) spp.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This beech-maple forest was sampled at 22 locations in the park. Sites range from gentle to steep slopes to lower flats and summits on any aspect. Soils are also variable but typically are moderately well- to well-drained silt loam but can also include silty clay, clay loam, loam and silt. The unvegetated surface is dominated by leaf litter, sometimes with substantial downed wood, and may include some large and small rocks and bare soil. Evidence of disturbance includes deer browse, erosion, and the presence of trails and exotic species.
Global Environment: This community is found on flat to rolling topography (Braun 1950, Pell and Mack 1977). In the southern parts of its range, it is more likely to be found on steeper slopes than in the northern portion (Braun 1950). The soils are predominantly

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silt loam, loam, or sandy loam and develop over glacial till of Wisconsin age (Braun 1950, Dodge and Harman 1985). This community was found to develop on sites with till 0.4-4.0 m thick in southern Michigan (Dodge and Harman 1985).

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The sparse to dense canopy (40-90% cover), 20-35 m tall, and very sparse to moderate (5-70%) subcanopy (10-15 m) are codominated by *Acer saccharum* (sugar maple) and *Fagus grandifolia* (American beech); additional common and/or abundant species may include *Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Magnolia acuminata* (cucumber-tree), and *Tilia americana* (American basswood). The very sparse to moderate (5-60%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers share the same dominants as the canopy. *Lindera benzoin* (northern spicebush), *Ostrya virginiana* (hophornbeam), and *Viburnum acerifolium* (mapleleaf viburnum) are the most common and abundant shrubs. Native herbs include *Allium tricoccum* (ramp), *Arisaema triphyllum* (Jack in the pulpit), *Carex albursina* (white bear sedge), *Caulophyllum thalictroides* (blue cohosh), *Circaea lutetiana* (broadleaf enchanter's nightshade), *Mitchella repens* (partridgeberry), *Parthenocissus quinquefolia* (Virginia creeper), *Podophyllum peltatum* (mayapple), *Polygonatum biflorum* (smooth Solomon's seal), *Polystichum acrostichoides* (Christmas fern), and *Viola canadensis* (Canadian white violet). In addition, this community supports Ohio state-critically imperiled *Galium labradoricum* (northern bog bedstraw) and state-imperiled *Ophioglossum engelmannii* (limestone adderstongue).

Global Vegetation: This community is characterized by a dense to moderately dense canopy of deciduous trees, an absent to sparse shrub layer, and a moderately to well-developed herbaceous layer. The canopy formed by the overstory trees and smaller saplings greatly reduces the amount of light that reaches lower vegetation strata. This canopy is composed primarily of *Acer saccharum* (sugar maple) and *Fagus grandifolia* (American beech). *Liriodendron tulipifera* (tuliptree) is sometimes codominant and *Carpinus caroliniana* (American hornbeam), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood), and *Ulmus americana* (American elm) are often present in the canopy or subcanopy. *Diervilla lonicera* (northern bush honeysuckle), *Euonymus obovatus* (running strawberry bush), *Lonicera canadensis* (American fly honeysuckle), *Sambucus racemosa var. racemosa* (red elderberry), and *Viburnum* (viburnum) spp. are typical shrubs. The herbaceous layer is often diverse, typically including spring ephemerals. Common species include *Arisaema triphyllum* (Jack in the pulpit), *Dryopteris intermedia* (intermediate woodfern), *Maianthemum canadense* (Canada mayflower) (in northern stands), *Maianthemum racemosum* (feathery false lily of the valley), *Osmorhiza claytonii* (Clayton's sweetroot), *Podophyllum peltatum* (mayapple), *Polygonatum biflorum* (smooth Solomon's seal), *Trillium grandiflorum* (white trillium), and *Viola* (violet) spp.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit), *Fagus grandifolia* (American beech), *Lindera benzoin* (northern spicebush), *Podophyllum peltatum* (mayapple), *Polystichum acrostichoides* (Christmas fern), *Viburnum acerifolium* (mapleleaf viburnum), *Viola canadensis* (Canadian white violet)

Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Galium labradoricum* (northern bog bedstraw, Ohio state-critically imperiled, G5), *Ophioglossum engelmannii* (limestone adderstongue, Ohio state-imperiled, G5), *Phegopteris connectilis* (long beechfern, Ohio state-vulnerable, G5); **Invasive/Exotic**: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)

Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (13-Nov-2006). There have been 155 occurrences documented: 3 in Illinois (where the community is ranked S4) (but beech-maple is only a small part of the Illinois type to which this global type is crosswalked), 86 in Indiana (S3), 36 in Michigan (S3), and 30 in Ohio (S3). Although no other occurrences have been documented, the community is also reported in Ontario and New York. Sizes of 129 occurrences total 8895 acres. This type was once a widespread matrix forest that now occupies small remnants, often less than 500 acres in size.

CLASSIFICATION

Status: Standard

Classification Confidence: 1 - Strong

Cuyahoga Valley National Park Comments: Information not available.

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Global Comments: Wisconsin glaciation history is used to define the southern limits of this type, and further work is needed to determine how floristically distinct these glaciated stands are from southern unglaciated stands, which are placed in *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411). *Liriodendron tulipifera* (tuliptree) and other southern hardwoods, such as *Liquidambar styraciflua* (sweetgum), are much less constant in this type compared to the unglaciated stands, as is, perhaps, *Asimina triloba* (pawpaw). Northward *Betula alleghaniensis* (yellow birch) and *Betula papyrifera* (paper birch) are very infrequent compared to *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* (Canada mayflower) Forest (CEGL005004). In New York and Pennsylvania this type may cover both the glaciated lake till plain and perhaps some parts of the glaciated Allegheny Plateau, consistent with its distribution in Ohio. Arguing for this is the low dominance to absence of *Liriodendron tulipifera* (tuliptree), low dominance of *Betula* (birch) spp., and the high dominance of *Tilia americana* (American basswood). On the other hand, the presence of *Betula lenta* (sweet birch), and perhaps that of *Tsuga canadensis* (eastern hemlock), in that region are somewhat unusual for this type, indicating the more Allegheny influence. And the inclusion of both glaciated till plain and plateau habitats in the type would broaden the environmental parameters. This type may be in east-central Illinois (Vermillion County, near Danville), but is largely extirpated (B. McClain pers. comm. 1999). Stands still occur across the stateline in Indiana.

Global Similar Associations:

- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004)
- *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411)
- *Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest (CEGL006296)
- *Quercus alba - Fagus grandifolia* Western Allegheny Plateau Forest (CEGL006144)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This common community was sampled along Bridle Trail, Buckeye Trail and Ebbert Loop Trail at Bedford Reservation, at Blue Hen Falls and O'Neil Woods, along Boston Mills Road, and along Everett-Perkins Trail, Furnace Run, Langes Run, Octagon Forest Point Trail, Tree Farm Trail, and Wetmore Trail.

Global Range: This upland forest is found in the southern Great Lakes area of the United States and Canada, ranging from Illinois, Indiana, and Michigan, east to Ontario and western New York. Range extent is minimally estimated at 70,000 square km and may extend over 200,000 square km.

Nations: CA, US

States/Provinces: IL, IN, MI:S3, NY, OH, ON

TNC Ecoregions: 36:C, 44:C, 45:C, 48:C, 49:C, 61:C

USFS Ecoregions (1994/95): 212Fa:PP?, 212Fb:PPP, 221Bc:CCC, 221Ef:CCC, 221Fa:CCC, 221Fb:CCC, 221Fc:CCC, 222De:CCC, 222Ga:CCC, 222Gc:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hd:CCC, 222Hf:CCC, 222Ia:CCC, 222Ib:CCC, 222Ic:CC?, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jc:CCC, 222Jd:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kj:CCC, 251De:CCC

Federal Lands: NPS (Cuyahoga Valley, Indiana Dunes, Saratoga); USFS (Finger Lakes); USFWS (Iroquois)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FBMG

Cuyahoga Valley National Park Inventory Notes: Information not available.

Cuyahoga Valley National Park Plots and Observation Points: (22 plots): CUVA.7, CUVA.12, CUVA.21, CUVA.60, CUVA.63, CUVA.69, CUVA.73, CUVA.89, CUVA.98, CUVA.99, CUVA.106, CUVA.108, CUVA.114, CUVA.122, CUVA.132, CUVA.142, CUVA.146, CUVA.148, CUVA.150, CUVA.196, CUVA.201, CUVA.218.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake

References: Braun 1950, Cain 1935, Chapman et al. 1989, Crumpacker et al. 1988, Dodge and Harman 1985, Edinger et al. 2002, Edinger et al. 2007, Homoya et al. 1988, Hop et al. 2009, Kost et al. 2007, Kuchler 1964, Midwestern Ecology Working Group n.d., NRCS 2004a, ONHD unpubl. data, Pell and Mack 1977, White and Madany 1978

M013. Eastern North American Ruderal Forest & Plantation

G032. Northern & Central Conifer & Hardwood Plantation

Norway Spruce Plantation

***Picea abies* Planted Forest**

Norway Spruce Planted Forest

Identifier: CEGL007167

ELEMENT CONCEPT

Global Summary: These plantation forests are dominated by the exotic species *Picea abies* (Norway spruce), which makes up 70-100% of the canopy. The understory is typically sparse with little, if any, spruce regeneration. Hardwood regeneration and herbaceous species composition tend to reflect the pre-plantation forest types. In the Southeast this occurs as experimental plantations.

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ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Norway spruce plantation was sampled twice in the park. The sites are gently sloping mid- and toeslopes, one with well-drained silt loam soil and the other with somewhat poorly drained clay soil. The unvegetated surface is dominated by leaf litter, sometimes with substantial downed wood. Evidence of disturbance includes managed tree plantings and the presence of trails and exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The dense canopy (70-80% cover), 20-35 m tall, is dominated by *Picea abies* (Norway spruce); additional species found at low cover include *Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Populus grandidentata* (bigtooth aspen), *Prunus serotina* (black cherry), and *Ulmus americana* (American elm). Understory layers are sparse. Shrubs include *Lindera benzoin* (northern spicebush) and *Rhamnus cathartica* (common buckthorn). The herb layer is nearly absent.
Global Vegetation: These plantation forests are dominated by the exotic species *Picea abies* (Norway spruce), which makes up 70-100% of the canopy. The understory is typically sparse with little, if any, spruce regeneration. Hardwood regeneration and herbaceous species composition tend to reflect the pre-plantation forest types.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea abies* (Norway spruce)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea abies* (Norway spruce)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Picea abies* (Norway spruce)
Global: *Picea abies* (Norway spruce)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Picea abies* (Norway spruce, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Solanum dulcamara* (climbing nightshade, invasive/exotic, Low)
Global: Invasive/Exotic: *Picea abies* (Norway spruce, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) (8-Aug-2000). This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Samples were taken at along the Chestnut Pond Plateau Trail near the Valley Picnic Area and along Tree Farm Trail.
Global Range: Information not available.
Nations: US
States/Provinces: DE, ME, NC, NJ, NY, OH, PA, VA?, VT
TNC Ecoregions: 48:C, 49:C, 51:?, 61:C, 62:C, 63:C
USFS Ecoregions (1994/95): 212Ab:CCC, 221Ae:CCC, 221Bc:CCC, 221Fa:CCC, 222Ib:CCC, 232Ac:CCC, M212Ba:CCC, M221D:PP
Federal Lands: NPS (Appalachian Trail [Lower New England], Appalachian Trail [Northern Appalachians], C&O Canal, Cuyahoga Valley, George Washington Parkway, Great Smoky Mountains?, Marsh-Billings-Rockefeller, Saratoga); USFWS (Aroostook, Erie, Iroquois, Supawna Meadows)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSCP
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (2 plots): CUVA.39, CUVA.68.

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Local Description Authors: M.J. Russo
Global Description Authors: S.C. Gawler
References: Allard 1990, Coxe 2009, Edinger et al. 2002, Edinger et al. 2007, NRCS 2004a, Southeastern Ecology Working Group n.d.

Larch Plantation

***Larix (laricina, decidua)* Planted Forest**
(Tamarack, European Larch) Planted Forest
Identifier: CEGL006408

ELEMENT CONCEPT

Global Summary: These planted forests are dominated by the European *Larix decidua* (European larch) or the native *Larix laricina* (tamarack), often in monoculture. They typically occur in small patches, often on abandoned agricultural or cleared lands. Understory species vary with geography and site history. In Vermont, for example, the indigenous northern hardwoods *Acer saccharum* (sugar maple) and *Fraxinus americana* (white ash) form an understory. Shrub and ground layers are poorly developed.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: The only site at which this community was observed was a small, generally flat area near a stream. The ground was covered in needles with significant woody litter, as well.
Global Environment: These plantations typically occur in small patches, often on abandoned agricultural or cleared lands in a variety of environmental settings.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The canopy is dense and dominated by *Larix decidua* (European larch) planted in rows. Few other canopy trees are present. The understory is sparse.
Global Vegetation: These planted forests are dominated by the European *Larix decidua* (European larch) or the native *Larix laricina* (tamarack), often in monoculture. Understory species vary with geography and site history. In Vermont, for example, the indigenous northern hardwoods *Acer saccharum* (sugar maple) and *Fraxinus americana* (white ash) form an understory. Shrub and ground layers are poorly developed.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Larix decidua* (European larch)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Larix decidua* (European larch)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: *Larix decidua* (European larch), *Larix laricina* (tamarack)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Invasive/Exotic: *Larix decidua* (European larch, invasive/exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) (6-Dec-2005). This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: The range of this association is not well-documented, but scattered locations have been observed throughout most of New England, New York and Pennsylvania.
Nations: US

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States/Provinces: ME, NY, OH, PA, VT
TNC Ecoregions: 60:C, 63:C
USFS Ecoregions (1994/95): 212C:CC, 212D:CC, 212Fc:CCC, M212Ba:CCC
Federal Lands: NPS (Cuyahoga Valley, Marsh-Billings-Rockefeller, Upper Delaware)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSCP
Cuyahoga Valley National Park Inventory Notes: One small stand of this community was found during photo reconnaissance. There were no Accuracy Assessment points in this community.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: S.C. Gawler
References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Perles et al. 2008

Red Pine Plantation

***Pinus resinosa* Planted Forest**
Red Pine Planted Forest
Identifier: CEGL007177

ELEMENT CONCEPT

Global Summary: Plantations of *Pinus resinosa* (red pine) occur in various settings and soil types. *Pinus resinosa* (red pine) makes up 80-100% of the canopy. In older stands, or in canopy gaps, native regeneration includes hardwoods such as *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), and *Fagus grandifolia* (American beech), as well as the conifers *Pinus strobus* (eastern white pine), *Picea rubens* (red spruce), and/or *Tsuga canadensis* (eastern hemlock). *Acer pensylvanicum* (striped maple) may be present as a small tree. Shrubs and herbs are typically few.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Information not available.
Global Environment: Plantations of *Pinus resinosa* (red pine) occur in various settings and soil types.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The canopy of this community is dominated by planted *Pinus resinosa* (red pine). Other trees can be present in the canopy, particularly in stands that are old or where canopy gaps have formed. *Acer rubrum* (red maple) is the most common, though *Fraxinus americana* (white ash), *Prunus serotina* (black cherry), and *Liriodendron tulipifera* (tuliptree) can also occur.
Global Vegetation: *Pinus resinosa* (red pine) makes up 80-100% of the canopy. In older stands, or in canopy gaps, native regeneration includes hardwoods such as *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), and *Fagus grandifolia* (American beech), as well as the conifers *Pinus strobus* (eastern white pine), *Picea rubens* (red spruce), and/or *Tsuga canadensis* (eastern hemlock). *Acer pensylvanicum* (striped maple) may be present as a small tree. Shrubs and herbs are typically few.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus resinosa* (red pine)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus resinosa* (red pine)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Pinus resinosa* (red pine)
Global: *Pinus resinosa* (red pine)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) (8-Aug-2000). This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate

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Cuyahoga Valley National Park Comments: Information not available.
Global Comments: In the southern portion of the range, these plantations are known from the Laurel Fork area of the Warm Springs Ranger District; in New England, they are scattered and generally small.
Global Similar Associations:
- *Pinus resinosa / Menziesia pilosa / Polypodium appalachianum* Forest (CEGL006108)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: Information not available.
Nations: US
States/Provinces: DE, MD, ME, NC, NY, OH, VA, VT, WV
TNC Ecoregions: 51:C, 59:C, 61:C, 63:C
USFS Ecoregions (1994/95): 212Ab:CCC, 221Ae:CCC, 221Db:CCC, M212Ba:CCC, M221Aa:CCC, M221Ba:CCC
Federal Lands: NPS (Cuyahoga Valley, Marsh-Billings-Rockefeller); USFS (George Washington, Monongahela); USFWS (Aroostook, Moosehorn)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSCP
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so there are no plots for it. Three sites were visited for Accuracy Assessment.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: S.C. Gawler
References: Allard 1990, Coxe 2009, Edinger et al. 2002, Fleming and Coulling 2001, Fleming and Moorhead 1996, Southeastern Ecology Working Group n.d.

White Pine Plantation

***Pinus strobus* Planted Forest**
Eastern White Pine Planted Forest
Identifier: CEGL007178

ELEMENT CONCEPT

Global Summary: This white pine plantation type is found throughout the northeastern and midwestern United States and adjacent Canada. Stands contain plantations of *Pinus strobus* (eastern white pine) that are maintained for the extraction of forest products. Some have been planted as reclamation projects (e.g., following strip-mining). At maturity, the tree canopy is usually dense and contains a monospecific layer of *Pinus strobus* (eastern white pine). *Pinus resinosa* (red pine) or *Pinus virginiana* (Virginia pine) is occasionally present in small amounts. In older stands or gaps, regenerating trees may include *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry); *Robinia pseudoacacia* (black locust) and *Betula lenta* (sweet birch) are occasionally present. *Acer pensylvanicum* (striped maple) and *Ostrya virginiana* (hophornbeam) are common small trees. The shrub layer is typically sparse and mostly consists of smaller individuals of the tree species. The field layer varies from sparse to absent; it may be locally well-developed in small openings, with variable composition. In some stands, mosses may be abundant. Susceptibility to a variety of pests or diseases, including white pine blister rust (*Cronartium ribicola*) and southern pine beetle (*Dendroctonus frontalis*), has had some impact on its commercial use.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community is found on flat to gently sloping sites. Woody debris, both coarse and fine, is common on the forest floor.
Global Environment: Stands contain plantations of *Pinus strobus* (eastern white pine) that are maintained for the extraction of forest products. The type does well on a variety of soils. Some have been planted on strip-mine reclamation sites.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The canopy of this community is dominated by planted *Pinus strobus* (eastern white pine). In canopy gaps or older stands, deciduous trees make their way into the canopy. *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Prunus serotina* (black cherry), and *Liriodendron tulipifera* (tuliptree) are the most common of these.
Global Vegetation: The tree canopy at maturity is usually dense and contains a monospecific layer of *Pinus strobus* (eastern white pine). *Pinus resinosa* (red pine) or *Pinus virginiana* (Virginia pine) is occasionally present in small amounts. In older stands or gaps, regenerating trees may include *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry); *Robinia pseudoacacia* (black locust) and *Betula lenta* (sweet birch) are occasionally present. *Acer pensylvanicum* (striped maple) and *Ostrya virginiana* (hophornbeam) are common small trees. The shrub layer is typically sparse and

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mostly consists of smaller individuals of the tree species. The field layer varies from sparse to absent; it may be locally well-developed in small openings, with variable composition. In some stands, mosses may be abundant.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)

Global

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Pinus strobus* (eastern white pine)
Global: *Pinus strobus* (eastern white pine)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Other: *Rhus aromatica* var. *arenaria* (fragrant sumac, G5T3Q)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) (8-Aug-2000). This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: There was a lot of planting of white pine from the 1930s into the 1950s, but there has been very little planting since then (P. Manion pers. comm. 2001). On the Daniel Boone National Forest of Kentucky, *Pinus strobus* (eastern white pine) plantings are of limited extent and are related to wildlife plantings. In the southern part of this type's range, there has been some damage from southern pine beetle (*Dendroctonus frontalis*). These plantations have been observed in the Peters Mountain area (James River Ranger District) and various other sites in the George Washington and Jefferson national forests.
Global Similar Associations:
- *Pinus* spp. Planted Forest (CEGL006313)
- *Pinus strobus* Semi-natural Forest (CEGL007944)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This white pine plantation type is found throughout the northeastern and midwestern United States and adjacent Canada.
Nations: CA, US
States/Provinces: DE, GA, IN, KY, MD, NC, NH, NJ, NY, OH, PA, SC, TN, VA, VT, WV
TNC Ecoregions: 47:C, 48:C, 51:C, 52:C, 59:C, 61:C, 62:C, 63:C
USFS Ecoregions (1994/95): 212:C, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Db:CCC, 221He:CCC, 222Jj:CCC, 232Ab:CCC, 232Ac:CCC, M212Ba:CCC, M221Aa:CCC, M221Bb:CCC, M221Ce:CCC, M221Dc:CCC, M221Dd:CCC
Federal Lands: BIA (Eastern Band of Cherokee); NPS (Antietam, Appalachian Trail [Central Appalachians], Appalachian Trail [Lower New England], Appalachian Trail [Northern Appalachians], Appalachian Trail [Southern Blue Ridge], Blue Ridge Parkway, Booker T. Washington, C&O Canal, Catoctin Mountain, Chattahoochee River, Chickamauga-Chattanooga, Cuyahoga Valley, Indiana Dunes, Marsh-Billings-Rockefeller, Monocacy, New River Gorge, Saratoga, Valley Forge); USFS (Chattahoochee, Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, George Washington, Jefferson, Nantahala, Pisgah, Sumter, Sumter (Mountains)); USFWS (Chesapeake Marshlands, E.B. Forsythe, Supawna Meadows)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSCP
Cuyahoga Valley National Park Inventory Notes:
Cuyahoga Valley National Park Plots and Observation Points: CUVA.20, CUVA.41, CUVA.56, CUVA.95
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler
References: Allard 1990, Coxe 2009, Edinger et al. 2002, Edinger et al. 2007, Fleming and Coulling 2001, Fleming and Moorhead 2000, Hop et al. 2009, NRCS 2004a, NatureServe 2009, Patterson 2008b, Podniesinski et al. 2005b, Reschke 1990, Southeastern

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Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst 2001a, Vanderhorst 2001b, Vanderhorst and Streets 2006, Vanderhorst et al. 2007

Scotch Pine Plantation

***Pinus sylvestris* Planted Forest**
Scotch Pine Planted Forest
Identifier: CEGL006686

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community occurs on flat to gently sloping sites with moderately well-drained silt loam soil. The unvegetated surface is dominated by leaf litter with some downed wood and bare soil. Evidence of disturbance includes managed tree plantings and the presence of trails and exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate canopy (average 70% cover), 20-35 m tall, is dominated by *Pinus sylvestris* (Scotch pine). The sparse subcanopy (10-15 m) and tall-shrub (2-5 m) layer are dominated by *Acer rubrum* (red maple). Herbs are nearly absent.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus sylvestris* (Scotch pine)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Acer rubrum* (red maple), *Pinus sylvestris* (Scotch pine)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Pinus sylvestris* (Scotch pine, invasive/exotic, Medium/Low)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (modified/managed) (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSCP
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist.
Cuyahoga Valley National Park Plots and Observation Points:

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Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Virginia Pine Plantation

***Pinus virginiana* Planted Forest**
Virginia Pine Planted Forest
Identifier: CEGL004730

ELEMENT CONCEPT

Global Summary: This association includes planted stands of *Pinus virginiana* (Virginia pine) which have little understory, but they may have admixtures of other native or off-site pines (e.g., *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), *Pinus taeda* (loblolly pine)). These are cultivated forests and are not considered natural or near-natural vegetation. They are maintained as plantations for the harvest of forest products, or for production of Christmas trees and on strip-mined sites. Stands have suffered some damage from southern pine beetle (*Dendroctonus frontalis*). Stands are planted in the Inner Coastal Plain for Christmas tree production.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Virginia pine plantation was sampled at two locations in the park. The sites are gentle to moderate slopes and upper flats with moderately well- to well-drained silty clay and silt loam soils. The unvegetated surface is dominated by leaf litter with some downed wood and traces of large and small rocks and bare soil. Evidence of disturbance includes deer browse, managed tree plantings, and the presence of trails and exotic species.
Global Environment: These are cultivated forests and are not considered natural or near-natural vegetation. They are maintained as plantations for the harvest of forest products. Stands are planted in the Inner Coastal Plain for Christmas tree production.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate to dense canopy (50-80% cover), 20-35 m tall, is dominated by *Pinus virginiana* (Virginia pine); additional species found at low cover may include *Acer saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), and *Prunus serotina* (black cherry). The sparse to moderate (20-70%) subcanopy (10-15 m) is dominated by *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), and *Sassafras albidum* (sassafras). Shrubs are sparse and include *Lindera benzoin* (northern spicebush) and exotics *Berberis thunbergii* (Japanese barberry) and *Rhamnus cathartica* (common buckthorn). The sparse herb layer is dominated by tree seedlings and trace herbs.
Global Vegetation: This association includes planted stands of *Pinus virginiana* (Virginia pine) with little understory, but may have admixtures of other native or off-site pines (e.g., *Pinus echinata* (shortleaf pine), *Pinus strobus* (eastern white pine), *Pinus taeda* (loblolly pine)). At Arnold Air Force Base, Coffee and Franklin counties, Tennessee, *Pinus virginiana* (Virginia pine) is dominant in dry-mesic, low to mid-slope forests. *Pinus strobus* (eastern white pine) is scattered throughout, with *Juniperus virginiana var. virginiana* (eastern red-cedar) occurring in patches. The subcanopy contains *Acer rubrum* (red maple), *Cornus florida* (flowering dogwood), and *Liquidambar styraciflua* (sweetgum). The tall-shrub layer includes *Sassafras albidum* (sassafras), *Cornus florida* (flowering dogwood), *Cercis canadensis* (eastern redbud), *Liquidambar styraciflua* (sweetgum), and *Quercus stellata* (post oak). The herbaceous layer is sparse or nearly absent, and contains *Polystichum acrostichoides* (Christmas fern), Asteraceae sp., *Carex* (sedge) spp., *Botrychium biternatum* (sparselobe grapefern), and exotic *Lonicera japonica* (Japanese honeysuckle).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Needle-leaved tree	*Pinus virginiana* (Virginia pine)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Pinus virginiana* (Virginia pine)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Picea abies* (Norway spruce, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)
Global: Invasive/Exotic: *Lonicera japonica* (Japanese honeysuckle, invasive/exotic, High/Medium)

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CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (cultural) (8-Aug-2000). This community represents vegetation which has been planted in its current location by humans and/or is treated with annual tillage, a modified conservation tillage, or other intensive management or manipulation. It is not a conservation priority and does not receive a conservation rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Stands have suffered some damage from the Southern Pine Beetle (*Dendroctonus frontalis*).

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at Brecksville Reservation, along Buckeye Trail at Pine Lane, Pine Grove Trail and Riding Run.
Global Range: This alliance is found throughout the Piedmont of the southeastern United States and ranges into part of the Cumberland Plateau, Interior Low Plateau, Inner Coastal Plain, and the Southern Blue Ridge. It is known to occur in Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia, and may possibly range into Mississippi.
Nations: US
States/Provinces: AL, GA, KY, MS?, NC, OH, SC, TN, VA
TNC Ecoregions: 43:C, 44:P, 49:C, 50:C, 51:C, 52:C
USFS Ecoregions (1994/95): 221Fa:CCC, 221Hc:CCC, 221He:CCC, 222Eb:CCC, 231B:CC, 232:?, M221Dc:???, M221Dd:???
Federal Lands: DOD (Arnold, Fort Gordon, Fort Stewart?); NPS (Appomattox Court House, Chickamauga-Chattanooga, Cuyahoga Valley); USFS (Chattahoochee, Chattahoochee (Piedmont), Chattahoochee (Southern Blue Ridge), Cherokee, Daniel Boone, Land Between the Lakes?, Nantahala?, Pisgah?, Uwharrie?)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSCP
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (2 plots): CUVA.24, CUVA.94.
Local Description Authors: M.J. Russo
Global Description Authors: M. Pyne
References: Allard 1990, Eyre 1980, Patterson 2008a, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data

G030. Northern & Central Hardwood & Conifer Ruderal Forest

Successional Black Locust Forest

***Robinia pseudoacacia* Semi-natural Forest**
Black Locust Semi-natural Forest
Identifier: CEGL007279

ELEMENT CONCEPT

Global Summary: This black locust semi-natural forest is found locally throughout the eastern United States. Stands often establish on old fields abandoned after agricultural cropping or pasturing or around old homesites. In some areas it occurs on post-agricultural floodplain terraces. This vegetation has also become established following the planting of *Robinia pseudoacacia* (black locust) to stabilize and enrich nutrient-poor soils that are subject to erosion. The vegetation is dominated by *Robinia pseudoacacia* (black locust). Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus rubra* (northern red oak), *Ulmus rubra* (slippery elm), and in some areas *Acer platanoides* (Norway maple) or *Ailanthus altissima* (tree of heaven). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy); *Lindera benzoin* (northern spicebush) is sometimes present. The invasive non-native *Rosa multiflora* (multiflora rose) may be present as a shrub, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry). Non-native species such as *Alliaria petiolata* (garlic mustard), *Chelidonium majus* (celandine), *Glechoma hederacea* (ground ivy), and *Convallaria majalis* (European lily of the valley) can characterize the herb layer, which may also have a native component.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Information not available.

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Global Environment: This type often establishes on old fields abandoned after agricultural cropping or pasturing or around old home sites. This vegetation has also become established following the planting of *Robinia pseudoacacia* (black locust) to stabilize and enrich nutrient-poor soils that are subject to erosion (Rabie 2000). Soils are variable and may be highly acidic, especially where established on old mine sites.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The canopy of this community is dominated by *Robinia pseudoacacia* (black locust). Associated species include *Juglans nigra* (black walnut), *Platanus occidentalis* (American sycamore), *Populus deltoides* (eastern cottonwood), and *Ulmus* (elm) spp. The understory often has robust shrub and herb layers with weedy species such as *Rosa multiflora* (multiflora rose), *Lonicera* (honeysuckle) spp., and *Verbesina alternifolia* (wingstem).

Global Vegetation: The vegetation is dominated by *Robinia pseudoacacia* (black locust) forming a partial to nearly complete canopy. Associated woody species vary from site to site and include *Prunus serotina* (black cherry), *Juniperus virginiana* (eastern red-cedar), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), *Celtis occidentalis* (common hackberry), *Juglans nigra* (black walnut), *Quercus rubra* (northern red oak), *Ulmus rubra* (slippery elm), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and in some areas *Acer platanoides* (Norway maple) or *Ailanthus altissima* (tree of heaven). Understory vegetation is highly variable depending on site history and often includes *Toxicodendron radicans* (eastern poison-ivy); *Lindera benzoin* (northern spicebush) is sometimes present. The invasive non-natives *Rosa multiflora* (multiflora rose) and *Elaeagnus umbellata* (autumn olive) are typically the most common shrubs, along with the non-native bramble *Rubus phoenicolasius* (wine raspberry). *Cornus florida* (flowering dogwood) may be present in the subcanopy. Non-native species such as *Alliaria petiolata* (garlic mustard), *Chelidonium majus* (celandine), *Glechoma hederacea* (ground ivy), *Dactylis glomerata* (orchardgrass), *Daucus carota* (Queen Anne's lace), and *Convallaria majalis* (European lily of the valley) can characterize the herb layer, which may have a native component as well, for example with (depending on geography) *Ageratina altissima* (white snakeroot), *Dichanthelium clandestinum* (deertongue), *Elymus hystrix var. hystrix* (eastern bottlebrush grass), *Leersia virginica* (whitegrass), *Parthenocissus quinquefolia* (Virginia creeper), *Pilea pumila* (Canadian clearweed), *Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Verbesina alternifolia* (wingstem), *Verbesina occidentalis* (yellow crownbeard), and *Viola* (violet) spp.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Robinia pseudoacacia* (black locust)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Robinia pseudoacacia* (black locust)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Robinia pseudoacacia* (black locust)
Global: *Acer rubrum* (red maple), *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Invasive/Exotic: *Acer platanoides* (Norway maple, invasive/exotic, High/Medium), *Ailanthus altissima* (tree of heaven, invasive/exotic, Medium), *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Chelidonium majus* (celandine, invasive/exotic, Medium/Insignificant), *Convallaria majalis* (European lily of the valley, invasive/exotic), *Dactylis glomerata* (orchardgrass, invasive/exotic, Medium/Insignificant), *Daucus carota* (Queen Anne's lace, invasive/exotic, Low), *Elaeagnus umbellata* (autumn olive, invasive/exotic, High), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Rubus phoenicolasius* (wine raspberry, invasive/exotic, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (24-Oct-2002). Although *Robinia pseudoacacia* (black locust) is a native species found in the Central Appalachians and Ozark Mountains, it does not typically become a dominant species in these natural habitats (Elias 1980). It is now widespread in the eastern U.S. in disturbed habitats. This forest represents early-successional vegetation and is thus not of high conservation concern and does not receive a conservation status rank.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.
Global Similar Associations:

- *Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Semi-natural Forest (CEGL006599) can have *Robinia* as an important canopy component but is not dominated by it as is this type.
- *Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana* Semi-natural Forest (CEGL004133)
- *Robinia pseudoacacia - Celtis occidentalis - (Fraxinus americana, Liriodendron tulipifera)* Semi-natural Forest (CEGL007281)

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OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This black locust semi-natural forest is found locally throughout the eastern United States.
Nations: US
States/Provinces: AR, DC?, DE, IA, KY, MA, MD, MS, NC, NJ, NY, OH, OK, PA, TN, VA, VT, WV
TNC Ecoregions: 38:C, 39:C, 43:C, 44:C, 48:C, 49:C, 50:C, 51:C, 59:C, 61:C, 62:C, 63:C
USFS Ecoregions (1994/95): 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Fa:CCC, 222Ab:CCC, 222Ag:CCC, 222An:CCC, 222Ic:CCC, 231Bh:CCC, 232Ad:CCC, M212Ba:CCC, M221Aa:CCC, M221Ab:CCC, M221Ac:CCP, M221Ad:CCP, M221Ba:CCP, M221Bb:CCC, M221Bc:CCP, M221Bd:CCP, M221Be:CCC, M221Bf:CCP, M221Ca:CPP, M221Cb:CPP, M221Cc:CPP, M221Ce:CPP, M221Da:CCC, M221Db:CCC, M221Dc:CCC, M221Dd:CCP, M231Aa:CCC, M231Ab:CCC, M231Ac:CCC, M231Ad:CCC
Federal Lands: NPS (Antietam, Appalachian Trail [Southern Blue Ridge], Blue Ridge Parkway, Bluestone, Buffalo River?, C&O Canal, Cape Cod, Catoctin Mountain, Cuyahoga Valley, George Washington Birthplace, Marsh-Billings-Rockefeller, Minute Man, Morristown, National Capital-East, New River Gorge, Saratoga, Vicksburg); USFS (George Washington, Jefferson, Monongahela, Nantahala, Ouachita, Ouachita (Mountains), Ozark, Pisgah); USFWS (Montezuma)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSBL
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist for it. Three sites were visited during Accuracy Assessment.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler and L.A. Sneddon
References: Baalman 1965, CAP pers. comm. 1998, Edinger et al. 2002, Edinger et al. 2007, Ehrenfeld 1977, Elias 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Patterson 2011a, Fleming et al. 2006, Gaertner 1955, Gawler et al. 2005, Hoagland 2000, INAI unpubl. data, McDonald 1938, NRCS 2004a, Patterson 2008d, Rabie 2000, Rawinski et al. 1996, Sneddon et al. 2008, Sneddon et al. 2010, Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst et al. 2007, Vanderhorst et al. 2008, WVNHP unpubl. data b

Successional Red Maple - Black Cherry Forest

***Acer rubrum - Prunus serotina / Rosa multiflora* Forest [Park Special]**
Red Maple - Black Cherry / Multiflora Rose Forest
Identifier: CEPS006687

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This red maple - black cherry forest was sampled at 14 locations in the park. The sites are gentle to moderate lowslopes and summits with a full spectrum of soil drainages ranging from well-drained silt loam to poorly drained clay loam soils. The unvegetated surface is dominated by leaf litter with some downed wood and occasional bare soil. Evidence of disturbance includes past logging and clearing, deer browse, and the presence of trails and exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate canopy to dense (40-90% cover), 15-30 m tall, and sparse to moderate (20-70%) subcanopy (10-15 m) are dominated by *Acer rubrum* (red maple) and/or *Prunus serotina* (black cherry); additional tree species may include *Aesculus glabra* (Ohio buckeye), *Asimina triloba* (pawpaw), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Sassafras albidum* (sassafras), and *Ulmus rubra* (slippery elm). Shrub layers are relatively sparse and are mostly made up of canopy tree saplings. Common herbs (30-50%) include *Circaea lutetiana* (broadleaf enchanter's nightshade), *Geum canadense* (white avens), *Parthenocissus quinquefolia* (Virginia creeper), *Podophyllum peltatum* (mayapple), and *Polystichum acrostichoides* (Christmas fern).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tree canopy	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)

Global: Information not available.

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CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Circaea lutetiana* (broadleaf enchanter's nightshade), *Polystichum acrostichoides* (Christmas fern)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Hesperis matronalis* (dames rocket, invasive/exotic, Medium/Low), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Myrrhis odorata* (anise, invasive/exotic), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: This represents mesic disturbed forests at CUVA.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community is common throughout the park.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSMH
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (14 plots): CUVA.17, CUVA.34, CUVA.49, CUVA.65, CUVA.85, CUVA.182, CUVA.189, CUVA.198, CUVA.206, CUVA.211, CUVA.212, CUVA.214, CUVA.215, CUVA.219.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Successional Tuliptree - Red Maple Forest

***Liriodendron tulipifera - Acer rubrum - Populus* spp. Forest [Park Special]**
Tuliptree - Red Maple - Cottonwood species Forest
Identifier: CEPS006693

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This successional tuliptree - red maple - cottonwood forest was sampled at 24 locations in the park. The sites range from gentle to somewhat steep slopes and uplands. Soils range from somewhat poorly drained to well-drained and include clay loam, loam, loamy sand, sand, sandy loam, silt, silt loam, and silty clay. The unvegetated surface is dominated by leaf litter with some downed wood and occasional exposed bedrock, large and small rocks, and bare soil. Evidence of disturbance includes deer browse, past logging and clearing, and the presence of trails and exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: Dominants in the moderate to dense canopy (40-90% cover), 20-35 m tall, include *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), and *Populus grandidentata* (bigtooth aspen). The very sparse to moderate (5-70%) subcanopy (10-15 m) may include canopy species as well as *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), and *Prunus serotina* (black cherry). Additional tree species include *Magnolia acuminata* (cucumber-tree), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Sassafras albidum* (sassafras), and *Ulmus rubra* (slippery elm). The very

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sparse to moderate (5-70%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers share the same dominants as the canopy. Additional common shrubs include *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum dentatum* (southern arrow-wood), and exotics *Berberis thunbergii* (Japanese barberry), *Ligustrum sinense* (Chinese privet), and *Rosa multiflora* (multiflora rose). The herb layer is sparse when present and often dominated by tree seedlings. The most common and abundant herbs are *Alliaria petiolata* (garlic mustard) (exotic), *Arisaema triphyllum* (Jack in the pulpit), *Polystichum acrostichoides* (Christmas fern), *Parthenocissus quinquefolia* (Virginia creeper), *Prenanthes alba* (white rattlesnakeroot), *Potentilla simplex* (common cinquefoil), *Circaea lutetiana* (broadleaf enchanter's nightshade), *Podophyllum peltatum* (mayapple), *Onoclea sensibilis* (sensitive fern), and *Polygonum virginianum* (jumpseed). In addition, this community supports Ohio state-imperiled *Phaseolus polystachios* (thicket bean) and state-vulnerable *Asclepias variegata* (redring milkweed).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera* (tuliptree), *Populus grandidentata* (bigtooth aspen)
Herb (field)	Forb	*Arisaema triphyllum* (Jack in the pulpit)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Acer rubrum* (red maple), *Arisaema triphyllum* (Jack in the pulpit), *Fagus grandifolia* (American beech), *Lindera benzoin* (northern spicebush), *Liriodendron tulipifera* (tuliptree), *Parthenocissus quinquefolia* (Virginia creeper), *Polystichum acrostichoides* (Christmas fern), *Rosa multiflora* (multiflora rose), *Viburnum acerifolium* (mapleleaf viburnum)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Asclepias variegata* (redring milkweed, Ohio state-vulnerable, G5), *Phaseolus polystachios* (thicket bean, Ohio state-imperiled, G5); **Invasive/Exotic**: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Amaranthus retroflexus* (redroot amaranth, invasive/exotic), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Convallaria majalis* (European lily of the valley, invasive/exotic), *Epipactis helleborine* (broadleaf helleborine, invasive/exotic, Medium/Low), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Picea abies* (Norway spruce, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: This association represents disturbed dry-mesic to mesic forests at CUVA.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This widespread community was sampled along Buckeye Trail at Bedford Reservation, along Boston Mills Road, at the Brecksville Nature Center, and along Buckeye Trail, Riding Run, Everett-Perkins Trail, Frazee Horse Trail, Boston Trail at Happy Days, Ledges Trail Connector at Kendall Ledges, Northwest Trail, Salt Run Trail, Langes Run, Wetmore Trail, and at Shady Knoll Picnic Area.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSMH
Cuyahoga Valley National Park Inventory Notes: Information not available.

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Cuyahoga Valley National Park Plots and Observation Points: (24 plots): CUVA.04, CUVA.13, CUVA.16, CUVA.20, CUVA.23, CUVA.25, CUVA.33, CUVA.55, CUVA.57, CUVA.61, CUVA.74, CUVA.84, CUVA.86, CUVA.87, CUVA.96, CUVA.97, CUVA.100, CUVA.113, CUVA.120, CUVA.128, CUVA.129, CUVA.131, CUVA.140, CUVA.221.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)

***Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus (rubra, alba) / Polystichum acrostichoides* Forest**
Tuliptree - Eastern White Pine - Eastern Hemlock - (Northern Red Oak, White Oak) / Christmas Fern Forest
Identifier: CEGL006304

ELEMENT CONCEPT

Global Summary: This mixed hardwood - white pine - hemlock cove forest is widely but locally distributed in the southern part of the Central Appalachians in Virginia, West Virginia, and Maryland. It occurs on the lower slopes and bottoms of ravines and coves at lower elevations, generally below 915 m (3000 feet). Sites may be underlain by bedrock or colluvial and alluvial deposits of various sedimentary and metasedimentary rocks, granitic rocks, or metabasalt. Habitats are generally mesic with acidic soils of moderate or intermediate fertility. The overstory is codominated by variable mixtures *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), and *Quercus alba* (white oak). This forest generally has a moderate to strong evergreen component, but *Pinus strobus* (eastern white pine) varies from widely scattered to codominant, and *Tsuga canadensis* (eastern hemlock) has been greatly reduced by recent outbreaks of the hemlock woolly adelgid and may be restricted to the understory. Less frequent overstory associates include *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya* (hickory) spp., *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), and *Quercus prinus* (chestnut oak). Characteristic understory species include *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Viburnum acerifolium* (mapleleaf viburnum), *Rubus* (blackberry) spp., *Corylus americana* (American hazelnut), *Hamamelis virginiana* (American witch-hazel), *Hydrangea arborescens* (wild hydrangea), and *Lindera benzoin* (northern spicebush). The herb layer is usually patchy to moderately dense. Frequent patch-dominants include *Amphicarpaea bracteata* (American hogpeanut), *Dennstaedtia punctilobula* (eastern hayscented fern), *Eurybia divaricata* (white wood aster), and *Polystichum acrostichoides* (Christmas fern). Other constant but low-cover herbs include *Botrychium virginianum* (rattlesnake fern), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium triflorum* (fragrant bedstraw), *Maianthemum racemosum ssp. racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), and *Stellaria pubera* (star chickweed). Many additional herbs occur at low constancy.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Information not available.
Global Environment: This community occurs at lower elevations, generally below 915 m (3000 feet), on the lower slopes and bottoms of ravines and coves, extending to upper slopes, ridgetops, and rolling plateaus on parts of the Cumberland Plateau. Sites may be underlain by bedrock or colluvial and alluvial deposits of various metasedimentary rocks, granitic rocks, or metabasalt. Habitats are generally mesic with acidic soils of moderate or intermediate fertility. Soils are mostly well-drained, dry to moist sandy loam, sandy clay loam, silt loam, loam, and silty clay.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: Information not available.
Global Vegetation: The overstory is codominated by variable mixtures of *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and *Quercus alba* (white oak). This forest generally has a moderate to strong evergreen component, but *Pinus strobus* (eastern white pine) varies from absent to widely scattered to codominant, and *Tsuga canadensis* (eastern hemlock) has been greatly reduced in many areas by recent outbreaks of the hemlock woolly adelgid and may be restricted to the understory. Less frequent overstory associates include *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Nyssa sylvatica* (blackgum), and *Quercus prinus* (chestnut oak). The subcanopy is of variable cover and may include *Acer pensylvanicum* (striped maple), *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hophornbeam), *Oxydendrum arboreum* (sourwood), *Nyssa sylvatica* (blackgum), *Pinus strobus* (eastern white pine), and *Tsuga canadensis* (eastern hemlock). The shrub layer is typically patchy or open and characterized by *Viburnum acerifolium* (mapleleaf viburnum), *Rubus* (blackberry) spp., *Corylus americana* (American hazelnut), *Hamamelis virginiana* (American witch-hazel), *Hydrangea arborescens* (wild hydrangea), *Ilex opaca* (American holly), and *Lindera benzoin* (northern spicebush). The herb layer is usually patchy to moderately dense. Frequent patch-dominants include *Amphicarpaea bracteata* (American hogpeanut), *Dennstaedtia punctilobula* (eastern hayscented fern), *Eurybia divaricata* (white wood aster), and *Polystichum acrostichoides* (Christmas fern). Other constant but low-cover herbs include *Botrychium virginianum* (rattlesnake fern), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea*

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quaternata (fourleaf yam), *Galium triflorum* (fragrant bedstraw), *Maianthemum racemosum ssp. racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Stellaria pubera* (star chickweed), *Viola hastata* (halberdleaf yellow violet), and *Dryopteris intermedia* (intermediate woodfern). Many additional herbs occur at low constancy. Species richness of 34 Virginia and West Virginia plot samples ranges from 21 to 98 taxa per 400 square meters (mean = 57), with the WV plots decidedly less species-rich (WV mean=28.5 spp.; VA mean = 64 spp.).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Vulnerable: *Panax quinquefolius* (American ginseng, under collection pressure, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (25-Jan-2008). This community appears to be widely but locally distributed over a large part of the Central Appalachians in Virginia, West Virginia, and Maryland. The type frequently forms large patches in suitable mesic habitats, but mature, high-quality stands are uncommon due to extensive past logging and more recent biotic disturbances (e.g., hemlock woolly adelgid).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This association is represented by 35 Virginia plots, all of which have been analyzed in a statewide classification (>1300 plots) of montane upland forests and woodlands (Fleming and Patterson 2009b). Ten plots from the southern part of the Central Appalachians were classified as this association in the Appalachian Trail classification project (Fleming and Patterson 2009a).
Global Similar Associations:

- *Liriodendron tulipifera - Pinus strobus - (Tsuga canadensis) / Carpinus caroliniana / Amphicarpaea bracteata* Forest (CEGL008405) very similar but currently defined as a montane alluvial forest of small-stream floodplains.
- *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539) occurs on drier sites, primarily in the central Appalachian Ridge and Valley province and the Piedmont.
- *Pinus strobus - Tsuga canadensis / Acer pensylvanicum / Polystichum acrostichoides* Forest (CEGL006019) evergreen forest restricted to the northern part of the Central Appalachians.
- *Tsuga canadensis - Quercus prinus - Liriodendron tulipifera / Kalmia latifolia - (Rhododendron catawbiense)* Forest (CEGL008512) occurs in the same region but occupies extremely infertile coves, mostly on acidic granite, sandstone, and quartzite.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This community occurs in the southern portion of the Central Appalachians of Maryland, West Virginia, and Virginia, extending to the adjacent Cumberland Plateau in West Virginia. It is rare in the western Piedmont foothills of Virginia, adjacent to the Blue Ridge.
Nations: US
States/Provinces: MD, OH, VA:S4, WV
TNC Ecoregions: 49:C, 50:C, 52:C, 59:C
USFS Ecoregions (1994/95): 231Ak:CCC, M221Aa:CCC, M221Ab:CCC, M221Bd:CCC, M221Be:CCC, M221Ca:CCC, M221Da:CCC, M221Db:CCC
Federal Lands: NPS (Appalachian Trail [Central Appalachians], Blue Ridge Parkway, Cuyahoga Valley, Gauley River, Shenandoah); USFS (George Washington, Jefferson, Wayne)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FHMO
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (3 plots): CUVA.083, CUVA.167, CUVA.195.
Local Description Authors: J. Drake
Global Description Authors: G.P. Fleming, mod. S.C. Gawler
References: CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Fleming 2002b, Fleming and Coulling 2001, Fleming and Patterson 2003, Fleming and Patterson 2009a, Fleming and Patterson 2009b, Fleming and Patterson 2011a, Fleming and Taverna

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2006, Fleming et al. 2001, Harrison 2004, Harrison 2011, Vanderhorst et al. 2010, Young et al. 2006, Young et al. 2007, Young et al. 2009

Conifer Plantation Breakup Forest

***Pinus* spp. - *Picea abies* - *Acer rubrum* - *Liriodendron tulipifera* Ruderal Forest**
Pine species - Norway Spruce - Red Maple - Tuliptree Ruderal Forest
Identifier: CEGL005208

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This forest community is found on generally flat sites. Since this community occurs where former conifer plantations are becoming decadent and succeeding to a mixed hardwood-conifer forest, there is often substantial downed trees and branches. Canopy gaps are frequent and many of the old conifer trees have sparse crowns.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This mixed conifer-hardwood forest is formed when old conifer plantations become decadent and the conifers begin to die. Early-successional hardwood species, particularly *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), and *Populus* (cottonwood) spp., proliferate under the thinning conifer canopy. The conifer component is often one species, depending on the original plantation. *Pinus resinosa* (red pine), *Pinus sylvestris* (Scotch pine), *Pinus strobus* (eastern white pine), *Pinus virginiana* (Virginia pine), and *Picea abies* (Norway spruce) are the most common at Cuyahoga Valley National Park. The shrub stratum density varies. Where the canopy is thin and more light is allowed, the shrub stratum is often dense. Where the tree canopy is denser, the shrub stratum is usually sparse to moderate.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (11-Jan-2013).

CLASSIFICATION

Status: Provisional
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: Information not available.
USFS Ecoregions (1994/95): Information not available.
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSCP
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (3 plots): CUVA.8, CUVA.110, CUVA.135.
Local Description Authors: J. Drake

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Global Description Authors:
References: Midwestern Ecology Working Group n.d.

M012. North-Central Oak - Hardwood & Pine Forest

G649. North-Central Oak - Hickory Forest & Woodland

Midwestern White Oak - Red Oak Forest

***Quercus alba - Quercus rubra - Carya ovata* Glaciated Forest**
White Oak - Northern Red Oak - Shagbark Hickory Glaciated Forest
Identifier: CEGL002068

ELEMENT CONCEPT

Global Summary: This oak forest community is widespread in the north-central United States. Stands occur primarily on glaciated, rolling topography on a wide variety of soils that have a dry-mesic moisture condition. The canopy is variable but typically closed (>80%). *Quercus alba* (white oak) and *Quercus rubra* (northern red oak) are the leading dominants, but *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Quercus velutina* (black oak), and *Carya ovata* (shagbark hickory) can also be codominant. Typical associates include *Juglans nigra* (black walnut) and, more south or east, *Carya alba* (mockernut hickory) and *Carya glabra* (pignut hickory). The subcanopy contains *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and, increasingly, *Acer rubrum* (red maple) or *Acer saccharum* (sugar maple). The shrub layer is quite variable but can include *Cornus alternifolia* (alternateleaf dogwood), *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Parthenocissus quinquefolia* (Virginia creeper), *Ribes cynosbati* (eastern prickly gooseberry), and *Zanthoxylum americanum* (common pricklyash). The herbaceous layer includes *Amphicarpaea bracteata* (American hogpeanut), *Anemone virginiana* (tall thimbleweed), *Symphyotrichum cordifolium* (common blue wood aster), *Botrychium virginianum* (rattlesnake fern), *Brachyelytrum erectum* (bearded shorthusk), *Circaea lutetiana ssp. canadensis* (broadleaf enchanter's nightshade), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Galium concinnum* (shining bedstraw), *Geranium maculatum* (spotted geranium), *Osmorhiza claytonii* (Clayton's sweetroot), *Sanicula odorata* (clustered blacksnakeroot), and *Maianthemum racemosum* (feathery false lily of the valley).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This oak-hickory forest was sampled at 31 locations in the park. Sites range from gentle to somewhat steep slopes and summits. Soils are moderately well- to well-drained clay loam, loam, silt, silt loam, and silty clay. The unvegetated surface is dominated by leaf litter with some downed wood and occasional bare soil. Evidence of disturbance includes deer browse, erosion, and the presence of trails and exotic species.
Global Environment: This community is found primarily on glaciated, rolling topography on a wide variety of soils that have a dry-mesic moisture condition. It is also found in the unglaciated Driftless Area of the upper Midwest.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate to dense canopy (50-80% cover), 20-35 m tall, is dominated by *Carya ovata* (shagbark hickory), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Quercus velutina* (black oak); additional common or abundant species can include *Carya laciniosa* (shellbark hickory), *Liriodendron tulipifera* (tuliptree), and *Prunus serotina* (black cherry). The sparse to moderate (10-60%) subcanopy (10-15 m) is dominated by *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), and *Ostrya virginiana* (hophornbeam). The very sparse to moderate (5-50%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers are made up of canopy and subcanopy species; additional shrubs may include *Carpinus caroliniana* (American hornbeam), *Fraxinus americana* (white ash), *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), and *Viburnum acerifolium* (mapleleaf viburnum). The herb layer is sparse and dominated by tree seedlings along with such herbs as *Podophyllum peltatum* (mayapple), *Arisaema triphyllum* (Jack in the pulpit), *Prenanthes alba* (white rattlesnakeroot), *Polygonatum biflorum* (smooth Solomon's seal), *Mitchella repens* (partridgeberry), and *Polystichum acrostichoides* (Christmas fern).
Global Vegetation: The canopy is variable but typically closed (>80%). *Quercus alba* (white oak) and *Quercus rubra* (northern red oak) are the leading dominants, but *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Quercus velutina* (black oak), and *Carya ovata* (shagbark hickory) can also be codominant. Typical associates include *Juglans nigra* (black walnut), and more south or east, *Carya alba* (mockernut hickory) and *Carya glabra* (pignut hickory). The subcanopy contains *Ostrya virginiana* (hophornbeam), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and, increasingly, *Acer rubrum* (red maple) or *Acer saccharum* (sugar maple). The shrub layer is quite variable but can include *Cornus alternifolia* (alternateleaf dogwood), *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Parthenocissus quinquefolia* (Virginia creeper), *Ribes cynosbati* (eastern prickly gooseberry), and *Zanthoxylum americanum* (common pricklyash). The herbaceous layer includes *Amphicarpaea bracteata* (American hogpeanut), *Anemone virginiana* (tall thimbleweed), *Symphyotrichum cordifolium* (common blue wood aster), *Botrychium virginianum* (rattlesnake fern), *Brachyelytrum erectum* (bearded shorthusk), *Circaea lutetiana ssp. canadensis* (broadleaf enchanter's nightshade), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Galium concinnum* (shining bedstraw), *Geranium maculatum* (spotted geranium), *Osmorhiza claytonii* (Clayton's sweetroot), *Sanicula*

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odorata (clustered blacksnakeroot), and *Maianthemum racemosum* (feathery false lily of the valley) (Curtis 1959, Nelson 1985, MNNHP 1993, Anderson 1996).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya ovata* (shagbark hickory), *Quercus alba* (white oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech)
Short shrub/sapling	Broad-leaved deciduous shrub	*Fraxinus americana* (white ash)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit), *Carya ovata* (shagbark hickory), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Podophyllum peltatum* (mayapple), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Viburnum acerifolium* (mapleleaf viburnum)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Castanea dentata* (American chestnut, Ohio state-vulnerable, G4); **Invasive/Exotic**: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Galium mollugo* (false baby's breath, invasive/exotic), *Hesperis matronalis* (dames rocket, invasive/exotic, Medium/Low), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)
Global: Vulnerable: *Panax quinquefolius* (American ginseng, under collection pressure, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996). Many sites have been cleared, logged, and grazed. It is not clear how many high quality, large tracts exist.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This type rarely has any other oak species in it beyond *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), and occasional *Quercus macrocarpa* (bur oak) or *Quercus ellipsoidalis* (northern pin oak), unlike stands farther south with southern oak species. This type is primarily found on glaciated terrain, including Wisconsinan through Kansan, but its distribution may extend beyond that. Where stands have either *Acer rubrum* (red maple) or *Acer saccharum* (sugar maple) at >20% canopy coverage or basal area, they should be placed in *Quercus rubra - (Acer saccharum*, *Quercus alba)* Forest (CEGL005017), an oak-maple type. Also compare to *Quercus alba - Quercus rubra - Carya ovalis / Acer saccharum / Polystichum acrostichoides* Forest (CEGL007233) of the southeastern states.
Global Similar Associations:

- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067) an unglaciated white oak-red oak type
- *Quercus alba - Quercus rubra - Carya ovalis / Acer saccharum / Polystichum acrostichoides* Forest (CEGL007233)
- *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070) an unglaciated white oak-red oak type
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059) a red oak-white oak-maple type; generally more mesic or more maple-dominated.
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)
- *Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest (CEGL007700)
- *Quercus rubra - (Acer saccharum, Quercus alba)* Forest (CEGL005017) a red oak-white oak-maple type; generally more mesic or more maple-dominated.
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This widespread community was sampled at Ottoman Point and along Bridle and Buckeye trails at Bedford Reservation, at Blue Hen Falls, along Boston Mills Road, along Deerlick Trail at Brecksville Reservation, along

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Everett-Perkins Trail, Furnace Run, Old Carriage Trail (and overlook), Wetmore-Langes Run, Valley Bridle Trail, and along Chestnut Pond Plateau Trail and Plateau Trail at Valley Picnic Area.

Global Range: This oak forest community is widespread in the north-central United States, ranging from Ohio west to Minnesota, south to Iowa, and east to Indiana.

Nations: CA, US

States/Provinces: IA:S4, IL, IN, MI, MN, MO, NY, OH, ON, QC:S3?, WI:S3

TNC Ecoregions: 35:C, 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C

USFS Ecoregions (1994/95): 212Fb:PPP, 212Jj:P??, 212Ka:P??, 221Ea:CCC, 221Ec:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCP, 221Fc:CCC, 222Aa:CCC, 222Ak:CCC, 222Ao:CCC, 222Aq:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222Id:CCP, 222If:CCC, 222Ja:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ke:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222Lb:CCC, 222Lc:CCC, 222Qb:CCC, 251Be:CCC, 251Cb:CCC, 251Cc:CCC, 251Cd:CCC, 251Ce:CCC, 251Cf:CCC, 251Cg:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251De:CCC, 251Df:CCC, 251Dh:CCP

Federal Lands: NPS (Cuyahoga Valley, Effigy Mounds, Indiana Dunes, Saint Croix); USFS (Finger Lakes)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FDMO

Cuyahoga Valley National Park Inventory Notes: Information not available.

Cuyahoga Valley National Park Plots and Observation Points: (31 plots): CUVA.35, CUVA.36, CUVA.37, CUVA.44, CUVA.47, CUVA.52, CUVA.59, CUVA.67, CUVA.76, CUVA.79, CUVA.88, CUVA.101, CUVA.102, CUVA.104, CUVA.105, CUVA.107, CUVA.117, CUVA.123, CUVA.125, CUVA.133, CUVA.134, CUVA.136, CUVA.145, CUVA.176, CUVA.179, CUVA.200, CUVA.202, CUVA.204, CUVA.207, CUVA.213, CUVA.216.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Abrams 1992, Anderson 1996, CDPNQ unpubl. data, Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Homoya et al. 1988, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Kost et al. 2007, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, Nelson 1985, Nelson 2010, ONHD unpubl. data, WNHI 2011, WNHIP unpubl. data, White and Madany 1978

Black Oak - White Oak - Hickory Forest

***Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest**

Black Oak - White Oak - (Pignut Hickory, Shagbark Hickory) Forest

Identifier: CEGL002076

ELEMENT CONCEPT

Global Summary: This black oak - white oak forest community is found throughout the northern and central midwestern United States and adjacent Canada. Stands occur on dry to dry-mesic mid- to upper slopes and terraces where soils are more sandy and/or rocky. Bedrock is sandstone, siltstone, chert, or shale, and northward is covered by thin loess or glacial till. Trees in this community often have moderate to short trunks and spreading crowns, and the canopy can vary from open to closed (50-100%). *Quercus velutina* (black oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), and *Carya ovata* (shagbark hickory) are typical tree dominants. Associated oaks can include *Quercus ellipsoidalis* (northern pin oak) (northward), *Quercus muehlenbergii* (chinkapin oak), and southward, *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), and *Quercus stellata* (post oak). Typical shrubs and small trees include *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Ostrya virginiana* (hophornbeam), and *Sassafras albidum* (sassafras). Vines include *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* (grape) spp. The herbaceous layer can include *Agrimonia gryposepala* (tall hairy agrimony), *Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Botrychium virginianum* (rattlesnake fern), *Carex blanda* (eastern woodland sedge), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* (feathery false lily of the valley), and *Maianthemum stellatum* (starry false lily of the valley), among others. More southern stands may contain *Danthonia spicata* (poverty oatgrass).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This black oak - shagbark hickory forest was sampled at 16 locations in the park. The sites range from gentle to steep slopes with moderately well- to well-drained clay loam, silt and silt loam soils. The unvegetated surface is dominated by leaf litter with some downed wood and bare soil. Evidence of disturbance includes past logging, deer browse, and the presence of trails and exotic species.

Global Environment: This community is often found on ridge crests or upper slopes that are well-drained to excessively drained. Soils are often sandy loam, thin and rocky, with outcroppings of exposed bedrock. Bedrock is sandstone, siltstone, chert, or shale, or northward covered by thin loess or glacial till (Curtis 1959, White and Madany 1978, Nelson 1985).

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VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The sparse to dense canopy (40-80% cover), 15-35 m tall, is dominated by *Quercus velutina* (black oak); additional species include *Acer saccharum* (sugar maple), *Carya ovata* (shagbark hickory), *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), and *Quercus rubra* (northern red oak). The sparse to moderate (20-60%) subcanopy (5-15 m) is dominated by *Fagus grandifolia* (American beech), as is the sparse (5-40%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers. Additional species in the shrub layers include saplings of canopy species as well as *Amelanchier arborea* (common serviceberry), *Cornus florida* (flowering dogwood), *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Viburnum acerifolium* (mapleleaf viburnum). The herb layer is sparse, contains many tree seedlings and may include *Arisaema triphyllum* (Jack in the pulpit), *Conopholis americana* (American cancer-root), *Mitchella repens* (partridgeberry), *Parthenocissus quinquefolia* (Virginia creeper), *Podophyllum peltatum* (mayapple), and *Polygonatum biflorum* (smooth Solomon's seal). This community also supports Ohio state-imperiled *Viburnum opulus var. americanum* (American cranberrybush) and state-vulnerable *Castanea dentata* (American chestnut) and *Oligoneuron ohioense* (Ohio goldenrod).

Global Vegetation: Trees in this community often have moderate to short trunks and spreading crowns, and the canopy can vary from open to closed (50-100%). *Quercus velutina* (black oak), *Quercus alba* (white oak), *Carya glabra* (pignut hickory), and *Carya ovata* (shagbark hickory) are typical tree dominants. Associated oaks can include *Quercus ellipsoidalis* (northern pin oak) (northward), *Quercus muehlenbergii* (chinkapin oak), and southward, *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak) and *Quercus stellata* (post oak). Typical shrubs and small trees include *Cornus florida* (flowering dogwood) (southward), *Cornus foemina* (stiff dogwood), *Corylus americana* (American hazelnut) (northward), *Ostrya virginiana* (hophornbeam), and *Sassafras albidum* (sassafras). Vines include *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Vitis* (grape) spp. The herbaceous layer can include *Agrimonia gryposepala* (tall hairy agrimony), *Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Botrychium virginianum* (rattlesnake fern), *Carex blanda* (eastern woodland sedge), *Carex pensylvanica* (Pennsylvania sedge), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Geranium maculatum* (spotted geranium), *Polystichum acrostichoides* (Christmas fern), *Maianthemum racemosum* (feathery false lily of the valley), and *Maianthemum stellatum* (starry false lily of the valley), among others (Curtis 1959, White and Madany 1978, Nelson 1985, TNC 1995a). *Quercus velutina* (black oak) does not persist under a dense overstory and is most abundant in cut-over upland forests where the canopy is incomplete.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Carya ovata* (shagbark hickory), *Quercus alba* (white oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Sassafras albidum* (sassafras)
Shrub/sapling (tall & short)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), *Vitis vulpina* (frost grape)
Tall shrub/sapling	Broad-leaved deciduous tree	*Cornus florida* (flowering dogwood), *Cornus foemina* (stiff dogwood)
Herb (field)	Forb	*Agrimonia rostellata* (beaked agrimony), *Amphicarpaea bracteata* (American hogpeanut), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Dioscorea quaternata* (fourleaf yam), *Galium circaezans* (licorice bedstraw), *Maianthemum racemosum* (feathery false lily of the valley), *Maianthemum stellatum* (starry false lily of the valley)
Herb (field)	Graminoid	*Carex blanda* (eastern woodland sedge)
Herb (field)	Fern or fern ally	*Botrychium virginianum* (rattlesnake fern), *Polystichum acrostichoides* (Christmas fern)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Arisaema triphyllum* (Jack in the pulpit), *Fagus grandifolia* (American beech), *Podophyllum peltatum* (mayapple)

Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Castanea dentata* (American chestnut, Ohio state-vulnerable, G4), *Oligoneuron ohioense* (Ohio goldenrod, Ohio state-vulnerable, G4), *Viburnum opulus* var. *americanum* (American cranberrybush, Ohio

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state-imperiled, G5T5); **Invasive/Exotic**: *Amaranthus retroflexus* (redroot amaranth, invasive/exotic), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)
Global: Vulnerable: *Myotis sodalis* (indiana myotis, State listed endangered; often utilize shagbark hickory as roost sites (TNC 1995a), G2); **Other**: *Agkistrodon contortrix* (copperhead, G5), *Antennaria plantaginifolia* (woman's tobacco, G5), *Antrostomus vociferus* (eastern whip-poor-will, G5), *Callirhytis quercuspunctata* (gouty oak gall wasp, GNR), *Castanea pumila* var. *ozarkensis* (Ozark chinkapin, G5T3), *Chionaspis corni* (dogwood scale, GNR), *Cornus drummondii* (roughleaf dogwood, G5), *Cyanocitta cristata* (blue jay, G5), *Danthonia spicata* (poverty oatgrass, contained in most southern stands., G5), *Dryocopus pileatus* (pileated woodpecker, G5), *Eurytides marcellus* (zebra swallowtail, G5), *Glaucomys volans* (southern flying squirrel, G5), *Hylocichla mustelina* (wood thrush, G5), *Lynx rufus* (bobcat, State listed threatened in Illinois (TNC 1995a), G5), *Melanerpes carolinus* (red-bellied woodpecker, G5), *Melanerpes erythrocephalus* (red-headed woodpecker, G5), *Meleagris gallopavo* (wild turkey, G5), *Nymphalis antiopa* (mourning cloak, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Piranga olivacea* (scarlet tanager, G5), *Plestiodon laticeps* (broad-headed skink, G5), *Sayornis phoebe* (eastern phoebe, G5), *Schizura badia* (chestnut schizura, G5), *Sciurus carolinensis* (eastern gray squirrel, G5), *Sciurus niger* (eastern fox squirrel, G5), *Setophaga cerulea* (cerulean warbler, G4), *Tamias striatus* (eastern chipmunk, G5), *Thryothorus ludovicianus* (carolina wren, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: It is possible that unglaciated stands may differ sufficiently from glaciated stands to warrant separating into two types, but this depends on resolving the types' distribution southward. Is there a thin acidic soil, non-glaciated type (i.e., *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795)) versus deeper, glacial soil type? This type appears to go as far north as northern Illinois, Indiana, and southern Michigan, and probably into southern Wisconsin in section 222K, but not 222L (Eric Epstein pers. comm. 1999, H. Dunevitz pers. comm. 2000). The type concept in Wisconsin remains to be resolved. Indiana suggested that the unglaciated stands have more *Quercus coccinea* (scarlet oak). In Michigan, this could fit the interlobate region. Types on sand and typically more dominated by *Quercus velutina* (black oak) are placed in either *Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest (CEGL005030) or *Quercus velutina / Carex pensylvanica* Forest (CEGL002078). This type has been described in southern Illinois by Robertson et al. (1984), Fralish (1988b), and Fralish et al. (1991). Braun (1950, p. 145-146) also noted the prominence of black and white oaks in the Ozark Hills and Illinois, the Mammoth Cave area of Kentucky, and throughout the oak-hickory forest region, especially the Mississippi Valley and Prairie Peninsula regions. In the Ozarks, this type may exist, but, based on the recommendations from D. Ladd, T. Nigh, D. Zollner, and B. Heumann, stands are placed either in *Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland (CEGL002150) or in *Quercus velutina - Quercus coccinea - Carya texana* Ozark Forest (CEGL002399). *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011) may be equivalent to this type, at least in northern Missouri (M. Leahy pers. comm. 1999).
Global Similar Associations:

- *Quercus (alba, rubra, velutina) - Carya* spp. / *Viburnum acerifolium* Forest (CEGL006336)
- *Quercus alba - (Quercus velutina) - Carya ovata / Ostrya virginiana* Forest (CEGL002011) This more western oak-hickory type is at or near the range limits of white, black and red oak, and only shagbark hickory is present.
- *Quercus alba - Carya alba - (Quercus velutina) / Desmodium nudiflorum - (Carex picta)* Forest (CEGL007795)
- *Quercus alba - Carya alba / Ostrya virginiana / Carex pensylvanica - Schizachyrium scoparium* Forest (CEGL007818)
- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067) can also be found under environmental conditions which support this community.
- *Quercus alba - Quercus rubra - Quercus muehlenbergii / Cercis canadensis* Forest (CEGL002070)
- *Quercus alba - Quercus stellata - Quercus velutina / Schizachyrium scoparium* Woodland (CEGL002150)
- *Quercus alba - Quercus velutina - Carya alba / Desmodium nudiflorum* Ozark Forest (CEGL004270)
- *Quercus falcata - Quercus alba - Quercus stellata - Quercus velutina* Forest (CEGL005018) is restricted to sandy loam soils in the Interior Low Plateau and Appalachian Plateau.
- *Quercus rubra - Quercus alba - (Quercus velutina, Acer rubrum) / Viburnum acerifolium* Forest (CEGL002462)
- *Quercus velutina - Carya (alba, glabra) / Vaccinium arboreum* Forest (CEGL004987)
- *Quercus velutina - Quercus alba / Vaccinium (angustifolium, pallidum) / Carex pensylvanica* Forest (CEGL005030) is typically on deep sandy substrates.
- *Quercus velutina - Quercus coccinea - Carya texana* Ozark Forest (CEGL002399)
- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078) found on deeper sands, more mono-dominant.

OTHER COMMENTS

Other Comments: Information not available.

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ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Bridle Trail at Bedford Reservation, at Blue Hen Falls, Boston Store and Brandywine Falls, and along Boston Trail at Happy Days, Oak Hill Trail - Plateau Trail, and Wetmore Trail.
Global Range: This oak forest community is found throughout the northern and central midwestern United States and adjacent Canada, ranging from Ohio and Ontario, west to possibly southern Wisconsin, south to northern Missouri, and east to Indiana and Kentucky.
Nations: CA, US
States/Provinces: AR, IA?, IL, IN, KY, MI, MO, OH, ON
TNC Ecoregions: 36:C, 38:C, 44:C, 46:C, 47:C, 48:C, 49:C
USFS Ecoregions (1994/95): 221Fa:CCC, 222Ag:CCC, 222An:CCC, 222Ca:CCC, 222De:CCC, 222Df:CCC, 222Dh:CCP, 222Di:CCP, 222Ek:CCC, 222Em:CCC, 222Fe:CCC, 222Ga:CCC, 222Gb:CCC, 222Gd:CCC, 222Ha:CCC, 222Hb:CCP, 222Hf:CCP, 222Jb:CCP, 222Jg:CCC, 222Jh:CCC, 222Ji:CCP, 222Jj:CCC, 222Kf:CCC, 222Kj:CCC, 231:C, 251Cf:CCC, 251Ci:CCC, 251Cj:CCC, 251Ck:CCC, 251Dc:CCC, 251Dd:CCC, 251Df:CCC, 251Dh:CCP
Federal Lands: NPS (Buffalo River, Cuyahoga Valley, Ozark Riverways); USFS (Shawnee)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FDMO
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (16 plots): CUVA.01, CUVA.02, CUVA.10, CUVA.14, CUVA.15, CUVA.19, CUVA.40, CUVA.45, CUVA.54, CUVA.91, CUVA.93, CUVA.109, CUVA.119, CUVA.144, CUVA.175, CUVA.194.
Local Description Authors: M.J. Russo
Global Description Authors: M. Guetersloh
References: Anderson 1996, Braun 1950, Chapman et al. 1989, Chastain et al. 2006, Clark and Hutchinson 1994, Curtis 1959, Eyre 1980, Faircloth 1971, Foti 1994a, Foti 1994b, Foti et al. 1994, Fralish 1987, Fralish 1988b, Fralish et al. 1991, Gordon 1969, Homoya et al. 1988, INAI unpubl. data, Illinois Nature Preserve Commission 1973, Jenkins and Pallardy 1993, Kost et al. 2007, Kuchler 1964, McNab and Avers 1994, Midwestern Ecology Working Group n.d., Mohlenbrock 1986, Nelson 1985, Nelson 2010, Nigh et al. 2000, ONHD unpubl. data, Robertson et al. 1984, SAF 1967, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, Wharton 1989, White and Madany 1978

M014. Northern Mesic Hardwood & Conifer Forest

G742. Southern & Central Appalachian Northern Hardwoods - Hemlock Forest

East-central Hemlock - Hardwood Forest

***Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia)* Forest**
Eastern Hemlock - American Beech - Sugar Maple / (American Witch-hazel, Mountain Laurel) Forest
Identifier: CEGL005043

ELEMENT CONCEPT

Global Summary: This community is found in parts of the Interior Low Plateau, the Western Allegheny Plateau, and possibly the Central Appalachians of Virginia in the northeastern and east-central United States. Stands occur on dry-mesic to mesic slopes, sometimes in steep-sloped valleys. Soils are typically acidic silty to sandy loams, with a sandstone or shale parent material. The overstory is dominated by *Tsuga canadensis* (eastern hemlock), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Fagus grandifolia* (American beech). Rarely does any one of these comprise more than 50% of the mature trees in a stand. Other trees are common in the canopy, among them *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Carya* (hickory) spp., *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Pinus strobus* (eastern white pine), *Prunus serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Tilia americana* (American basswood). The shrub layer, occasionally sparse, contains *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), and *Viburnum acerifolium* (mapleleaf viburnum), as well as ericaceous shrubs, including *Kalmia latifolia* (mountain laurel) (except in the northern portion of the Western Allegheny Plateau) and *Rhododendron maximum* (great laurel). The ground layer contains the ferns *Botrychium virginianum* (rattlesnake fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polystichum acrostichoides* (Christmas fern), and the herbs *Arisaema triphyllum* (Jack in the pulpit), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Podophyllum peltatum* (mayapple), *Viola blanda* (sweet white violet), and *Viola rotundifolia* (roundleaf yellow violet), among others. Three subtypes are possible: (1) steep-walled sandstone gorges and talus, where *Hydrangea arborescens* (wild hydrangea), *Kalmia latifolia* (mountain laurel), and *Dryopteris marginalis* (marginal woodfern) may be indicative; (2) more gently sloped valleys, with shrubs such as *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum); and (3) rolling lakeplain ridges. The Kentucky examples, which are mesic rather than dry-mesic, may lack *Acer saccharum* (sugar maple), *Maianthemum canadense* (Canada mayflower), and several other species, and may contain *Magnolia* (magnolia) spp. (e.g., *Magnolia tripetala* (umbrella-tree), *Magnolia acuminata* (cucumber-tree), and *Magnolia*

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macrophylla (bigleaf magnolia)) (J. Campbell pers. comm. 2000). In addition, *Betula lenta* (sweet birch) (widespread on Appalachian plateaus) is replaced by *Betula alleghaniensis (var. macrolepis*?) in western Kentucky and southern Indiana.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This hemlock-beech forest was sampled at six locations in the park. The sites range from gentle to steep slopes and summits with mostly northern and western aspects. Soils range from somewhat poorly drained loamy sand to moderately well-drained sandy loam to well-drained silty clay and silt loam. The unvegetated surface is dominated by leaf litter with some downed wood, large and small rocks and bare soil. Evidence of disturbance includes the presence of trails.
Global Environment: Stands occur on dry-mesic to mesic slopes, sometimes in steep-sloped valleys, but also in more gently sloped valleys and rolling lakeplain ridges. Soils are typically acidic, silty to sandy loams, with a sandstone or shale parent material (Anderson 1982). Some Indiana stands occur on limestone (M. Homoya pers. comm. 1999).

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate to dense canopy (60-90% cover), 20-35 m tall, and/or sparse to moderate (20-50%) subcanopy (10-15 m) are dominated by *Tsuga canadensis* (eastern hemlock) and may include *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), and/or *Quercus velutina* (black oak). The very sparse to moderate (10-60%) tall-shrub (2-5 m) layer is also dominated by *Tsuga canadensis* (eastern hemlock), and the sparse (5-10%) short-shrub (1-2 m) layer by *Hamamelis virginiana* (American witch-hazel) and *Viburnum acerifolium* (mapleleaf viburnum). Herbs are sparse but may include *Arisaema triphyllum* (Jack in the pulpit), *Mitchella repens* (partridgeberry), *Parthenocissus quinquefolia* (Virginia creeper), and *Polystichum acrostichoides* (Christmas fern). No exotic species were reported from examples of this community.
Global Vegetation: The overstory is dominated by *Tsuga canadensis* (eastern hemlock), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Fagus grandifolia* (American beech). Rarely does any one of these comprise more than 50% of the mature trees in a stand. Other trees are common in the canopy, among them *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Carya* (hickory) spp., *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Pinus strobus* (eastern white pine), *Prunus serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Tilia americana* (American basswood). The shrub layer, occasionally sparse, contains *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), and *Viburnum acerifolium* (mapleleaf viburnum), as well as ericaceous shrubs, including *Kalmia latifolia* (mountain laurel) and *Rhododendron maximum* (great laurel). The ground layer contains the ferns *Botrychium virginianum* (rattlesnake fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polystichum acrostichoides* (Christmas fern), and the herbs *Arisaema triphyllum* (Jack in the pulpit), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Podophyllum peltatum* (mayapple), *Viola blanda* (sweet white violet), and *Viola rotundifolia* (roundleaf yellow violet), among others. Three subtypes are possible: (1) steep-walled sandstone gorges and talus, where *Hydrangea arborescens* (wild hydrangea), *Kalmia latifolia* (mountain laurel), and *Dryopteris marginalis* (marginal woodfern) may be indicative; (2) more gently sloped valleys, with shrubs such as *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum); and (3) rolling lakeplain ridges (Black and Mack 1976, Anderson 1982). In Virginia, this type would be expected north of the range of *Rhododendron maximum* (great laurel) (G. Fleming pers. comm. 2000). The Kentucky examples, which are mesic rather than dry-mesic, may lack *Acer saccharum* (sugar maple), *Maianthemum canadense* (Canada mayflower), and several other species, and may contain *Magnolia* (magnolia) spp., (e.g., *Magnolia tripetala* (umbrella-tree), *Magnolia acuminata* (cucumber-tree), and *Magnolia macrophylla* (bigleaf magnolia)) (J. Campbell pers. comm. 2000). In addition, *Betula lenta* (sweet birch) (widespread on Appalachian Plateaus) is replaced by *Betula alleghaniensis (var. macrolepis*?) in western Kentucky and southern Indiana.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tall shrub/sapling	Needle-leaved shrub	*Tsuga canadensis* (eastern hemlock)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Hamamelis virginiana* (American witch-hazel), *Mitchella repens* (partridgeberry)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G3? (29-Sep-2004). Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis* (eastern hemlock).

CLASSIFICATION

Status: Standard

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Classification Confidence: 2 - Moderate

Cuyahoga Valley National Park Comments: Information not available.

Global Comments: This type appears to vary from pure evergreen to mixed evergreen-deciduous. Black and Mack (1976) suggest that this type contains more temperate species, such as several *Dryopteris* (woodfern) spp. (*Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern)) and *Viburnum acerifolium* (mapleleaf viburnum) when compared to more northern/boreal types, such as *Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest (CEGL005042), which contains *Clintonia borealis* (bluebead), *Coptis trifolia* (threeleaf goldthread), and *Cornus canadensis* (bunchberry dogwood). One of their subtypes, the steep-walled sandstone gorges and talus, where *Hydrangea arborescens* (wild hydrangea), *Kalmia latifolia* (mountain laurel), and *Dryopteris marginalis* (marginal woodfern) may be indicative, has some conceptual and environmental overlap with *Tsuga canadensis - (Fagus grandifolia*, *Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407) of the southern Cumberland Plateau and Central Appalachians. Related vegetation in Virginia is covered by various other associations.

Global Similar Associations:

- *Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum* Forest (CEGL007543)
- *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum / (Magnolia tripetala)* Forest (CEGL005222)
- *Tsuga canadensis - (Fagus grandifolia, Tilia americana var. heterophylla) / Magnolia tripetala* Forest (CEGL008407)
- *Tsuga canadensis - (Liriodendron tulipifera, Fagus grandifolia) / (Magnolia macrophylla, Ilex opaca) / Polystichum acrostichoides* Forest (CEGL004767)
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109)
- *Tsuga canadensis - Betula alleghaniensis - Prunus serotina / Rhododendron maximum* Forest (CEGL006206)
- *Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest (CEGL005042)
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088)
- *Tsuga canadensis - Quercus prinus - Liriodendron tulipifera / Kalmia latifolia - (Rhododendron catawbiense)* Forest (CEGL008512)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Egbert Loop Trail / Buckeye Trail at Bedford Reservation, at Kendall Ledges, and along Frazee Horse Trail, Old Carriage Trail and Salt Run.

Global Range: This community is found in parts of the Interior Low Plateau and the Western Allegheny Plateau of the northeastern and east-central United States, ranging from Pennsylvania and Ohio, south to Maryland and West Virginia, and westward to a few stands in Indiana and Kentucky. Stands in Indiana and ones in western Kentucky are not part of the continuous range of *Tsuga canadensis* (eastern hemlock).

Nations: US

States/Provinces: IN, KY, MD, OH:S3, PA, WV

TNC Ecoregions: 44:C, 45:C, 48:C, 49:C, 50:?, 59:?, 61:C

USFS Ecoregions (1994/95): 212:C, 221D:CC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ee:CCC, 221Ef:CCC, 221Eg:CCC, 221Fa:CCC, 221Fb:CCC, 221Fc:CCC, 222De:CC?, 222Dj:CCC, 222Ek:CCC, 222Em:CCC, 222Hb:CCC, 222Hf:CCC

Federal Lands: NPS (Cuyahoga Valley, Mammoth Cave); USFS (Wayne); USFWS (Erie)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FHBM

Cuyahoga Valley National Park Inventory Notes: Information not available.

Cuyahoga Valley National Park Plots and Observation Points: (6 plots): CUVA.03, CUVA.43, CUVA.82, CUVA.124, CUVA.127, CUVA.149.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen

References: Anderson 1982, Badger et al. 1997, Black and Mack 1976, Campbell pers. comm., Eastern Ecology Working Group n.d., Fike 1999, Fleming pers. comm., Harrison 2004, Harrison 2011, Homoya et al. 1988, Homoya pers. comm., ONHD unpubl. data, Pyne et al. 2010

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1.B.3. Temperate Flooded & Swamp Forest

1.B.3.Na. Eastern North American Flooded & Swamp Forest

M503. Central & Appalachian Swamp Forest

G597. Central Flatwoods & Pond Forest

Northern (Great Lakes) Flatwoods

***Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest**
Pin Oak - Swamp White Oak - Red Maple Flatwoods Forest
Identifier: CEGL005037

ELEMENT CONCEPT

Global Summary: This pin oak - swamp white oak flatwoods is found in the midwestern United States and adjacent Canada near Lake Michigan and Lake Erie. Stands occur on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. There is a layer of acidic sand over a layer of impermeable or nearly impermeable clay resulting in a shallow, perched water table. Ponding is common during the wet seasons and droughts in the summer, leading to a complex of forest upland and wetland species. Deciduous hardwoods and softwoods predominate. Diagnostic species include *Quercus bicolor* (swamp white oak), *Quercus ellipsoidalis* (northern pin oak), *Quercus palustris* (pin oak), and *Acer rubrum* (red maple). Other associates include *Ilex verticillata* (common winterberry) and *Ulmus americana* (American elm). The herbaceous layer, which can be sparse, contains *Carex muskingumensis* (Muskingum sedge), *Glyceria striata* (fowl mannagrass), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), and *Osmunda cinnamomea* (cinnamon fern).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This pin oak - swamp white oak forest was sampled three times in the park. The sites are gentle lower slope and lowland flat. The former site has moderately well-drained silt loam soil, while the other is described as having somewhat poorly drained, saturated silty clay soil. The unvegetated surface is dominated by leaf litter with some downed wood and bare soil. Evidence of disturbance includes deer browse, past clearing, and the presence of trails and exotic species.
Global Environment: This type is found on glaciated plains in the midwestern United States. This community occurs on poorly drained uplands or in depressions on level glacial lakeplains or outwash plains. There is a layer of acidic sand over a layer of impermeable or nearly impermeable clay resulting in a shallow, perched water table. Ponding is common during the wet seasons. In the dry months, the clay layer prevents water from moving up to the surface by capillary action from deeper, more moist soil. Thus, the soil moisture fluctuates widely over the year (White and Madany 1978, Homoya et al. 1988).

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderately dense canopy (50-70% cover), 20-35 m tall, is dominated by *Quercus palustris* (pin oak) and/or *Quercus bicolor* (swamp white oak); additional species found at lower cover may include *Acer rubrum* (red maple), *Prunus serotina* (black cherry), and *Quercus rubra* (northern red oak). *Ulmus americana* (American elm) may dominate a sparse (10-40%) subcanopy (10-15 m). The sparse to moderate (20-70%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers can include *Acer rubrum* (red maple), *Carya cordiformis* (bitternut hickory), *Cornus amomum* (silky dogwood), *Fraxinus pennsylvanica* (green ash), *Rhamnus cathartica* (common buckthorn) (exotic), and *Viburnum dentatum* (southern arrow-wood). Herbs are sparse.
Global Vegetation: Deciduous hardwoods and softwoods predominate. Diagnostic species include *Quercus bicolor* (swamp white oak), *Quercus ellipsoidalis* (northern pin oak), *Quercus palustris* (pin oak), and *Acer rubrum* (red maple). Other associates include *Ilex verticillata* (common winterberry) and *Ulmus americana* (American elm). The herbaceous layer, which can be sparse, contains *Carex muskingumensis* (Muskingum sedge), *Glyceria striata* (fowl mannagrass), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), and *Osmunda cinnamomea* (cinnamon fern) (White and Madany 1978, Homoya et al. 1988, Pat Comer pers. comm. 1997).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Cornus amomum* (silky dogwood)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Quercus bicolor* (swamp white oak), *Quercus ellipsoidalis* (northern pin oak), *Quercus palustris* (pin oak)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.

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Global: *Acer rubrum* (red maple), *Quercus bicolor* (swamp white oak), *Quercus ellipsoidalis* (northern pin oak), *Quercus palustris* (pin oak)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)

Global: Other: *Cephalanthus occidentalis* (common buttonbush, This field has not been reviewed., G5), *Cornus racemosa* (gray dogwood, This field has not been reviewed., G5?), *Cornus sericea* ssp. *sericea* (red-osier dogwood, This field has not been reviewed., G5T5), *Fraxinus pennsylvanica* (green ash, This field has not been reviewed., G5), *Ilex verticillata* (common winterberry, This field has not been reviewed., G5), *Photinia melanocarpa* (black chokeberry, This field has not been reviewed., G5), *Populus deltoides* (eastern cottonwood, This field has not been reviewed., G5), *Salix humilis* (prairie willow, This field has not been reviewed., G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G2G3 (22-Jun-1998). There are probably fewer than 100 occurrences of this community rangewide. It is reported from Ohio (where it is ranked S3), Indiana (S2), Illinois (S2), Ontario (S?), and Michigan (S?). Currently there are 19 occurrences documented from Illinois, Indiana, Ohio, and Michigan. This community has moderately restricted environmental requirements. Many sites of this community have been drained or cleared.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Cuyahoga Valley National Park Comments: Information not available.

Global Comments: This type is found on glaciated plains in the Midwest. The terms "swamp" and "flatwoods" may overlap (see e.g., Lee et al. 1998, who include flatwoods types in their swamp category). These terms need clarification. In Indiana, stands may also be related to the lakeplain oak opening type, *Quercus macrocarpa - Quercus palustris - Quercus bicolor / Calamagrostis canadensis* Wooded Herbaceous Vegetation (CEGL005120). In Michigan this type occurs only in Calhoun County. Ontario sands on the clayplain of the Niagara Peninsula should be compared with *Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005173).

Global Similar Associations:

- *Fagus grandifolia - Acer saccharum - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005173) contains beech and extends into central Indiana and western Ohio.
- *Quercus macrocarpa - Quercus palustris - Quercus bicolor / Calamagrostis canadensis* Wooded Herbaceous Vegetation (CEGL005120)
- *Quercus palustris - (Quercus stellata) - Quercus pagoda / Isoetes* spp. Forest (CEGL002101)
- *Quercus palustris - Quercus bicolor - (Liquidambar styraciflua)* Mixed Hardwood Forest (CEGL002432)
- *Quercus palustris - Quercus bicolor - Nyssa sylvatica - Acer rubrum* Sand Flatwoods Forest (CEGL002100) is a sand flatwoods.
- *Quercus phellos - (Quercus lyrata) / Carex* spp. - *Leersia* spp. Forest (CEGL002102)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Furnace Run at Black Road and along Chestnut Pond Plateau Trail near the Valley Picnic Area.

Global Range: This pin oak - swamp white oak flatwoods is found in the midwestern United States and Canada near Lake Michigan and Lake Erie, ranging from northern Illinois, northern Indiana, northern Ohio, and southeastern Michigan, to southern Ontario.

Nations: CA, US

States/Provinces: IL:S2, MI, OH, ON

TNC Ecoregions: 45:C, 46:C, 48:C, 49:C

USFS Ecoregions (1994/95): 221Fa:CCC, 221Fb:CCC, 222Ha:CCC, 222Hb:CCC, 222Ia:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Kj:CCC

Federal Lands: NPS (Cuyahoga Valley, Indiana Dunes)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FOSW

Cuyahoga Valley National Park Inventory Notes: Information not available.

Cuyahoga Valley National Park Plots and Observation Points: (3 plots): CUVA.38, CUVA.103, CUAV.188.

Local Description Authors: M.J. Russo

Global Description Authors: J. Drake, D. Faber-Langendoen, and D. Ambrose

References: Comer pers. comm., Cowardin et al. 1979, Homoya et al. 1988, Hop et al. 2009, Madany 1981, Midwestern Ecology Working Group n.d., ONHD unpubl. data, White and Madany 1978

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M302. Eastern North American Ruderal Flooded & Swamp Forest

G552. Northern & Central Ruderal Flooded & Swamp Forest

Tuliptree - Elm - Ash Forest

***Liriodendron tulipifera* - *Ulmus* spp. - *Fraxinus pennsylvanica* Forest [Park Special]**
Tuliptree - Elm species - Green Ash Forest
Identifier: CEPS006684

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This successional tuliptree - elm - black cherry forest was sampled at seven locations in the park. The sites are gentle lowslopes and summits with somewhat poorly drained to well-drained loam, silty clay and silt loam soils. The unvegetated surface is dominated by leaf litter with some downed wood and bare soil. Evidence of disturbance includes deer browse and the presence of trails and exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate canopy (50-70% cover), 15-20+ m tall, is dominated by *Liriodendron tulipifera* (tuliptree) and may contain *Fraxinus americana* (white ash), *Prunus serotina* (black cherry), *Prunus virginiana* (chokecherry), *Ulmus americana* (American elm), and/or *Ulmus rubra* (slippery elm), which also make up the sparse to moderate (20-60%) subcanopy (5-15 m). The sparse (5-40%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers include *Crataegus* (hawthorn) spp., *Lindera benzoin* (northern spicebush), and several exotic species, most notably *Ligustrum sinense* (Chinese privet) and *Rosa multiflora* (multiflora rose). Common and/or abundant species in the herbaceous layer (10-50%) include *Geum canadense* (white avens), *Impatiens capensis* (jewelweed), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonum virginianum* (jumpseed), *Polystichum acrostichoides* (Christmas fern), *Verbesina alternifolia* (wingstem), and *Viola canadensis* (Canadian white violet). In addition, this community supports Ohio state-imperiled *Phaseolus polystachios* (thicket bean).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Ulmus americana* (American elm), *Ulmus rubra* (slippery elm)
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rosa multiflora* (multiflora rose)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Geum canadense* (white avens), *Impatiens capensis* (jewelweed), *Liriodendron tulipifera* (tuliptree), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonum virginianum* (jumpseed), *Polystichum acrostichoides* (Christmas fern), *Rosa multiflora* (multiflora rose)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Phaseolus polystachios* (thicket bean, Ohio state-imperiled, G5); **Invasive/Exotic**: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Duchesnea indica* (Indian strawberry, invasive/exotic, Low/Insignificant), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera japonica* (Japanese honeysuckle, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Myrrhis odorata* (anise, invasive/exotic), *Nepeta cataria* (catnip, invasive/exotic), *Picea abies* (Norway spruce, invasive/exotic), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: This association represents disturbed wet-mesic forested sites at CUVA.
Global Comments: Information not available.

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OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at Hampton Hills and along Salt Run Trail and Tree Farm Trail.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSFH
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (7 plots): CUVA.26, CUVA.29, CUVA.70, CUVA.78, CUVA.178, CUVA.190, CUVA.193.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Sycamore - Walnut Forest

***Platanus occidentalis - Juglans nigra - (Fraxinus americana)* Forest [Park Special]**
American Sycamore – Black Walnut – (White Ash) Forest
Identifier: CEPS006688

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This American sycamore forest was sampled at 14 locations in the park. The sites are gently sloping lowlands and flat basins near streams that may occasionally flood. Soils are somewhat poorly drained to well-drained clay loam, loam, sandy loam, loamy sand, and silt loam. The unvegetated surface is dominated by leaf litter with some downed wood and occasional large and small rocks and bare soil. Evidence of disturbance includes deer browse, altered hydrology, and the presence of trails and exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The sparse to dense canopy (40-80% cover), 20-35 m tall, is dominated by *Platanus occidentalis* (American sycamore); additional species may include *Juglans nigra* (black walnut), *Populus deltoides* (eastern cottonwood), *Prunus serotina* (black cherry), and *Ulmus americana* (American elm). The sparse to moderate (20-70%) subcanopy (10-15 m) may contain *Acer negundo* (box-elder), *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), *Aesculus glabra* (Ohio buckeye), *Fagus grandifolia* (American beech), and/or *Ulmus americana* (American elm). The very sparse to moderate (5-50%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers are made up of canopy and subcanopy species along with *Lindera benzoin* (northern spicebush). The herb layer is sparse (up to 40%) to nearly absent; common and/or abundant species include *Alliaria petiolata* (garlic mustard) (exotic), *Allium tricoccum* (ramp), *Arisaema triphyllum* (Jack in the pulpit), *Circaea lutetiana* (broadleaf enchanter's nightshade), *Impatiens capensis* (jewelweed), *Onoclea sensibilis* (sensitive fern), *Parthenocissus quinquefolia* (Virginia creeper), *Polygonum virginianum* (jumpseed), *Toxicodendron radicans* (eastern poison-ivy), and *Verbesina alternifolia* (wingstem). In addition, this community supports Ohio state-critically imperiled *Galium palustre* (common marsh bedstraw) and state-imperiled *Actaea rubra* (red baneberry).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Platanus occidentalis* (American sycamore)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Alliaria petiolata* (garlic mustard), *Allium tricoccum* (ramp), *Arisaema triphyllum* (Jack in the pulpit), *Circaea lutetiana* (broadleaf enchanter's nightshade), *Impatiens capensis* (jewelweed), *Lindera benzoin* (northern spicebush), *Platanus occidentalis* (American sycamore), *Polygonum virginianum* (jumpseed)

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Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Actaea rubra* (red baneberry, Ohio state-imperiled, G5), *Galium palustre* (common marsh bedstraw, Ohio state-critically imperiled, G5); **Invasive/Exotic**: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Euonymus fortunei* (winter creeper, invasive/exotic, High/Medium), *Galium mollugo* (false baby's breath, invasive/exotic), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Hesperis matronalis* (dames rocket, invasive/exotic, Medium/Low), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Myrrhis odorata* (anise, invasive/exotic), *Nepeta cataria* (catnip, invasive/exotic), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Urtica dioica* (stinging nettle, invasive/exotic), *Vinca minor* (common periwinkle, invasive/exotic, Low)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: This association represents disturbed wet-mesic floodplain forests at CUVA.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Towpath Trail including at Beaver Marsh and Stumpy Basin, along Buckeye and Hemlock Creek trails at Bedford Reservation, at Br 4 and Br 3 at Brecksville Reservation, at Hampton Hills, along Buckeye and Valley Bridle trails at Pine Lane, and along Salt Run Trail - Lake Trail.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FFCS
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (14 plots): CUVA.06, CUVA.09, CUVA.28, CUVA.42, CUVA.48, CUVA.50, CUVA.81, CUVA.115, CUVA.116, CUVA.130, CUVA.139, CUVA.168, CUVA.172, CUVA.192.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Successional Cottonwood Forest

***Populus deltoides* Early-Successional Semi-natural Forest [Park Special]**
Eastern Cottonwood Early-Successional Semi-natural Forest
Identifier: CEPS006689

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This eastern cottonwood early-successional semi-natural forest was sampled at two locations in the park. The sites are gently sloping uplands with poorly drained clay loam soils. The unvegetated surface is dominated by leaf litter with some downed wood. Evidence of disturbance includes the presence of numerous exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate canopy (50-70% cover), 10-20 m tall, is dominated by *Populus deltoides* (eastern cottonwood); *Carya laciniosa* (shellbark hickory) codominates in one stand. Additional tree species found at lower cover include *Fraxinus americana* (white ash), *Salix nigra* (black willow), and *Ulmus americana* (American elm). Shrubs are sparse. Herbs (70-90%) are a mix of native and exotic species that includes *Agrostis gigantea* (redtop), *Alliaria petiolata* (garlic mustard),

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Apocynum cannabinum (Indianhemp), *Carex cristatella* (crested sedge), *Cirsium arvense* (Canada thistle), *Juncus* (rush) sp., *Cicuta maculata* (spotted water hemlock), *Scirpus cyperinus* (woolgrass), and *Solidago canadensis* (Canada goldenrod).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya laciniosa* (shellbark hickory), *Populus deltoides* (eastern cottonwood)
Herb (field)	Forb	*Cicuta maculata* (spotted water hemlock), *Solidago canadensis* (Canada goldenrod)
Herb (field)	Graminoid	*Scirpus cyperinus* (woolgrass)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Cirsium arvense* (Canada thistle, invasive/exotic, High/Medium), *Elaeagnus angustifolia* (Russian olive, invasive/exotic, High), *Lonicera japonica* (Japanese honeysuckle, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Lysimachia nummularia* (creeping jenny, invasive/exotic, Medium/Low), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Taraxacum officinale* (common dandelion, invasive/exotic)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at Terra Vista Natural Study Area.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSEC
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (2 plots): CUVA.27, CUVA.154.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

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M029. Northern & Central Floodplain Forest & Scrub

G041. Eastern Cottonwood - Black Willow Floodplain Forest

Midwestern Cottonwood - Black Willow Forest

***Populus deltoides - Salix nigra* Forest**
Eastern Cottonwood - Black Willow Forest
Identifier: CEGL002018

ELEMENT CONCEPT

Global Summary: This cottonwood - black willow forest is characteristic of the fronts and banks of most major rivers and streams throughout the Central Forest Region, extending into the northern forest particularly within the Mississippi, Ohio, and Missouri River systems. It develops on bare, moist soil on recently formed sand bars, front-land ridges, and well-drained flats, along with *Salix interior* (sandbar willow), *Eragrostis hypnoides* (teal lovegrass), *Leptochloa panicea ssp. brachiata* (mucronate sprangeltop), *Lipocarpha micrantha* (smallflower halfchaff sedge), *Rumex maritimus* (golden dock), *Potentilla paradoxa* (Paradox cinquefoil), and *Bidens* (beggarticks) spp. This natural community can also be found on abandoned fields and well-drained ridges in the first bottoms. Soils are formed in alluvium, are deep, medium-textured, and with adequate or excessive moisture available for vegetation during the growing season. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* (eastern cottonwood) and *Salix nigra* (black willow), although *Fraxinus pennsylvanica* (green ash), *Acer saccharinum* (silver maple), *Acer negundo* (box-elder), *Platanus occidentalis* (American sycamore), and *Ulmus americana* (American elm) are also commonly encountered. Tree diversity is limited due to the dynamics of flooding and resultant deposition and scouring of sediments. The subcanopy is almost exclusively *Salix nigra* (black willow). The shrub layer is conspicuously absent in many parts of the range. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Species most often encountered in the ground layer include *Carex* (sedge) spp., *Leersia oryzoides* (rice cutgrass), *Bidens* (beggarticks) spp., and Asteraceae spp.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This eastern cottonwood forest was sampled six times in the park. The sites are seasonally flooded lowlands adjacent to streams. The soil is moderately well-drained silt loam or well-drained sand. The unvegetated surface is dominated by leaf litter with small amounts of downed wood, rocks and bare sand. Evidence of disturbance includes deer browse, flooding, and the presence of exotic species.
Global Environment: This community is quick to colonize newly deposited substrates adjacent to rivers, lakes, streams, and in frequently flooded, low, wet depressions in floodplains. Dynamic substrate availability caused by frequent flooding encourages the establishment and maintenance of this community type.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate (50-60% cover) canopy, 20-35 m tall, is dominated by *Populus deltoides* (eastern cottonwood); additional species found at lower cover include *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), and *Platanus occidentalis* (American sycamore). The sparse to moderate (30-50%) subcanopy (10-15 m) includes *Carpinus caroliniana* (American hornbeam), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Shrubs are sparse (10-30%) and made up of species from the canopy and subcanopy. Herbs may be dense (up to 70%); common and/or abundant species include *Circaea lutetiana* (broadleaf enchanter's nightshade), *Geum canadense* (white avens), *Laportea canadensis* (Canadian woodnettle), *Verbesina alternifolia* (wingstem), and exotics *Lysimachia nummularia* (creeping jenny) and *Urtica dioica* (stinging nettle).
Global Vegetation: This community is dominated by broadleaf deciduous trees. Canopy closure is complete, or nearly so, with few shrubs and limited tree species found in the type. The tree canopy is tall (to 30 m) and dominated by *Populus deltoides* (eastern cottonwood) and *Salix nigra* (black willow), although *Fraxinus pennsylvanica* (green ash), *Acer saccharinum* (silver maple), *Acer negundo* (box-elder), *Platanus occidentalis* (American sycamore), and *Ulmus americana* (American elm) are also commonly encountered. Tree diversity is limited due to the dynamics of flooding and deposition/scouring of sediments. The subcanopy is almost exclusively *Salix nigra* (black willow). The shrub layer is conspicuously absent in many parts of the range. Herbaceous growth can be thick and lush but is often patchy and sparse due to frequent inundation. Species most often encountered in the ground layer include *Carex* (sedge) spp., *Leersia oryzoides* (rice cutgrass), *Bidens* (beggarticks) spp., and Asteraceae spp. (TNC 1995a).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus deltoides* (eastern cottonwood)
Herb (field)	Forb	*Arisaema triphyllum* (Jack in the pulpit), *Geum canadense* (white avens)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus deltoides* (eastern cottonwood), *Salix nigra* (black willow)
Tree subcanopy	Broad-leaved deciduous tree	*Salix nigra* (black willow)

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Herb (field)	Forb	*Bidens aristosa* (bearded beggarticks), *Spermacoce glabra* (smooth false buttonweed), *Symphyotrichum lanceolatum* var. *lanceolatum* (white panicle aster), *Symphyotrichum lateriflorum* var. *lateriflorum* (calico aster)
Herb (field)	Graminoid	*Carex typhina* (cattail sedge), *Leersia oryzoides* (rice cutgrass)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Carpinus caroliniana* (American hornbeam), *Laportea canadensis* (Canadian woodnettle), *Ulmus rubra* (slippery elm)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Hesperis matronalis* (dames rocket, invasive/exotic, Medium/Low), *Lysimachia nummularia* (creeping jenny, invasive/exotic, Medium/Low), *Myrrhis odorata* (anise, invasive/exotic), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Vulnerable: *Macrochelys temminckii* (alligator snapping turtle, G3G4), *Vermivora bachmanii* (bachman's warbler, GH);
Other: *Acris gryllus* (southern cricket frog, G5), *Agkistrodon piscivorus* (cottonmouth, G5), *Aix sponsa* (wood duck, G5), *Ambystoma maculatum* (spotted salamander, G5), *Ardea alba* (great egret, G5), *Ardea herodias* (great blue heron, G5), *Buteo brachyurus* (short-tailed hawk, G4G5), *Buteo lineatus* (red-shouldered hawk, G5), *Butorides virescens* (green heron, G5), *Coccyzus americanus* (yellow-billed cuckoo, G5), *Didelphis virginiana* (virginia opossum, G5), *Egretta caerulea* (little blue heron, G5), *Euphagus carolinus* (rusty blackbird, G4), *Gallinago gallinago* (common snipe, G5), *Hyla avivoca* (bird-voiced treefrog, G5), *Hyla cinerea* (green treefrog, G5), *Ictinia mississippiensis* (mississippi kite, G5), *Limenitis archippus* (viceroy, G5), *Limnothlypis swainsonii* (swainson's warbler, G4), *Lithobates sphenocephalus* (southern leopard frog, G5), *Lontra canadensis* (north american river otter, G5), *Megaceryle alcyon* (belted kingfisher, G5), *Melanerpes carolinus* (red-bellied woodpecker, G5), *Melanerpes erythrocephalus* (red-headed woodpecker, G5), *Mniotilta varia* (black-and-white warbler, G5), *Mycteria americana* (wood stork, G4), *Myiarchus crinitus* (great crested flycatcher, G5), *Neovison vison* (american mink, G5), *Nyctanassa violacea* (yellow-crowned night-heron, G5), *Nycticorax nycticorax* (black-crowned night-heron, G5), *Nymphalis antiopa* (mourning cloak, G5), *Odocoileus virginianus* (white-tailed deer, G5), *Oryzomys palustris* (marsh oryzomys, G5), *Peromyscus gossypinus* (cotton deermouse, G5), *Phalacrocorax auritus* (double-crested cormorant, G5), *Polioptila caerulea* (blue-gray gnatcatcher, G5), *Procyon lotor* (raccoon, G5), *Quiscalus quiscula* (common grackle, G5), *Reithrodontomys humulis* (eastern harvest mouse, G5), *Scolopax minor* (american woodcock, G5), *Setophaga americana* (northern parula, G5), *Setophaga dominica* (yellow-throated warbler, G5), *Setophaga ruticilla* (american redstart, G5), *Sigmodon hispidus* (hispid cotton rat, G5), *Strix varia* (barred owl, G5), *Sylvilagus aquaticus* (swamp rabbit, G5), *Sylvilagus palustris* (marsh rabbit, G5), *Toxicodendron radicans* (eastern poison-ivy, G5), *Vireo olivaceus* (red-eyed vireo, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (22-Jun-1998). The current range of this community is much smaller than the presettlement range due to extensive logging, ditching, draining, and land clearing for conversion to croplands. The reduced waterflows and channelization of rivers decreases the frequency of natural floods necessary for the scouring and deposition of new substrates that favor cottonwood regeneration.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: The name of the community must have an additional species added to highlight the distinction between this and *Populus deltoides - Salix nigra / Mikania scandens* Forest (CEGL007346). Kentucky occurrences are intermediate between the two. This type does not occur in Nebraska, where *Salix nigra* (black willow) is a very uncommon tree species. In fact it is thought to have been incorrectly reported as more widespread in the state because it can be confused with *Salix amygdaloides* (peachleaf willow) (G. Steinauer pers. comm. 2000).
Global Similar Associations:

- *Acer saccharinum - Ulmus americana* Forest (CEGL002586)
- *Populus deltoides - Salix nigra / Mikania scandens* Forest (CEGL007346) occurs in the southeastern United States.
- *Populus deltoides - Salix nigra* Woodland (CEGL004919)
- *Salix nigra* Forest (CEGL002103) a *Salix nigra*-dominated community.
- *Salix nigra* Temporarily Flooded Shrubland (CEGL003901) a *Salix nigra*-dominated community.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at Bedford Reservation.

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Global Range: This cottonwood - black willow forest is characteristic of the fronts and banks of most major rivers and streams throughout the Central Forest Region, extending into the northern forest particularly within the Mississippi, Ohio, and Missouri River systems, extending from Ohio west to Minnesota, southward to Oklahoma, and east to Kentucky.
Nations: US
States/Provinces: AR?, IA:SU, IL, IN, KS:SU, KY, MN, MO, NE:S2, OH, OK, WI:S3, WY
TNC Ecoregions: 35:C, 36:C, 37:C, 38:P, 39:?, 42:C, 43:C, 44:C, 46:C, 48:C, 49:C
USFS Ecoregions (1994/95): 221Fa:CCC, 222Ad:CP?, 222Ae:CP?, 222C:CP, 222D:CP, 222E:CP, 222F:CP, 222G:CP, 222H:CP, 222I:CP, 222Jj:CCC, 222K:CC, 222Lf:CCC, 222Mb:CCC, 222Me:CCC, 231A:PP, 231B:PP, 231E:PP, 231F:PP, 231G:PP, 232B:PP, 232C:PP, 234A:PP, 251Ba:CCC, 251Bb:CCC, 251Cd:CC?, 251Cg:CCC, 251D:CP
Federal Lands: NPS (Cuyahoga Valley, Effigy Mounds?, Fort Larned, Indiana Dunes, Saint Croix); USFS (St. Francis?)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FFCS
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (6 plots): CUVA.66, CUVA.143, CUVA.157, CUVA.184, CUVA.209, CUVA.220.
Local Description Authors: M.J. Russo
Global Description Authors: M. Guetersloh, mod. D. Faber-Langendoen
References: Braun 1950, Bruner 1931, Cogan 2007b, Collins et al. 1981, Cowardin et al. 1979, Evans 1991, Evans et al. 2009, Eyre 1980, Faber-Langendoen 2001, Galloway 1963, Galloway 1964, Hefley 1937, Hoagland 2000, Homoya et al. 1988, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Kuchler 1964, Lauver et al. 1999, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, Nelson 1985, Nelson 2010, ONHD unpubl. data, Rogers 1953, SAF 1967, Steinauer and Rolfsmeier 2000, TNC 1985, TNC 1995a, UNESCO 1973, Voigt and Mohlenbrock 1964, WNDD unpubl. data, WNHI 2011, WNHIP unpubl. data, Ware and Penfound 1949, White and Madany 1978, Zanoni et al. 1979

G652. Silver Maple - Green Ash - Sycamore - Hackberry Floodplain Forest

Silver Maple - Elm Forest

***Acer saccharinum - Ulmus americana* Forest**
Silver Maple - American Elm Forest
Identifier: CEGL002586

ELEMENT CONCEPT

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

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This silver maple forest was sampled once in the park. The site is an intermittently flooded flat with poorly drained clay soil. The unvegetated surface is dominated by leaf litter with some downed wood and bare soil. Evidence of disturbance includes trash and the presence of trails and exotic species.
Global Environment: This community occurs on temporarily flooded soils along major rivers and smaller perennial streams. Soils may be well-drained and sandy, more loamy on infrequently flooded bottomlands and levees, or deep silts on stabilized sites along larger rivers. It appears to be favored by deposition of deep sandy sediments by low-energy floodwaters. The community may form small linear patches among other floodplain associations or be locally extensive. The structure and composition of the type is influenced by the flooding regime. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

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VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate canopy (60% cover), 15-20 m tall, is dominated by *Acer saccharinum* (silver maple) and *Salix nigra* (black willow). The very sparse (10%) subcanopy (5-10 m) contains *Acer negundo* (box-elder). Shrubs are absent. The herb layer is dominated by exotics *Lysimachia nummularia* (creeping jenny), *Pennisetum glaucum* (pearl millet), *Sorghum halepense* (Johnsongrass), and *Urtica dioica* (stinging nettle).

Global Vegetation: The canopy cover is more-or-less closed and dominated by *Acer saccharinum* (silver maple). Codominants may include *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and rarely *Acer saccharum* (sugar maple). Associated species may include *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Acer negundo* (box-elder), *Salix nigra* (black willow), *Celtis occidentalis* (common hackberry), *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), *Fraxinus pennsylvanica* (green ash), and occasionally *Halesia tetraptera* (mountain silverbell). The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis* (common elderberry), *Rubus occidentalis* (black raspberry), or *Lindera benzoin* (northern spicebush). Woody and herbaceous vines can be prominent, including among the woody vines *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). Herbaceous vine species include *Apios americana* (groundnut), *Amphicarpaea bracteata* (American hogpeanut), and *Echinocystis lobata* (wild cucumber). Grasses, forbs, and ferns dominate the ground layer, including various combinations of *Symphyotrichum lateriflorum* (calico aster), *Boehmeria cylindrica* (small-spike false nettle), *Chasmanthium latifolium* (Indian woodoats), *Cryptotaenia canadensis* (Canadian honewort), *Erythronium americanum* (dogtooth violet), *Solidago gigantea* (giant goldenrod), *Cinna arundinacea* (sweet woodreed), *Leersia virginica* (whitegrass), *Elymus virginicus* (Virginia wildrye), *Helianthus* (sunflower) sp., *Impatiens capensis* (jewelweed), *Impatiens pallida* (pale touch-me-not), *Laportea canadensis* (Canadian woodnettle), *Matteuccia struthiopteris* (ostrich fern), *Menispermum canadense* (common moonseed), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Polygonum virginianum* (jumpseed), *Rudbeckia laciniata* (cutleaf coneflower), *Verbesina alternifolia* (wingstem), *Urtica dioica* (stinging nettle), and others. A variety of exotics may be present, including *Lysimachia* (yellow loosestrife) spp., *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), *Polygonum cuspidatum* (Japanese knotweed), *Rosa multiflora* (multiflora rose), and *Lonicera japonica* (Japanese honeysuckle).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharinum* (silver maple), *Salix nigra* (black willow)
Tree subcanopy	Broad-leaved deciduous tree	*Acer negundo* (box-elder)

Global

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharinum* (silver maple)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Graminoid	*Leersia virginica* (whitegrass)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Acer saccharinum* (silver maple)

Global: *Acer negundo* (box-elder), *Acer saccharinum* (silver maple), *Alliaria petiolata* (garlic mustard), *Conium maculatum* (poison hemlock), *Elymus virginicus* (Virginia wildrye), *Glechoma hederacea* (ground ivy), *Humulus japonicus* (Japanese hop), *Populus deltoides* (eastern cottonwood), *Urtica dioica* ssp. *gracilis* (California nettle)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Hesperis matronalis* (dames rocket, invasive/exotic, Medium/Low), *Lysimachia nummularia* (creeping jenny, invasive/exotic, Medium/Low), *Myosotis scorpioides* (true forget-me-not, invasive/exotic), *Pennisetum glaucum* (pearl millet, invasive/exotic), *Sorghum halepense* (Johnsongrass, invasive/exotic, High/Medium), *Urtica dioica* (stinging nettle, invasive/exotic)

Global: Invasive/Exotic: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Conium maculatum* (poison hemlock, invasive/exotic, Medium/Low), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Humulus japonicus* (Japanese hop, invasive/exotic, Medium/Low), *Lonicera japonica* (Japanese honeysuckle, invasive/exotic, High/Medium), *Microstegium vimineum* (Nepalese browntop, invasive/exotic, High/Medium), *Polygonum cuspidatum* (Japanese knotweed, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low); **Other**: *Matteuccia struthiopteris* (ostrich fern, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996). There has been significant conversion of stands to agriculture, hydrologic modifications due to river dams, etc., and siltation caused by modified flooding regimes.

CLASSIFICATION

Status: Standard

Classification Confidence: 2 - Moderate

Cuyahoga Valley National Park Comments: Information not available.

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Global Comments: This type includes stands where *Acer saccharinum* (silver maple) represents the majority of trees (>50% cover or basal area?). This type is most clearly expressed on larger rivers. To some degree this type is more northern, separable from the more southern type *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431), but this distinction is not yet well resolved. In the southern parts of its range, this type may overlap with *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334), but that type is generally a higher terrace, small stream type. Compare this type with SAF cover type 62 (Eyre 1980). In Minnesota stands with less than either 50% cottonwood or silver maple and not in northwestern Minnesota tend to occur here (i.e., a mixed floodplain forest), as do silver maple stands with a supercanopy of cottonwoods. In southwestern Minnesota, stands with only some swamp white oak go here. If swamp white oak is dominant the stands probably belong with either an association in the *Quercus palustris - (Quercus bicolor)* Seasonally Flooded Forest Alliance (A.329), or *Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia* spp. - *Cinna* (woodreed) spp. Forest (CEGL002098), at least in the Midwest. *Fraxinus pennsylvanica* (green ash) is a typical codominant in this type. In Wisconsin, this type may better be named *Acer saccharinum - Fraxinus pennsylvanica - Betula nigra* Forest (E. Epstein pers. comm. 1999).

Global Similar Associations:

- *Acer (rubrum, saccharinum) - Fraxinus* spp. - *Ulmus americana* Forest (CEGL005038) grades into this community in backwater swamps.
- *Acer saccharinum - (Populus deltoides) / Matteuccia struthiopteris - Laportea canadensis* Forest (CEGL006147) is somewhat more northern, lacking *Platanus* and *Betula nigra*.
- *Acer saccharinum - Acer negundo / Ageratina altissima - Laportea canadensis - (Elymus virginicus)* Forest (CEGL006217)
- *Acer saccharinum - Betula nigra / Cephalanthus occidentalis* Forest (CEGL007810)
- *Acer saccharinum - Celtis laevigata - Carya illinoinensis* Forest (CEGL002431) is more southern.
- *Acer saccharinum* Temporarily Flooded Forest [Placeholder] (CEGL007304)
- *Fagus grandifolia - Quercus* spp. - *Acer rubrum - Juglans nigra* Forest (CEGL005014) in the eastern part of its range on the mesic side.
- *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest (CEGL002089) in the western part of its range on the mesic side.
- *Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* Forest (CEGL002014)
- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334) may overlap in southern parts of the range of CEGL002586.
- *Populus deltoides - Salix nigra* Forest (CEGL002018) grades into this community on the wetter side.
- *Quercus macrocarpa - Quercus bicolor - Carya laciniosa / Leersia* spp. - *Cinna* spp. Forest (CEGL002098)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Towpath Trail.

Global Range: This association is found throughout the midwestern United States and in the mid-Atlantic region of the eastern United States, ranging from Delaware, New Jersey, and Pennsylvania west to Minnesota, and south to Arkansas.

Nations: CA, US

States/Provinces: AR, DE, IA:SU, IL, IN, KY, MI, MN, MO, NJ, NY, OH, ON, PA, QC?, TN, WI:S3, WV:S3S4

TNC Ecoregions: 35:C, 36:C, 37:C, 38:C, 40:?, 42:C, 43:P, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 60:C, 61:C, 62:C

USFS Ecoregions (1994/95): 212Fc:CCC, 212Hb:CCC, 212He:CCC, 212Hm:CCC, 212Ht:CCP, 212Hv:CCC, 212Hw:CCP, 212Hx:CCP, 212Hy:CCP, 212Ja:CCC, 212Je:CCC, 212Jf:CCC, 212Jj:CC?, 212Jl:CCC, 212Js:CCC, 212Ka:CC?, 212Kb:CCC, 212Mb:CPP, 212Na:CC?, 212Nb:CCP, 212Nc:CCC, 212Nd:CCC, 221Bd:CCC, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ec:CCC, 221Ed:CCC, 221Ef:CCC, 221Fa:CCC, 222Aj:CCC, 222An:CCC, 222Ap:CCC, 222Aq:CCC, 222Ch:CCC, 222Db:CCC, 222Dc:CCP, 222De:CCC, 222Df:CCP, 222Ei:CPP, 222Ek:CPP, 222El:CPP, 222Em:CPP, 222Fa:CCP, 222Fb:CCC, 222Fc:CCP, 222Fd:CCP, 222Fe:CCP, 222Ff:CCP, 222Ga:CCC, 222Gb:CCC, 222Gc:CCC, 222Gd:CCP, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hc:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Ka:CCC, 222Kb:CCC, 222Kd:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCP, 222Lc:CCC, 222Ld:CCC, 222Lf:CCC, 222Ma:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 232Ac:CCC, 234Aa:CC?, 234Am:CCC, 234An:CCC, 251Ba:CCC, 251Be:CCC, 251Cc:CCC, 251Cd:CCC, 251Cf:CCC, 251Dd:CCP, 251De:CCC, 251Df:CCC, 251Dg:CCC, 251Dh:CCC, 251Eb:CCC, M221Cb:CCC

Federal Lands: NPS (Buffalo River, Cuyahoga Valley, Delaware Water Gap, Effigy Mounds, Indiana Dunes, New River Gorge, Saint Croix, Upper Delaware); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron-Manistee, Huron?, Manistee, Nicolet?, Ozark?, Wayne); USFWS (Erie)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FFSM

Cuyahoga Valley National Park Inventory Notes: Information not available.

Cuyahoga Valley National Park Plots and Observation Points: (1 plot): CUVA.126.

Local Description Authors: M.J. Russo

Global Description Authors: D. Faber-Langendoen, mod. L.A. Sneddon, E. Largay, S.C. Gawler

References: Anderson 1996, CAP pers. comm. 1998, CDPNQ unpubl. data, Chapman et al. 1989, Coxe 2009, Edinger et al. 2002, Eyre 1980, Faber-Langendoen 2001, Fike 1999, Homoya et al. 1988, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Kost et al.

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2007, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, Nelson 1985, Nelson 2010, ONHD unpubl. data, Perles et al. 2007, Perles et al. 2008, Podniesinski and Wagner 2002, TDNH unpubl. data, Vanderhorst et al. 2007, WNHI 2011, WNHIP unpubl. data, WPC and TNC 2002, WVNHP unpubl. data b, Walton et al. 1996, White and Madany 1978, Zimmerman 2011k, Zimmerman et al. 2012

Central Green Ash - Elm - Hackberry Forest

***Fraxinus pennsylvanica - Ulmus* spp. - *Celtis occidentalis* Forest**
Green Ash - Elm species - Common Hackberry Forest
Identifier: CEGL002014

ELEMENT CONCEPT

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

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This American elm - ash forest was sampled three times in the park. The sites are gentle lowlands with well-drained to somewhat poorly drained silt loam soils. These sites are in valley bottoms. The unvegetated surface is dominated by leaf litter with some downed wood and bare soil. Evidence of disturbance includes the presence of trails and exotic species.
Global Environment: Stands occur along upper floodplain terraces of rivers and streams and in upland ravine bottoms. Soils are moderately well-drained to poorly drained.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate (50% cover) canopy, 20-35 m tall, and moderate (60%) subcanopy (10-15 m) contain *Ulmus americana* (American elm), *Fraxinus pennsylvanica* (green ash), *Fraxinus americana* (white ash), and *Acer rubrum* (red maple). The sparse (30%) tall-shrub (2-5 m) and short-shrub (1-2 m) layers include *Fagus grandifolia* (American beech), *Sassafras albidum* (sassafras), and exotics *Rosa multiflora* (multiflora rose) and *Lonicera maackii* (Amur honeysuckle). Herbs are sparse. However, this community does support Ohio state-imperiled *Phaseolus polystachios* (thicket bean).
Global Vegetation: The vegetation has an open to closed tree canopy that is dominated by *Fraxinus pennsylvanica* (green ash), *Celtis occidentalis* (common hackberry), and *Ulmus americana* (American elm). Other tree species that may be present include *Juglans nigra* (black walnut), *Tilia americana* (American basswood), *Acer saccharinum* (silver maple), *Populus deltoides* (eastern cottonwood). *Ulmus rubra* (slippery elm) can be part of the subcanopy. The shrub layer in the western part of the range includes *Cornus drummondii* (roughleaf dogwood), *Ribes missouriense* (Missouri gooseberry), *Symphoricarpos occidentalis* (western snowberry), and *Zanthoxylum americanum* (common pricklyash), as well as woody vines, such as *Parthenocissus vitacea* (woodbine), *Smilax tamnoides* (bristly greenbrier), *Toxicodendron radicans* (eastern poison-ivy), and *Vitis riparia* (riverbank grape). The herbaceous layer in the western part of the range includes *Elymus virginicus* (Virginia wildrye), *Festuca subverticillata* (nodding fescue), *Galium aparine* (stickywilly), *Geum canadense* (white avens), and *Laportea canadensis* (Canadian woodnettle) (Steinauer and Rolfsmeier 2000).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Ulmus americana* (American elm)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

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OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Phaseolus polystachios* (thicket bean, Ohio state-imperiled, G5); **Invasive/Exotic**: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Berberis thunbergii* (Japanese barberry, invasive/exotic, High/Medium), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G5 (22-Jun-1998).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: This community can have a similar canopy composition to *Liriodendron tulipifera - Ulmus* spp. - *Fraxinus pennsylvanica* (green ash) Forest (CEPS006684). This community represents more natural stands in ravine floodplains versus the more disturbed CEPS006684 which is typically on broad, flat sites. The understory of this community has fewer weedy species.
Global Comments: The distinction between this type and *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest (CEGL002089) needs clarification. This type could be in Wisconsin.
Global Similar Associations:

- *Acer (rubrum, saccharinum) - Fraxinus* spp. - *Ulmus americana* Forest (CEGL005038)
- *Acer negundo* Forest (CEGL005033)
- *Acer saccharinum - Ulmus americana* Forest (CEGL002586) may be more typical of large rivers and streams.
- *Carya illinoinensis - Celtis laevigata* Forest (CEGL002087)
- *Fraxinus pennsylvanica - (Juglans nigra, Platanus occidentalis)* Forest (CEGL006575)
- *Fraxinus pennsylvanica - Ulmus americana - (Acer negundo, Tilia americana)* Northern Forest (CEGL002089)
- *Fraxinus pennsylvanica - Ulmus americana - Celtis laevigata / Ilex decidua* Forest (CEGL002427)
- *Fraxinus pennsylvanica - Ulmus crassifolia - Celtis laevigata* Forest (CEGL004618)
- *Platanus occidentalis - Acer saccharinum - Juglans nigra - Ulmus rubra* Forest (CEGL007334)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Buckeye Trail at Bedford Reservation and along Brandywine Gorge Trail at Brandywine Falls.
Global Range: This community is found in the central United States along upper floodplain terraces of rivers and streams and in upland ravine bottoms, ranging from Ohio and Ontario west to Iowa, south to Kansas, and east to Indiana.
Nations: CA, US
States/Provinces: IA:SU, IL, IN, KS:SU, MI, NE:S3, OH, ON, QC?, WY
TNC Ecoregions: 33:C, 35:C, 36:C, 37:C, 44:P, 45:C, 48:C, 49:C
USFS Ecoregions (1994/95): 221Ec:CCP, 221Ed:CCP, 221Ef:CCC, 221Fa:CCC, 222Dc:CCC, 222Ek:CCC, 222Em:CCP, 222Fd:CCC, 222Fe:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222If:CCC, 222Jb:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 251Be:CCC, 251Cp:CCC, 251Cq:CCC, 251Fd:CCC, 251G:CC, 255:C
Federal Lands: NPS (Cuyahoga Valley, Fort Larned, Homestead, Tallgrass Prairie); USFS (Wayne)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FSFH
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (3 plots): CUVA.92, CUVA.137, CUVA.205.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: CDPNQ unpubl. data, Chapman et al. 1989, Cogan 2007b, Currier 1982, Homoya et al. 1988, INAI unpubl. data, Kindscher et al. 2011a, Kindscher et al. 2011b, Lauver et al. 1999, Midwestern Ecology Working Group n.d., ONHD unpubl. data, Rolfsmeier and Steinauer 2010, Steinauer and Rolfsmeier 1997, Steinauer and Rolfsmeier 2000, Steinauer and Rolfsmeier 2003, WNDD unpubl. data, White and Madany 1978

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M504. Northern Swamp Forest

G046. Northern Conifer & Hardwood Alkaline Swamp

Red Maple - Black Ash Swamp

***Fraxinus nigra - Acer rubrum / Rhamnus alnifolia / Carex leptalea* Saturated Forest**
Black Ash - Red Maple / Alderleaf Buckthorn / Bristly-stalked Sedge Saturated Forest
Identifier: CEGL007441

ELEMENT CONCEPT

Global Summary: Closed-canopy deciduous swamp forest of poorly drained depressions or seepage zones in the unglaciated portions of Lower New England/Northern Piedmont, High Allegheny Plateau, and Central Appalachians. This forest can occur as narrow zones to small inclusions to large swamps. Soils are generally mucky and without substantial peat development. It often occurs in areas of calcareous bedrock. The canopy is codominated by *Acer rubrum* (red maple) and *Fraxinus nigra* (black ash) with associates such as *Betula alleghaniensis* (yellow birch), *Ulmus rubra* (slippery elm), *Ulmus americana* (American elm), and *Pinus strobus* (eastern white pine). The understory is patchy, ranging from shrub-dominated to sedge-dominated. Shrubs include *Lindera benzoin* (northern spicebush), *Toxicodendron vernix* (poison-sumac), *Alnus incana* (gray alder), *Salix* (willow) spp., and *Rhamnus alnifolia* (alderleaf buckthorn). The herb layer is diverse with *Carex leptalea* (bristly-stalked sedge), *Carex bromoides* (bromelike sedge), *Caltha palustris* (yellow marsh-marigold), *Veratrum viride* (green false hellebore), *Platanthera grandiflora* (greater purple fringed orchid), *Geum rivale* (purple avens), *Symplocarpus foetidus* (skunk-cabbage), *Cypripedium reginae* (showy lady's slipper), *Trollius laxus* (American globeflower), *Osmunda cinnamomea* (cinnamon fern), *Impatiens capensis* (jewelweed), *Cardamine bulbosa* (bulbous bittercress), *Saxifraga pensylvanica* (eastern swamp saxifrage), *Dryopteris cristata* (crested woodfern), *Carex lacustris* (hairy sedge), and *Symplocarpus foetidus* (skunk-cabbage).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Information not available.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The canopy of this community is moderately open to moderately closed. Tree density may be high, but individual trees tend to have sparse canopies. *Fraxinus nigra* (black ash) is the dominant tree with smaller amounts of *Fraxinus pennsylvanica* (green ash) and *Ulmus rubra* (slippery elm). There is a robust tall-shrub stratum with *Toxicodendron vernix* (poison-sumac), *Alnus incana* (gray alder), *Rosa palustris* (swamp rose), and *Frangula alnus* (glossy buckthorn). The herbaceous stratum ranges from sparse to dense and is very diverse.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (1-Dec-1997).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.
Global Similar Associations:

- *Acer rubrum - Fraxinus americana - Fraxinus nigra - Betula alleghaniensis / Veratrum viride - Carex bromoides* Forest (CEGL008416) to the south in Virginia.
- *Acer rubrum - Fraxinus nigra - (Larix laricina) / Rhamnus alnifolia* Forest (CEGL006009) occurs in glaciated areas, differentiated by having *Larix laricina*.

OTHER COMMENTS

Other Comments: Information not available.

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ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: There is only one known site for this community near the intersection of Wetmore Rd and Akron-Peninsula Rd.
Global Range: Found in the unglaciated portions of Lower New England/Northern Piedmont, High Allegheny Plateau, and Central Appalachians, from New York to Maryland and West Virginia.
Nations: US
States/Provinces: MD, NY, OH, PA, WV
TNC Ecoregions: 59:C, 60:C, 61:C
USFS Ecoregions (1994/95): 212Fb:CCC, 212Fd:CCC, 221Ad:CCC, 221Am:CCC, 221E:CP, 221Fa:CCC, 221Fb:CCC, M221Aa:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Da:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: FBAS
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist. Only one site is known in the park. Two Accuracy Assessment points were placed in this site.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: S.L. Neid
References: CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eichelberger 2011j, Fike 1999, Harrison 2004, Harrison 2011, Zimmerman et al. 2012

2. SHRUBLAND & GRASSLAND

2.B.2. Temperate Grassland, Meadow & Shrubland

2.B.2.Nc. Eastern North American Grassland, Meadow & Shrubland

M123. Eastern North American Ruderal Shrubland & Grassland

G059. Northern & Central Ruderal Meadow & Shrubland

Successional Central Dry-Mesic Herbaceous Field

***Daucus carota - Leucanthemum vulgare* Semi-natural Herbaceous Vegetation [Park Special]**
Queen Anne's-lace - Oxeye Daisy Semi-natural Herbaceous Vegetation
Identifier: CEPS006692

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This semi-natural herbaceous vegetation was sampled at five locations in the park. The sites are generally gentle to moderate slopes and upper flats with moderately well- to well-drained silty clay and silt loam soils. One site, however, has hummocky topography with a few small puddles of water and saturated soil. The unvegetated surface is dominated by leaf litter with some bare soil. Evidence of disturbance includes the presence of trails and an abundance of exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate to totally vegetated (60-100% cover) herbaceous layer is a mix of native and exotic species, the most common of which are *Daucus carota* (Queen Anne's lace) and *Leucanthemum vulgare* (oxeye daisy). Other taxa may include *Achillea millefolium* (common yarrow), *Andropogon virginicus* (broomsedge bluestem), *Apocynum cannabinum* (Indianhemp), *Bromus inermis* (smooth brome), *Carex blanda* (eastern woodland sedge), *Cirsium arvense* (Canada thistle), *Cyperus esculentus* (yellow nutsedge), *Dactylis glomerata* (orchardgrass), *Dianthus armeria* (Deptford pink), *Dipsacus fullonum* (Fuller's teasel), *Eleusine indica* (Indian goosegrass), *Elymus hystrix* (eastern bottlebrush grass), *Elymus repens* (quackgrass), *Hypericum perforatum* (common St. Johnswort), *Lolium pratense* (meadow ryegrass), *Lotus corniculatus* (bird's-foot trefoil), *Phleum pratense* (timothy), *Plantago lanceolata* (narrowleaf plantain), *Rudbeckia hirta* (blackeyed Susan), *Scirpus cyperinus* (woolgrass), *Solidago gigantea* (giant goldenrod), *Sorghastrum nutans* (Indiangrass), *Tridens flavus* (purpletop tridens), and *Trifolium pratense* (red clover). A total of 21 exotic species were reported from the five sampled stands. However, this community also supports Ohio state-critically imperiled *Baptisia australis* (blue wild indigo).

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Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Daucus carota* (Queen Anne's lace), *Leucanthemum vulgare* (oxeye daisy)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Baptisia australis* (blue wild indigo, Ohio state-critically imperiled, G5); **Invasive/Exotic**: *Bromus inermis* (smooth brome, invasive/exotic, High/Medium), *Cirsium arvense* (Canada thistle, invasive/exotic, High/Medium), *Convolvulus arvensis* (field bindweed, invasive/exotic, Medium/Low), *Cyperus esculentus* (yellow nutsedge, invasive/exotic), *Dactylis glomerata* (orchardgrass, invasive/exotic, Medium/Insignificant), *Daucus carota* (Queen Anne's lace, invasive/exotic, Low), *Dianthus armeria* (Deptford pink, invasive/exotic, Low/Insignificant), *Dipsacus fullonum* (Fuller's teasel, invasive/exotic, Medium/Low), *Eleusine indica* (Indian goosegrass, invasive/exotic), *Elymus repens* (quackgrass, invasive/exotic, High/Medium), *Hesperis matronalis* (dames rocket, invasive/exotic, Medium/Low), *Hypericum perforatum* (common St. Johnswort, invasive/exotic, High/Medium), *Leucanthemum vulgare* (oxeye daisy, invasive/exotic, Medium/Low), *Lolium pratense* (meadow ryegrass, invasive/exotic, High/Low), *Lonicera tatarica* (Tatarian honeysuckle, invasive/exotic, High/Medium), *Lotus corniculatus* (bird's-foot trefoil, invasive/exotic, Medium/Low), *Phleum pratense* (timothy, invasive/exotic, Medium), *Plantago lanceolata* (narrowleaf plantain, invasive/exotic, High/Low), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Trifolium pratense* (red clover, invasive/exotic, Low/Insignificant)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: This association includes dry-mesic to mesic disturbed herbaceous sites at CUVA.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Deerlick Trail at Brecksville Reservation, at Pine Hollow, and along Buckeye Trail, Langes Run and Wetmore Trail.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HSFD
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (5 plots): CUVA.32, CUVA.46, CUVA.75, CUVA.118, CUVA.166.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Successional Autumn-olive - Hawthorn - Multiflora Rose Shrubland

***Elaeagnus umbellata - Crataegus* spp. - *Rosa multiflora* Ruderal Shrubland**
Autumn-olive - Hawthorn species - Multiflora Rose Ruderal Shrubland
Identifier: CEGL005207

ELEMENT CONCEPT

Global Summary: Information not available.

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ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This upland disturbed shrubland was sampled 6 times in the park. It occurs on a variety of habitats. Slopes may be flat to moderate and of any aspect. Soils are typically moderate to fine (not sands). These sites do not flood regularly but may be wet-mesic.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This upland shrubland occupies disturbed sites where shrubs have come to dominate. The shrub cover ranges from open to closed (25-100%) and is often >2 m tall. Some stands are so thick as to be nearly impenetrable. Most dominants are exotic. *Rosa multiflora* (multiflora rose), *Elaeagnus umbellata* (autumn olive), and *Crataegus* (hawthorn) spp. are the most common. *Cornus drummondii* (roughleaf dogwood), *Malus* (apple) spp., *Rubus* (blackberry) spp., and other shrubs typical of old fields can also be present. The herbaceous stratum varies inversely with the shrub stratum with closed shrub canopies having sparse herbaceous understories and vice-versa. Herbaceous species are variable but are typical of disturbed sites. *Anthoxanthum odoratum* (sweet vernalgrass), *Leucanthemum vulgare* (oxeye daisy), *Daucus carota* (Queen Anne's lace), *Solidago* (goldenrod) spp., *Poa pratensis* (Kentucky bluegrass), and several other species are common.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (11-Jan-2013).

CLASSIFICATION

Status: Provisional
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community is found in all regions of the park.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: Information not available.
USFS Ecoregions (1994/95): Information not available.
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: SSDM
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (6 plots): CUVA.121, CUVA.153, CUVA.159, CUVA.174, CUVA.203, CUVA.208.
Local Description Authors: J. Drake
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Successional Central Wet-Mesic Herbaceous Field

***Impatiens capensis* - *Solidago* spp. - *Verbesina alternifolia* Semi-natural Herbaceous Vegetation [Park Special]**
Orange Jewelweed - Goldenrod species - Wingstem Semi-natural Herbaceous Vegetation**Identifier: CEPS006690**

ELEMENT CONCEPT

Global Summary: Information not available.

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ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This semi-natural herbaceous vegetation was sampled at 14 locations in the park. The sites include flat basin floors as well as gentle to moderate slopes and upper flats. Soils range from moderately well- to well-drained clay, loam, silt, sandy loam, and silt loam. One site, however, has hummocky topography with a few small puddles of water and somewhat poorly drained soil. The unvegetated surface is dominated by leaf litter with occasional wood, standing water and bare soil. Evidence of disturbance includes deer browse and the presence of trails, railroad tracks and an abundance of exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The moderate to totally vegetated (50-100% cover) herbaceous layer is a mix of native and exotic species, the most common of which are *Impatiens capensis* (jewelweed), *Solidago canadensis* (Canada goldenrod), *Solidago* (goldenrod) spp., and *Verbesina alternifolia* (wingstem). Other taxa may include *Alliaria petiolata* (garlic mustard), *Apocynum cannabinum* (Indianhemp), *Carex lurida* (shallow sedge), *Carex normalis* (greater straw sedge), *Carex vulpinoidea* (fox sedge), *Cirsium arvense* (Canada thistle), *Daucus carota* (Queen Anne's lace), *Dipsacus fullonum* (Fuller's teasel), *Eupatorium maculatum* (spotted joepyeweed), *Hypericum perforatum* (common St. Johnswort), *Juncus effusus* (common rush), *Leucanthemum vulgare* (oxeye daisy), *Panicum virgatum* (switchgrass), *Phleum pratense* (timothy), *Toxicodendron radicans* (eastern poison-ivy), *Urtica dioica* (stinging nettle), and *Vernonia gigantea* (giant ironweed). A total of 17 exotic species were reported from the five sampled stands.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Apocynum cannabinum* (Indianhemp), *Impatiens capensis* (jewelweed), *Solidago canadensis* (Canada goldenrod), *Verbesina alternifolia* (wingstem)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Apocynum cannabinum* (Indianhemp), *Impatiens capensis* (jewelweed), *Solidago canadensis* (Canada goldenrod), *Verbesina alternifolia* (wingstem)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Cirsium arvense* (Canada thistle, invasive/exotic, High/Medium), *Convolvulus arvensis* (field bindweed, invasive/exotic, Medium/Low), *Daucus carota* (Queen Anne's lace, invasive/exotic, Low), *Dipsacus fullonum* (Fuller's teasel, invasive/exotic, Medium/Low), *Hypericum perforatum* (common St. Johnswort, invasive/exotic, High/Medium), *Leucanthemum vulgare* (oxeye daisy, invasive/exotic, Medium/Low), *Ligustrum sinense* (Chinese privet, invasive/exotic, High/Medium), *Lotus corniculatus* (bird's-foot trefoil, invasive/exotic, Medium/Low), *Lysimachia punctata* (spotted loosestrife, invasive/exotic), *Phleum pratense* (timothy, invasive/exotic, Medium), *Plantago lanceolata* (narrowleaf plantain, invasive/exotic, High/Low), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low), *Rumex patientia* (patience dock, invasive/exotic), *Solanum dulcamara* (climbing nightshade, invasive/exotic, Low), *Urtica dioica* (stinging nettle, invasive/exotic), *Verbascum thapsus* (common mullein, invasive/exotic, Medium)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: This association represents wet-mesic disturbed herbaceous sites in the park.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at O'Neil Woods and Botzum Trailhead and along Langley Trail, Towpath Trail and Wetmore Trail.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C

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USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HSFW
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (14 plots): CUVA.51, CUVA.53, CUVA.58, CUVA.62, CUVA.64, CUVA.72, CUVA.77, CUVA.160, CUVA.165, CUVA.169, CUVA.171, CUVA.173, CUVA.181, CUVA.217.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

Timothy - Bluejoint Meadow

***Phleum pratense - (Calamagrostis canadensis)* Semi-natural Herbaceous Vegetation**
Timothy - (Bluejoint) Semi-natural Herbaceous Vegetation
Identifier: CEGL005249

ELEMENT CONCEPT

Global Summary: This timothy meadow is found throughout the northeastern United States and perhaps more widely in North America. The type may spontaneously occur in various human-disturbed habitats, or it may be planted. The meadows are dominated by *Phleum pratense* (timothy) and may contain a wide assortment of other weedy species.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This redtop - timothy herbaceous vegetation was sampled at four locations in the park. The sites are gentle lower slopes and uplands with to well-drained sand and silt loam soils. The unvegetated surface is dominated by leaf litter or bare soil. Evidence of disturbance includes clearing, mowing, and the presence of trails and exotic species.
Global Environment: This timothy meadow is found throughout the northeastern United States and perhaps more widely in North America. It can spontaneously occupy a wide variety of human-disturbed sites, whether they be old fields, clearings for development, or former pastures. The type may also be planted.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The complete cover (100%) of herbaceous vegetation is dominated by *Agrostis gigantea* (redtop) along with a mix of native and exotic species which may include *Apocynum cannabinum* (Indianhemp), *Carex vulpinoidea* (fox sedge), *Dactylis glomerata* (orchardgrass), *Juncus tenuis* (poverty rush), *Phleum pratense* (timothy), *Poa pratensis* (Kentucky bluegrass), *Scirpus atrovirens* (green bulrush), and *Scirpus pendulus* (rufous bulrush), among others. A total of 12 exotic species were reported from samples of this disturbed community type.
Global Vegetation: The meadows are dominated by *Phleum pratense* (timothy) and may contain a wide assortment of other weedy species.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Agrostis gigantea* (redtop), *Phleum pratense* (timothy)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Agrostis gigantea* (redtop, invasive/exotic, Medium/Low), *Bromus inermis* (smooth brome, invasive/exotic, High/Medium), *Dactylis glomerata* (orchardgrass, invasive/exotic, Medium/Insignificant), *Daucus carota* (Queen Anne's lace, invasive/exotic, Low), *Elaeagnus angustifolia* (Russian olive, invasive/exotic, High), *Hypericum perforatum* (common St. Johnswort, invasive/exotic, High/Medium), *Leucanthemum vulgare* (oxeye daisy, invasive/exotic, Medium/Low), *Lonicera maackii* (Amur honeysuckle, invasive/exotic, High), *Lotus corniculatus* (bird's-foot trefoil, invasive/exotic, Medium/Low), *Phleum pratense* (timothy, invasive/exotic, Medium), *Poa pratensis* (Kentucky bluegrass, invasive/exotic, Medium), *Trifolium pratense* (red clover, invasive/exotic, Low/Insignificant)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (8-Nov-2001). This vegetation type includes pasture and post-agricultural fields, and is largely composed of non-native grasses and herbs (generally of European origin).

CLASSIFICATION

Status: Standard

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Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: This community usually represents sites that are maintained in a open state, usually by mowing. Old fields that are generally not managed tend to have more forb cover and fall into either *Impatiens capensis - Solidago* spp. - Verbesina alternifolia Semi-natural Herbaceous Vegetation (CEPS006690) or *Daucus carota - Leucanthemum vulgare* Semi-natural Herbaceous Vegetation (CEPS006692).
Global Comments: Rangewide distribution of this semi-natural type could be very extensive.
Global Similar Associations:
- *Calamagrostis canadensis - Eupatorium maculatum* Herbaceous Vegetation (CEGL005174)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at the Harriet Keeler Memorial at Brecksville Reservation, along the railroad tracks at the Canal Visitor Center, and in the Terra Vista Natural Study Area.
Global Range: This timothy meadow is found throughout the northeastern United States and perhaps more widely in North America.
Nations: CA, US
States/Provinces: IL, MI, MN, NY, OH, ON, QC?, WI
TNC Ecoregions: 46:P, 48:C, 49:C
USFS Ecoregions (1994/95): 212:P, 221Fa:CCC, 222Ib:CCC, 222Ic:CCC
Federal Lands: NPS (Cuyahoga Valley, Isle Royale); USFWS (Iroquois, Montezuma)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HSGD
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (4 plots): CUVA.112, CUVA.152, CUVA.155, CUVA.183.
Local Description Authors: M.J. Russo
Global Description Authors: C. Reschke and D. Faber-Langendoen
References: CDPNQ unpubl. data, Chapman et al. 1989, Faber-Langendoen 2001, MNNHP 1993, Midwestern Ecology Working Group n.d., ONHD unpubl. data, TNC 1999b, White and Madany 1978

Restored Tallgrass Prairie

***Schizachyrium scoparium - Andropogon gerardii - Poa* spp. Semi-natural Herbaceous Vegetation [Park Special]**
Little Bluestem - Big Bluestem - Bluegrass species Semi-natural Herbaceous Vegetation
Identifier: CEPS006691

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This semi-natural herbaceous vegetation was sampled at three locations in the park. The sites are gentle slopes and summits with somewhat poorly drained silty clay or moderately well-drained silt soils. The unvegetated surface is dominated by leaf litter with some bare soil. Evidence of disturbance includes the presence of trails and exotic species.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The dense to totally vegetated (60-100% cover) herbaceous layer is dominated by *Schizachyrium scoparium* (little bluestem) or a mix of native and exotic species that includes it along with *Achillea millefolium* (common yarrow), *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Bromus* (brome) sp., *Elymus canadensis* (Canada wildrye), *Eragrostis* (lovegrass) sp., and *Leucanthemum vulgare*. This community also supports Ohio state-imperiled *Koeleria macrantha* (prairie Junegrass).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Koeleria macrantha* (prairie Junegrass), *Schizachyrium scoparium* (little bluestem)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem)
Global: Information not available.

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OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Koeleria macrantha* (prairie Junegrass, Ohio state-imperiled, G5); **Invasive/Exotic**: *Daucus carota* (Queen Anne's lace, invasive/exotic, Low), *Dipsacus fullonum* (Fuller's teasel, invasive/exotic, Medium/Low), *Duchesnea indica* (Indian strawberry, invasive/exotic, Low/Insignificant), *Leucanthemum vulgare* (oxeye daisy, invasive/exotic, Medium/Low), *Lotus corniculatus* (bird's-foot trefoil, invasive/exotic, Medium/Low), *Medicago lupulina* (black medick, invasive/exotic, Medium/Insignificant), *Melilotus officinalis* (yellow sweetclover, invasive/exotic, Medium/Low), *Poa compressa* (Canada bluegrass, invasive/exotic, High/Low), *Rhamnus cathartica* (common buckthorn, invasive/exotic, High/Medium), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (11-Apr-2011).

CLASSIFICATION

Status: Nonstandard
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Buckeye Trail at Bedford Reservation and at Boston Store and Hampton Hills.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: 49:C
USFS Ecoregions (1994/95): 221Fa:CCC
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HSGD
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (3 plots): CUVA.11, CUVA.80, CUVA.141.
Local Description Authors: M.J. Russo
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

2.B.4. Temperate & Boreal Scrub & Herb Coastal Vegetation

2.B.4.Na. Eastern North American Dune & Coastal Grassland & Shrubland

M176. Eastern North American Lake & River Shoreline Vegetation

G343. Eastern North American River Shoreline [Placeholder]

Riverine Gravel Wash

Midwest Gravel Wash River Sparse Vegetation
Midwest Gravel Wash River Sparse Vegetation
Identifier: CEGL002408

ELEMENT CONCEPT

Global Summary: This gravel wash river type is currently reported only from southern Ontario but may occur elsewhere in the central and upper Midwest. The type may be expected in rocky riverine areas with sedimentary rocks, but it is not clear how frequent such riverine gravel washes may be. Further characterization of the type is needed.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community is found along rivers and streams in Cuyahoga Valley National Park.
Global Environment: Information not available.

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VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: Vegetation is sparse in this community. Species composition is highly variable.
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This gravel wash river type is currently reported only from southern Ontario but may occur elsewhere in the central and upper Midwest. The type may be expected in rocky riverine areas with sedimentary rocks, but it is not clear how frequent such riverine gravel washes may be. Further characterization of the type is needed. This type does not extend into the Interior Highlands, where, e.g., *Hamamelis vernalis - Cornus obliqua - Hypericum prolificum* Shrubland (CEGL003898) is found in the Ozarks region.
Global Similar Associations:
- *Hamamelis vernalis - Cornus obliqua - Hypericum prolificum* Shrubland (CEGL003898)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This gravel wash type is reported from southern Ontario, Canada, and northern Ohio and may be expected in various parts of the central Midwestern United States.
Nations: CA?, US
States/Provinces: OH, ON?
TNC Ecoregions: Information not available.
USFS Ecoregions (1994/95): Information not available.
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: VRSV
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist. Thirteen sites were visited during Accuracy Assessment.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen
References: Midwestern Ecology Working Group n.d.

G194. Northern & Central Riverscour Wetland

Midwest Willow Sandbar Shrubland

***Salix interior - Salix eriocephala* Sandbar Shrubland**
Sandbar Willow - Missouri River Willow Sandbar Shrubland
Identifier: CEGL005078

ELEMENT CONCEPT

Global Summary: This sandbar willow type is found in the central, and possibly northeastern, United States and adjacent Canada. Its distribution is apparently centered on the Great Lakes region. Stands are dominated by *Salix interior* (sandbar willow) and *Salix*

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eriocephala (Missouri River willow). They occur on sandbars along major rivers and streams where river scouring and deposition creates newly exposed sandy substrates. The vegetation structure is quite dynamic, depending on flooding and ice scouring. Shrubs form a discontinuous to continuous canopy cover that may be fairly battered. *Salix interior* (sandbar willow) is the major dominant, sometimes the only shrub species present. *Salix eriocephala* (Missouri River willow) may be present in some examples. Other vegetation characteristics of this type are not well described.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community was sampled three times in the park. Stands occur on sandbars and gravelbars where recent flooding has scoured or deposited fresh alluvial material.
Global Environment: This community occurs along major rivers and streams, where river scouring and deposition creates newly exposed sandy substrates.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This community is dominated by shrub willows. Most commonly, these are *Salix interior* (sandbar willow). Small trees, especially *Salix nigra* (black willow), *Populus deltoides* (eastern cottonwood), and *Platanus occidentalis* (American sycamore), are common.
Global Vegetation: Shrubs form a discontinuous to continuous canopy cover that may be fairly battered by flooding and scouring. *Salix interior* (sandbar willow) is the major dominant, sometimes the only shrub species present. *Salix eriocephala* (Missouri River willow) may be present in some examples. Other vegetation characteristics of this type are not well-described.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This type is in need of further characterization to determine its rangewide character, and whether it is really needed in these states as a type. It may be of limited extent in the states in which it is found. Taxonomically, *Salix interior* (sandbar willow) was formerly combined into *Salix exigua* (narrowleaf willow). *Salix lutea* (yellow willow) has been treated as a variety of *Salix eriocephala* (Missouri River willow) by some authors (Great Plains Flora Association 1986).
Global Similar Associations:

- *Salix caroliniana* Temporarily Flooded Coastal Plain Shrubland (CEGL007052)
- *Salix caroliniana* Temporarily Flooded Ozark Shrubland (CEGL007064)
- *Salix exigua* Temporarily Flooded Shrubland (CEGL001197)
- *Salix interior* Temporarily Flooded Shrubland (CEGL008562)
- *Salix nigra / Phalaris arundinacea - Apocynum cannabinum* Temporarily Flooded Shrubland (CEGL006065)
- *Salix* spp. / *Andropogon gerardii - Sorghastrum nutans* Gravel Wash Herbaceous Vegetation (CEGL005175)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community is found along the Cuyahoga River and parts of major tributaries.
Global Range: This sandbar willow type is found in the central and possibly northeastern United States, and adjacent Canada, ranging from Indiana and Ontario to possibly Illinois, Ohio, and Pennsylvania.
Nations: CA, US
States/Provinces: IL, IN, OH, ON:S4, PA, QC
TNC Ecoregions: 48:C, 49:P
USFS Ecoregions (1994/95): 221Ec:PPP, 221Ed:PPP, 221Ef:PPP, 221Fa:PPP, 221Fb:PPP, 222Df:???, 222Ek:???, 222Fc:???, 251:C
Federal Lands: NPS (Cuyahoga Valley); USFS (Wayne)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: SWSM

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Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (3 plots) CUVA.170, CUVA.185, CUVA.191.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen
References: CDPNQ unpubl. data, Great Plains Flora Association 1986, Homoya et al. 1988, Kartesz 1999, Midwestern Ecology Working Group n.d., Voss 1985, White and Madany 1978, Zimmerman 2011n, Zimmerman and Podniesinski 2008, Zimmerman et al. 2012

2.B.5. Temperate & Boreal Bog & Fen

2.B.5.Na. North American Bog & Fen

M061. Appalachian, Interior Plateau & Prairie Fen

G183. North-Central Appalachian, Interior & Prairie Fen

Skunk-cabbage Seepage Meadow
***Symplocarpus foetidus* Herbaceous Vegetation**
Skunk-cabbage Herbaceous Vegetation
Identifier: CEGL002385

ELEMENT CONCEPT

Global Summary: This community is found throughout the upper midwestern region of the United States and adjacent Canada, ranging to the Northeast, where it develops around spring heads and in broader areas of groundwater discharge. The peat layer is typically less than 0.4 m deep. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus* (skunk-cabbage) and *Angelica atropurpurea* (purplestem angelica) are the dominant and indicative species in the Midwest; *Impatiens capensis* (jewelweed) is characteristic in the East. Other forbs and ferns present include *Caltha palustris* (yellow marsh-marigold), *Chelone glabra* (white turtlehead), *Epilobium coloratum* (purpleleaf willowherb), *Impatiens capensis* (jewelweed), *Pedicularis lanceolata* (swamp lousewort), *Pilea pumila* (Canadian clearweed), *Saxifraga pensylvanica* (eastern swamp saxifrage), *Solidago patula* (roundleaf goldenrod), and *Thelypteris palustris* (eastern marsh fern). Graminoid cover is generally low, less than 25%, and may include *Carex bromoides* (bromelike sedge), *Carex comosa* (longhair sedge), *Carex lacustris* (lake sedge), *Carex stricta* (upright sedge), and *Carex trichocarpa* (hairyfruit sedge).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This skunk-cabbage herbaceous vegetation was sampled at three locations in the park. The sites are saturated basin floors with poorly drained muck soils. The unvegetated surface is dominated by leaf litter with some downed wood and/or bare soil. Evidence of disturbance includes the presence of trails and exotic species.
Global Environment: This community develops around spring heads and in broader areas of groundwater discharge, where water flows to the surface in a diffuse rather than concentrated flow. Peat may be present in some areas, and perhaps locally can be as deep as 1 m, but it is typically less than 0.4 m deep. Stands can occur along the lower slopes of glacial moraines, ravines and in deep glacial meltwater-cut river valleys at the bases of slopes separating stream terraces. Soils are seasonally to more-or-less permanently saturated (MNNHP 1993).

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The dense (80-100% cover) herbaceous layer is a near monoculture of *Symplocarpus foetidus* (skunk-cabbage). Additional herbs may include *Cryptotaenia canadensis* (Canadian honewort), *Impatiens capensis* (jewelweed), and *Urtica dioica* (stinging nettle) (exotic), as well as a few scattered short shrubs of *Acer negundo* (box-elder), *Carpinus caroliniana* (American hornbeam), *Cornus drummondii* (roughleaf dogwood), and *Prunus serotina* (black cherry).
Global Vegetation: This is an herbaceous-dominated community. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus* (skunk-cabbage) and *Angelica atropurpurea* (purplestem angelica) are the leading dominant and indicator species. Other forbs and ferns present include *Caltha palustris* (yellow marsh-marigold), *Chelone glabra* (white turtlehead), *Epilobium coloratum* (purpleleaf willowherb), *Impatiens capensis* (jewelweed), *Impatiens capensis* (jewelweed), *Pedicularis lanceolata* (swamp lousewort), *Pilea pumila* (Canadian clearweed), *Saxifraga pensylvanica* (eastern swamp saxifrage), *Solidago patula* (roundleaf goldenrod), and *Thelypteris palustris* (eastern marsh fern). Graminoid cover is generally low, less than 25%, and may include *Carex bromoides* (bromelike sedge), *Carex comosa* (longhair sedge), *Carex lacustris* (lake sedge), *Carex stricta* (upright sedge), and *Carex trichocarpa* (hairyfruit sedge) (White and Madany 1978, MNNHP 1993).

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MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Symplocarpus foetidus* (skunk-cabbage)

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Symplocarpus foetidus* (skunk-cabbage)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Symplocarpus foetidus* (skunk-cabbage)
Global: *Caltha palustris* (yellow marsh-marigold), *Thelypteris palustris* (eastern marsh fern)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Urtica dioica* (stinging nettle, invasive/exotic)
Global: Vulnerable: *Poa paludigena* (bog bluegrass, In MN, this state-rare species appears to be endemic to this community (MNDNR 1993)., G3); **Other**: *Floerkea proserpinacoides* (false mermaidweed, G5), *Hydrocotyle americana* (American marshpennywort, G5)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4? (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This community is defined as an herbaceous community, thereby excluding many closed canopy seepage meadows with trees or shrubs rooted in the stand. However, some herbaceous seepage meadows could be quite shaded because of surrounding upland forests. This type is not always separated out by state heritage programs, since it can be a zone in other wetland types. *Carex lacustris* (lake sedge) may occur in this type. The presence of coarse-leaved sedges may be a structural difference as compared to fens, which typically have fine-leaved sedges (MNNHP 1993).
Global Similar Associations:

- *Acer rubrum - Fraxinus* spp. - *Betula papyrifera / Cornus canadensis* Forest (CEGL002071) may have a similar composition.
- *Carex crinita - Osmunda* spp. / *Physocarpus opulifolius* Seep Herbaceous Vegetation (CEGL002392)
- *Carex crinita - Osmunda* spp. / *Sphagnum* spp. Herbaceous Vegetation (CEGL002263)
- *Cornus sericea - Salix* spp. - (*Rosa palustris*) Shrubland (CEGL002186) may have a similar composition.
- *Fraxinus nigra* - Mixed Hardwoods - Conifers / *Cornus sericea / Carex* spp. Forest (CEGL002105) may have a similar composition.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Valley Bridle Trail at Bedford Reservation and along Haskill Run at Happy Days.
Global Range: This community is found throughout the upper midwestern region of the United States and adjacent Canada, where it develops around spring heads and in broader areas of groundwater discharge. The type extends from Indiana and possibly Ontario and Ohio, west to Minnesota and Iowa.
Nations: CA, US
States/Provinces: IA, IL:S2, IN, MA, MI, MN:S3, NJ, OH, ON, PA, WI:S2
TNC Ecoregions: 36:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 61:C, 62:C
USFS Ecoregions (1994/95): 212He:CPP, 212Hl:CP?, 212Hm:CPP, 212Hq:CPP, 212Hr:CPP, 212Ht:CPP, 212Hu:CPP, 212Hv:CP?, 212Hw:CP?, 212Hx:CP?, 212Kb:CCC, 221D:CC, 221Ec:CCC, 221Fa:CCC, 222Em:CPP, 222Ff:CCC, 222Gc:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCC, 222I:CP, 222Jb:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Lc:CCC, 222Lf:CCC, 222Md:CCC, 251Cf:CCC, 251Dd:CCC, M221:?
Federal Lands: NPS (Cuyahoga Valley, Indiana Dunes, Saint Croix, Valley Forge); USFS (Huron, Huron-Manistee, Manistee); USFWS (Erie)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: N/A
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (3 plots): CUVA.18, CUVA.138, CUVA.197.
Local Description Authors: M.J. Russo

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Global Description Authors: D. Faber-Langendoen, mod. L.A. Sneddon

References: Chapman et al. 1989, Fike 1999, Homoya et al. 1988, Hop et al. 2009, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, Newbold 1993, Newbold 1996, Podniesinski et al. 2005b, WNHI 2011, White and Madany 1978

2.B.6. Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

2.B.6.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh

M303. Eastern North American Ruderal Wet Meadow & Marsh

G556. Northern & Central Ruderal Wet Meadow & Marsh

Reed Canarygrass Eastern Marsh

***Phalaris arundinacea* Eastern Herbaceous Vegetation**
Reed Canarygrass Eastern Herbaceous Vegetation
Identifier: CEGL006044

ELEMENT CONCEPT

Global Summary: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. *Phalaris arundinacea* (reed canarygrass) is native to the United States and Canada but is now more widely distributed and abundant because of local introductions from both local and European populations. The introduced strains may be more aggressive ecotypes than native strains. Stands are found in both minerotrophic basin wetlands as well as rivershores. *Phalaris arundinacea* (reed canarygrass) has been widely used as a forage and hay crop, especially in marshes and floodplains, and it is used for wildlife food and for shoreline and ditch stabilization. Stands are dominated by *Phalaris arundinacea* (reed canarygrass), a 0.5- to 2-m tall perennial grass, which tends to occur in monocultures or associated with *Calamagrostis canadensis* (bluejoint). Associates in the glaciated Northeast include *Viburnum nudum* (possumhaw), *Alnus incana* (gray alder) or *Alnus serrulata* (hazel alder), *Viburnum dentatum* (southern arrow-wood), and *Agrostis gigantea* (redtop). In Central Appalachian bottomland old fields, characteristic associates include *Verbesina alternifolia* (wingstem) (which may be codominant), *Solidago rugosa* (wrinkleleaf goldenrod), *Boehmeria cylindrica* (small-spike false nettle), and *Euthamia graminifolia* (flat-top goldentop), along with exotic species such as *Glechoma hederacea* (ground ivy), *Coronilla varia* (purple crownvetch), *Rosa multiflora* (multiflora rose), and *Elaeagnus umbellata* (autumn olive). Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* (reed canarygrass) can displace native species over time. Further work is required to resolve the natural versus introduced nature of this type in the Southeast before a description can be completed.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This reed canarygrass herbaceous vegetation was sampled four times in the park. These are along river floodplains that are intermittently flooded with somewhat poorly drained silt loam soil. The unvegetated surface is dominated by leaf litter with some bare soil. Evidence of disturbance includes flooding and the presence of exotic species.
Global Environment: Stands are found in both minerotrophic basin wetlands as well as rivershores. The dominant species has been widely used as a forage and hay crop, especially in marshes and floodplains, and it is used for wildlife food and for shoreline and ditch stabilization (Barnes 1999).

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The dense (90% cover) herbaceous layer is a near monoculture of *Phalaris arundinacea* (reed canarygrass). Other common species are *Cirsium arvense* (Canada thistle), *Convolvulus arvensis* (field bindweed), and *Verbesina alternifolia* (wingstem).
Global Vegetation: Stands are dominated by *Phalaris arundinacea* (reed canarygrass), a 0.5- to 2-m tall perennial grass that is native to the United States and Canada, but which has also been introduced from European strains. The introduced strains may be more aggressive ecotypes than native strains (Barnes 1999). It tends to occur in monocultures or associated with *Calamagrostis canadensis* (bluejoint) or, less commonly, with a mixture of forbs equaling the graminoid cover. Associates in the glaciated Northeast include *Viburnum nudum* (possumhaw), *Salix* (willow) spp., *Alnus incana* (gray alder) or *Alnus serrulata* (hazel alder), *Viburnum dentatum* (southern arrow-wood), *Poa palustris* (fowl bluegrass), *Mentha arvensis* (wild mint), *Leersia virginica* (whitegrass), *Lythrum salicaria* (purple loosestrife), and *Agrostis gigantea* (redtop). In Central Appalachian bottomland old fields, characteristic associates include *Verbesina alternifolia* (wingstem) (which may be codominant), *Solidago rugosa* (wrinkleleaf goldenrod), *Boehmeria cylindrica* (small-spike false nettle), and *Euthamia graminifolia* (flat-top goldentop), along with exotic species such as *Glechoma hederacea* (ground ivy), *Coronilla varia* (purple crownvetch), *Rosa multiflora* (multiflora rose), and *Elaeagnus umbellata* (autumn olive). Midwest associates include species characteristic of wet meadows. *Phalaris arundinacea* (reed canarygrass) can displace

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native species over time (Apfelbaum and Sams 1987, Barnes 1999, and references therein). Further work is required to resolve the natural versus introduced nature of this type in the Southeast.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Phalaris arundinacea* (reed canarygrass)
Global: *Phalaris arundinacea* (reed canarygrass)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Cirsium arvense* (Canada thistle, invasive/exotic, High/Medium), *Convolvulus arvensis* (field bindweed, invasive/exotic, Medium/Low)
Global: Invasive/Exotic: *Coronilla varia* (purple crownvetch, invasive/exotic, High), *Elaeagnus umbellata* (autumn olive, invasive/exotic, High), *Glechoma hederacea* (ground ivy, invasive/exotic, Low), *Phalaris arundinacea* (reed canarygrass, invasive, High), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (1-Dec-1997). *Phalaris arundinacea* (reed canarygrass) is native to the United States and Canada but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Type has a broad distribution; in fact, it is widespread throughout temperate areas of the northern hemisphere. It is native to the United States and Canada, but is now more widely distributed and abundant because of local introductions from both local and European populations (Apfelbaum and Sams 1987). It can invade a variety of habitats, suggesting that little unites these stands apart from the dominance of *Phalaris arundinacea* (reed canarygrass). However, that may be the only reasonable way to describe this type. This vegetation is documented from Shady Valley TNC Preserve, Johnson County, Tennessee, where it occupies channelized streams, impoundments, and fen restoration sites. In these examples, characteristic associates include *Juncus effusus* (common rush), *Carex lurida* (shallow sedge), *Carex gynandra* (nodding sedge), and *Alnus serrulata* (hazel alder).
Global Similar Associations:
- *Calamagrostis canadensis* - *Eupatorium maculatum* Herbaceous Vegetation (CEGL005174)
- *Phalaris arundinacea* Western Herbaceous Vegetation (CEGL001474)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along the railroad tracks at the Canal Visitor Center.
Global Range: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. It currently ranges from Virginia north to Vermont, east to Minnesota and south to Tennessee.
Nations: CA, US
States/Provinces: CT, DE, IA, IN, MA, MD, ME, MN, NH, NJ, NY, OH, ON, PA, QC, RI, TN, VA, VT, WI?, WV
TNC Ecoregions: 46:P, 47:C, 48:C, 49:C, 50:C, 51:C, 59:C, 60:C, 61:C, 62:C
USFS Ecoregions (1994/95): 212Fc:CCC, 212G:CP, 221Aa:CCC, 221Bc:CCC, 221Bd:CCC, 221Da:CCC, 221Fa:CCC, 222Ib:CCC, 222Ic:CCC, 222Jj:CCC, 222L:CC, M221Ac:CCC, M221Ad:CCC, M221Bb:CCC, M221Bf:CCC, M221Dc:CCC
Federal Lands: NPS (Allegheny Portage Railroad, Appalachian Trail [Central Appalachians], Appalachian Trail [Lower New England], C&O Canal, Catoctin Mountain, Cuyahoga Valley, Delaware Water Gap, Effigy Mounds, Eisenhower, Gettysburg, Harpers Ferry, Indiana Dunes, Saint Croix, Saratoga, Saugus Iron Works, Upper Delaware); USFWS (Assabet River?, Erie, Great Meadows?, Great Swamp, Iroquois, Montezuma, Oxbow, Parker River)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HRCG, HMPM
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (4 plots): CUVA.156, CUVA.158, CUVA.177, CUVA.187.
Local Description Authors: M.J. Russo

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Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler

References: Apfelbaum and Sams 1987, Barnes 1999, CDPNQ unpubl. data, Cowardin et al. 1979, Coxe 2009, Edinger et al. 2002, Edinger et al. 2007, Fike 1999, Hop et al. 2005, Hop et al. 2009, Largay and Sneddon 2008, MNNHP 1993, Metzler and Barrett 2001, Metzler and Barrett 2006, Midwestern Ecology Working Group n.d., NRCS 2004a, ONHD unpubl. data, Perles et al. 2004, Perles et al. 2006c, Perles et al. 2006d, Perles et al. 2007, Perles et al. 2008, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, TDNH unpubl. data, TNC and WPC 2004, Thompson 1996, Thompson and Sorenson 2000, Vanderhorst 2001a, Vanderhorst and Streets 2006, Zimmerman 2011h, Zimmerman et al. 2012

Eastern Reed Marsh

***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation**
Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation
Identifier: CEGL004141

ELEMENT CONCEPT

Global Summary: This reed marsh type is found across the east-temperate regions of the United States and Canada. Stands occur in semipermanently flooded marshes, ditches, impoundments, etc., that have often been disturbed by human activity. The vegetation is variable, as *Phragmites australis* (common reed) will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis* (common reed), with few or no other vascular plants present.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community was sampled twice in the park. Sites can be in the floodplain or on disturbed basin wetlands separate from the floodplain.
Global Environment: Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This community is strongly dominated by *Phragmites australis* (common reed). Other wetland species that can tolerate the disturbed setting may be present, such as *Typha* (cattail) spp., *Phalaris arundinacea* (reed canarygrass), or *Carex* (sedge) spp.
Global Vegetation: The vegetation is often variable, as *Phragmites australis* (common reed) will often invade into existing natural or semi-natural communities present on the site. Once firmly established, this community is usually strongly dominated by *Phragmites australis* (common reed), with few or no other vascular plants present.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phragmites australis* (common reed)

Global

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Phragmites australis* (common reed)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Phragmites australis* (common reed)
Global: *Phragmites australis* (common reed)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (23-Nov-1997). Although almost always occurring as a naturalized type that arises from human disturbance, some stands in northern Minnesota and further north in Canada may be native. If so, they should be tracked as a separate type.

CLASSIFICATION

Status: Standard
Classification Confidence: 1 - Strong
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This is not a native community but is the result of the invasion of alien *Phragmites australis* (common reed) into natural or semi-natural vegetation. The vegetation has variable hydrology and, unless *Phragmites* (reed) is clearly dominant, is often treated as part of other marsh and meadow types. The geographic distribution of the type is arbitrarily limited to Bailey's Humid Temperate Domain in eastern North America (Bailey 1997, 1998). Stands in northern Minnesota and farther north in Canada may

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represent native stands. If so, they should be tracked as a different type. Tidal vegetation of the Gulf Coast of Louisiana and Texas dominated by *Phragmites australis* (common reed) is classified in the *Phragmites australis* (common reed) Tidal Herbaceous Alliance (A.1477).

Global Similar Associations:

- *Phragmites australis* Tidal Herbaceous Vegetation (CEGL004187)
- *Phragmites australis* Western North America Temperate Semi-natural Herbaceous Vegetation (CEGL001475)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This reed marsh type is found across the east-temperate regions of the United States and Canada, ranging from Maine west to the eastern Dakotas and Manitoba, south to Texas and east to Florida.
Nations: CA, US
States/Provinces: AL, AR, CT, DE, FL, GA, IA, IN, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ:S5, NY, OH, ON, PA:S5, QC, RI, SC, TX, VA, VT, WI, WV
TNC Ecoregions: 31:C, 39:P, 40:C, 41:C, 42:C, 47:C, 48:C, 52:P, 53:C, 55:C, 56:C, 57:C, 59:C, 60:C, 61:C, 62:C
USFS Ecoregions (1994/95): 212C:CP, 212Fc:CCC, 212Ho:CCC, 212Hw:CCC, 221Aa:CCP, 221Ab:CCC, 221Ae:CCC, 221Ai:CCC, 221Bc:CCC, 221Da:CCC, 222Ic:CCC, 222Jj:CCC, 231Fb:CCC, 232Ab:CCC, 232Ac:CCC, 232Ch:CCC, 232Dc:CCC, 232E:CC, 232G:CC, 234A:PP, 255Dc:CCC, M212:C, M221:P
Federal Lands: NPS (Appalachian Trail [Central Appalachians], Appalachian Trail [Lower New England], Appalachian Trail [Northern Appalachians], Assateague Island, Boston Harbor Islands, Cape Cod, Cuyahoga Valley, Indiana Dunes, Minute Man, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFWS (Alligator River, Aransas, Bon Secour, Brazoria, Cape May, E.B. Forsythe, Great Dismal Swamp, Great Meadows, Great Swamp, Matagorda Island, Monomoy, Montezuma, Oxbow, Parker River, Prime Hook, Supawna Meadows)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HCRM, HMPM
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (2 plots): CUVA.161, CUVA.186.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen
References: Bailey 1997, Bailey 1998, Bell et al. 2002, Brock et al. 2007, CDPNQ unpubl. data, Chapman et al. 1989, Clancy 1993b, Coxe 2009, Edinger et al. 2002, Edinger et al. 2007, Eichelberger 2011f, Faber-Langendoen 2001, Gawler et al. 2005, Harris et al. 1996, Homoya et al. 1988, Hop et al. 1999, Hop et al. 2009, INAI unpubl. data, Largay and Sneddon 2010, MNNHP 1993, Metzler and Barrett 1992, Metzler and Barrett 2001, Metzler and Barrett 2006, NRCS 2004a, NatureServe 2009, Nelson 1986, ONHD unpubl. data, Perles et al. 2008, Rawinski 1984, Schafale and Weakley 1990, Schotz pers. comm., Sneddon et al. 2010, Southeastern Ecology Working Group n.d., Swain and Kearsley 2001, TNC 1995c, Zimmerman et al. 2012

Japanese Knotweed Gravelbar

***Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation**
Japanese Knotweed Temporarily Flooded Herbaceous Vegetation
Identifier: CEGL008472

ELEMENT CONCEPT

Global Summary: Examples of this vegetation type are significant (monocultural) stands of the exotic forb *Polygonum cuspidatum* (Japanese knotweed), which are found in temporarily flooded habitats such as scour bars. These disturbed habitats flood very frequently and have lots of light and rocky or sandy soil. Stands of this vegetation may be dense and shrubby, or somewhat more open. Species diversity is low, as the patches of *Polygonum* (knotweed) shade out other plant species. This vegetation ranges across the Southeast north at least to Pennsylvania and New Jersey. In North Carolina, this vegetation is found on scour bars and low rocky banks of the Nolichucky and French Broad rivers. In Kentucky, *Polygonum cuspidatum* (Japanese knotweed) is found primarily along disturbed riverbanks and bars mostly in the Cumberland Plateau and Cumberland Mountains where it can form pure, dense stands.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community is found on riverbanks, usually along the Cuyahoga River.
Global Environment: Stands of this type are found in temporarily flooded habitats such as scour bars. These disturbed areas flood very frequently and have lots of light and rocky or sandy soil. In North Carolina, it is found on scour bars and low rocky banks of the Nolichucky and French Broad rivers (B. Brown pers. comm. 2001). In Kentucky, *Polygonum cuspidatum* (Japanese knotweed) is found primarily along disturbed riverbanks and bars mostly in the Cumberland Plateau and Cumberland Mountains where it can form pure, dense stands (M. Evans pers. comm. 2001).

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VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This community is composed of nearly monotypic stands of *Polygonum cuspidatum* (Japanese knotweed).

Global Vegetation: These are primarily monospecific stands of *Polygonum cuspidatum* (Japanese knotweed) with few other plant species. Some disturbance-oriented forbs may be present, such as *Impatiens* (touch-me-not) spp., *Phalaris arundinacea* (reed canarygrass), *Leersia virginica* (whitegrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum persicaria* (spotted ladysthumb), and *Boehmeria cylindrica* (small-spike false nettle), along with seedlings of some woody plants (e.g., *Platanus occidentalis* (American sycamore), *Salix nigra* (black willow)). The invasive exotic herbs *Alliaria petiolata* (garlic mustard) and *Microstegium vimineum* (Nepalese browntop) may be present.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum cuspidatum* (Japanese knotweed)

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Polygonum cuspidatum* (Japanese knotweed)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Polygonum cuspidatum* (Japanese knotweed)
Global: *Polygonum cuspidatum* (Japanese knotweed)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Invasive/Exotic: *Alliaria petiolata* (garlic mustard, invasive/exotic, High/Medium), *Microstegium vimineum* (Nepalese browntop, invasive/exotic, High/Medium), *Polygonum cuspidatum* (Japanese knotweed, invasive/exotic, High/Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (31-May-2001). This vegetation is composed of and dominated by a species which is not native to North America.

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This species has also been treated as *Reynoutria japonica*.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This vegetation is potentially found anywhere in the southeastern and mid-Atlantic United States where the exotic rhizomatous forb *Polygonum cuspidatum* (Japanese knotweed) has formed significant (monocultural) stands. This includes at least Alabama, Georgia, Kentucky, Maryland, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia.
Nations: US
States/Provinces: AL, GA, KY, NC, NJ, NY, OH, PA:S5, SC, TN, VA?
TNC Ecoregions: 42:P, 43:P, 44:P, 49:C, 50:C, 51:C, 52:P, 56:P, 57:P, 59:C, 60:C, 61:C, 62:C
USFS Ecoregions (1994/95): 212Fc:CCC, 221Bd:CCC, 232Aa:CCC, 232Ac:CCC, M221Ac:CCC
Federal Lands: NPS (Allegheny Portage Railroad, Cuyahoga Valley, Delaware Water Gap, Gateway, Upper Delaware); USFS (Cherokee?, Daniel Boone, Pisgah)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HSJK
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist. Eleven sites were visited during Accuracy Assessment.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: M. Pyne, mod. S.C. Gawler
References: Brown pers. comm., Edinger et al. 2002, Edinger et al. 2008a, M. Evans pers. comm., NRCS 2001b, Perles et al. 2006d, Perles et al. 2007, Perles et al. 2008, Schafale pers. comm., Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004, WPC and TNC 2002, Walz et al. 2008, Zimmerman 2011s, Zimmerman et al. 2012

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M069. Eastern North American Wet Meadow & Marsh

G125. Eastern North American Freshwater Marsh

Bulrush - Cattail - Bur-reed Shallow Marsh

***Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.)**
Herbaceous Vegetation
Softstem Bulrush - Cattail species - (Bur-reed species, Rush species) Herbaceous Vegetation
Identifier: CEGL002026

ELEMENT CONCEPT

Global Summary: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada. It is found in basin-like depressions, backwater areas of floodplains, and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium. Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani* (softstem bulrush), *Schoenoplectus fluviatilis* (river bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Typha angustifolia* (narrowleaf cattail), and *Typha latifolia* (broadleaf cattail) may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides* (rice cutgrass), *Eleocharis palustris* (common spikerush), *Juncus* (rush) spp., and *Sparganium* (bur-reed) spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum* (American water plantain), *Alisma triviale* (northern water plantain), *Sagittaria latifolia* (broadleaf arrowhead), *Sparganium eurycarpum* (broadfruit bur-reed), *Pontederia cordata* (pickerelweed), along with *Bacopa rotundifolia* (disk water-hyssop) and *Heteranthera limosa* (blue mudplantain). Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana* (Carolina mosquitofern), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), and *Utricularia macrorhiza* (common bladderwort).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This herbaceous wetland is found in seasonally flooded areas with silty or mucky soils.
Global Environment: This community ranges broadly over the midwestern United States. It is found in basin-like depressions, backwater areas of floodplains and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, often found in alluvium (Lauver et al. 1999).

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This community is dominated by *Sparganium* spp. (bur-reed) or a mix of *Sparganium* spp. (bur-reed), *Typha* spp. (cattail), and *Juncus* spp. (rush)
Global Vegetation: Vegetation varies from zones dominated by tall emergents 1-2 m tall to those with hydrophytic annual and perennial forbs <1 m tall. In the tall emergent zone, *Schoenoplectus tabernaemontani* (softstem bulrush), *Schoenoplectus fluviatilis* (river bulrush), *Schoenoplectus acutus* (hardstem bulrush), *Typha angustifolia* (narrowleaf cattail), and *Typha latifolia* (broadleaf cattail) may dominate, mixed with a variety of other herbaceous species, such as *Leersia oryzoides* (rice cutgrass), *Eleocharis palustris* (common spikerush), *Juncus* (rush) spp., and *Sparganium* (bur-reed) spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum* (American water plantain), *Alisma triviale* (northern water plantain), *Pontederia cordata* (pickerelweed), *Sagittaria latifolia* (broadleaf arrowhead), and *Sparganium eurycarpum* (broadfruit bur-reed), along with *Bacopa rotundifolia* (disk water-hyssop) and *Heteranthera limosa* (blue mudplantain). Other species that may dominate locally include *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum amphibium var. emersum* (longroot smartweed), and *Polygonum lapathifolium* (curlytop knotweed). Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana* (Carolina mosquitofern), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), and *Utricularia macrorhiza* (common bladderwort) (Eggers and Reed 1987, Steinauer and Rolfsmeier 2000).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (22-Jun-1998).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak

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Cuyahoga Valley National Park Comments: Information not available.

Global Comments: This is a very broadly defined type that intergrades between wet meadows and deep marshes. Shaw and Fredine (1971) (in Eggers and Reed 1987) define shallow marsh as "soils that are saturated to inundated by standing water up to 15 cm in depth, throughout most of the growing season." Depending on the local topographic context, the type may or may not be extensive. Any number of types could be separated within this coarsely defined type, but it is not yet clear how best to make such distinctions (e.g., the forb-dominated portions, such as *Pontederia cordata* (pickerelweed) or *Sagittaria latifolia* (broadleaf arrowhead)). [See e.g., *Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation (CEGL005240).] See also Lee et al. (1998), who separate out a *Sparganium eurycarpum* (broadfruit bur-reed) type. Taxonomically, *Schoenoplectus tabernaemontani* (softstem bulrush) is equivalent to former *Scirpus validus* (Kartesz 1999). In Minnesota, *Schoenoplectus acutus* (hardstem bulrush) may be the more common bulrush (R. Dana pers. comm. 1999). *Eleocharis* (spikerush) spp. can also be typical of this type. Dominant and characteristic plants should always be described from stands to allow for adequate characterization. In Nebraska, the pond marsh extends to south-central Nebraska (Steinauer and Rolfsmeier 2000).

Global Similar Associations:

- *Sagittaria latifolia - Leersia oryzoides* Herbaceous Vegetation (CEGL005240)
- *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229) This is the deep marsh equivalent of this type.
- *Typha* spp. - *Schoenoplectus* spp. - Mixed Herbs Great Plains Herbaceous Vegetation (CEGL002228)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.

Global Range: This shallow marsh mixed emergent community ranges broadly over the midwestern United States and adjacent Canada, from Ohio and Ontario west to Manitoba, south to Oklahoma and northern Arkansas, and east to Indiana.

Nations: CA, US

States/Provinces: AR, DC?, IA, IL, IN, KS:S1S2, MB:S4?, MI, MN, MO, ND:S3, NE, NM, OH, OK, ON, PA, QC, SD, SK, WI:S4, WY

TNC Ecoregions: 26:C, 33:C, 34:C, 35:C, 36:C, 37:C, 38:C, 39:C, 40:P, 42:P, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C

USFS Ecoregions (1994/95): 212Hb:CC?, 212Hm:CCC, 212Hs:CCC, 212Hv:CCC, 212Ib:C??, 212Ja:CCP, 212Jb:CC?, 212Jc:CCP, 212Jd:CCC, 212Je:CC?, 212Jf:CC?, 212Jj:CC?, 212Jk:CC?, 212Jl:CC?, 212Jm:CC?, 212Ka:CP?, 212Kb:CPP, 212La:CPP, 212Lb:CPP, 212Lc:CPP, 212Ld:CPP, 212Ma:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 212Nd:CPP, 221Ea:CCC, 221Ec:CCC, 221Ed:CCP, 221Ef:CCC, 221Fa:CCC, 221He:CCC, 222Ak:CC?, 222An:CCC, 222Ao:CCP, 222Db:CCC, 222Ga:CCC, 222Gb:CCC, 222Ha:CCC, 222Hc:CCC, 222Hf:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Md:CCC, 222Na:CPP, 232Ad:CCC, 251Aa:CP?, 251Cc:CCC, 251Cd:CC?, 251Cf:CCC, 251Cj:CCC, 251Co:CCC, 251Dg:CCC, 332E:PP

Federal Lands: NPS (Buffalo River, C&O Canal, Cuyahoga Valley, Effigy Mounds, Indiana Dunes, Isle Royale, National Capital-East, Prince William, Saint Croix); USFS (Chequamegon-Nicolet?, Chequamegon?, Chippewa?, Nicolet?, Ottawa?, Wayne); USFWS (Erie)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HMPM

Cuyahoga Valley National Park Inventory Notes: This community was found during Accuracy Assessment so little information exists for the community.

Cuyahoga Valley National Park Plots and Observation Points: Information not available.

Local Description Authors: J. Drake

Global Description Authors: D. Faber-Langendoen

References: Baalman 1965, CDPNQ unpubl. data, Chapman et al. 1989, Eggers and Reed 1987, Faber-Langendoen 2001, Greenall 1996, Hoagland 1997, Hoagland 2000, Homoya et al. 1988, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, Kartesz 1999, Lauver et al. 1999, Lee et al. 1998, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, Muldavin et al. 2000a, NDNHI unpubl. data, NMNHP unpubl. data, Nelson 1985, Nelson 2010, ONHD unpubl. data, Rolfsmeier and Steinauer 2010, Shaw and Fredine 1971, Steinauer and Rolfsmeier 1997, Steinauer and Rolfsmeier 2000, Steinauer and Rolfsmeier 2003, TNC 1999b, WNDD unpubl. data, WNHI 2011, WNHIP unpubl. data, White and Madany 1978

Midwest Cattail Deep Marsh

***Typha* spp. Midwest Herbaceous Vegetation**
Cattail species Midwest Herbaceous Vegetation
Identifier: CEGL002233

ELEMENT CONCEPT

Global Summary: This community type is found in deep marshes throughout the midwestern United States and Canada. The vegetation is dominated by relatively pure stands of *Typha* (cattail) spp., either *Typha latifolia* (broadleaf cattail) or *Typha angustifolia*

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(narrowleaf cattail) or both. Many associates could occur. This type may simply be a less diverse variation of *Typha* (cattail) spp. - *Schoenoplectus acutus* (hardstem bulrush) - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229), or is a semi-natural type resulting from human disturbance to wetlands.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This cattail marsh was sampled twice in the park. The site is a permanently flooded man-made fishing lake with very poorly drained muck soil. The unvegetated surface is dominated by standing water with some leaf litter. Evidence of disturbance includes man-made structures including trails and an observation dock.
Global Environment: These wetlands are found in glacial potholes, river valleys, ponds, and on lakeplains. They are characterized by continuous inundation and are considered a deep marsh. Water depth averages 0.3-0.6 m, ranging from several centimeters to more than one meter for a significant part of the growing season.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The dense (90% cover) herbaceous layer is a near monoculture of *Typha angustifolia* (narrowleaf cattail). Small amounts of *Lemna minor* (common duckweed) and Ohio state-imperiled *Sagittaria rigida* (sessilefruit arrowhead), *Schoenoplectus* spp (bulrush), and other wetland herbaceous species can be present.
Global Vegetation: This deepwater emergent marsh community is dominated by perennial, coarse-leaved graminoid vegetation. Stands may vary from a mosaic of emergents, submergents, and floating-leaved plants interspersed with areas of open water to dense stands of emergents (Harris et al. 1996). They may display substantial areas of open water, but vegetation covers at least 30% of the surface. The vegetation is dominated by relatively pure stands of *Typha* (cattail) spp., either *Typha latifolia* (broadleaf cattail) or *Typha angustifolia* (narrowleaf cattail) or both. Many associates could occur.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Typha angustifolia* (narrowleaf cattail)

Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Typha angustifolia* (narrowleaf cattail)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Vulnerable: *Sagittaria rigida* (sessilefruit arrowhead, Ohio state-imperiled, G5)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: It is unclear whether a separate *Typha* (cattail)-dominated type is needed in addition to the mixed *Typha* - *Scirpus* type (e.g., *Typha* (cattail) spp. - *Schoenoplectus acutus* (hardstem bulrush) - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)), as well as separate *Scirpus* (bulrush)-dominated types (e.g., *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)). Pure *Typha* (cattail) stands, depending on site conditions, are also perceived as degraded examples of the mixed type. In western Minnesota, where *Typha* (cattail) spp. form pure stands, the species may be *Typha angustifolia* (narrowleaf cattail) or *Typha X glauca* (blue cattail) in culturally disturbed marshes, and *Typha latifolia* (broadleaf cattail) (mixed with other species, especially Carices) in more undisturbed marshes (R. Dana pers. comm. 1999). Elsewhere, *Typha angustifolia* (narrowleaf cattail) is thought to be more typical of undisturbed marshes.
Global Similar Associations:

- *Schoenoplectus acutus - (Schoenoplectus fluviatilis)* Freshwater Herbaceous Vegetation (CEGL002225)
- *Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Eastern Herbaceous Vegetation (CEGL006153)
- *Typha latifolia - Caltha palustris* Herbaceous Vegetation (CEGL006245)
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229)
- *Typha* spp. Great Plains Herbaceous Vegetation (CEGL002389)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled at Kendall Lake.
Global Range: This community type is found in deep marshes throughout the midwestern United States, from Ohio and Ontario west to North Dakota, south to Kansas, and east to Indiana.

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Nations: CA, US
States/Provinces: IA:S5, IL, IN, KS:SU, MI, MN:S5, MO, ND, NE, OH:S5, ON, SD, WI:S4, WY
TNC Ecoregions: 32:C, 35:C, 36:C, 37:C, 38:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C
USFS Ecoregions (1994/95): 212Ha:CPP, 212Hb:CPP, 212He:CPP, 212Hh:CPP, 212Hi:CPP, 212Hj:CPP, 212Hk:CPP, 212Hl:CPP, 212Hm:CPP, 212Hn:CPP, 212Ho:CPP, 212Hp:CPP, 212Hq:CPP, 212Hr:CPP, 212Hs:CPP, 212Ht:CPP, 212Hv:CPP, 212Hw:CPP, 212Hx:CPP, 212Hy:CPP, 212Ib:C??, 212Ja:CPP, 212Jb:CPP, 212Jc:CPP, 212Jf:CPP, 212Jj:CPP, 212Jk:CPP, 212Jl:CPP, 212Jm:CPP, 212Jn:CPP, 212Jo:CPP, 212Jr:CPP, 212Ka:CCP, 212Kb:CCC, 212La:CPP, 212Mb:CPP, 212Na:CPP, 212Nb:CPP, 212Nc:CPP, 221Ec:CCC, 221Eg:CCC, 221Fa:CCC, 222Am:CCC, 222Ge:CCC, 222Ha:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 251Aa:CCC, 251Ba:CCC, 251Bb:CCC, 251Bd:CCC, 251Be:CCC, 251Cc:CCC, 251Cf:CCC, 251Cg:CCC, 251Dc:CCC, 251Dg:CCC, 251Ea:CCC, 251Ed:CCC, 255Aa:CCC
Federal Lands: NPS (Cuyahoga Valley, Indiana Dunes, Saint Croix, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Hiawatha, Nicolet, Ottawa?, Superior?)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HCTM, HMPM
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (2 plots): CUVA.31, CUVA.163.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Faber-Langendoen 2001, Harris et al. 1996, Homoya et al. 1988, Hop et al. 1999, Hop et al. 2009, INAI unpubl. data, Lauver et al. 1999, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, NDNHI unpubl. data, Nelson 1985, Nelson 2010, ONHD unpubl. data, Rolfsmeier and Steinauer 2010, Steinauer and Rolfsmeier 2003, WNDD unpubl. data, WNHI 2011, WNHIP unpubl. data, White and Madany 1978

G112. Eastern North American Wet Meadow

Lake Sedge Wet Meadow

***Carex lacustris* Herbaceous Vegetation**
Lake Sedge Herbaceous Vegetation
Identifier: CEGL002256

ELEMENT CONCEPT

Global Summary: This broad-leaved wet sedge meadow type occurs in the upper central midwestern and northeastern regions of the United States. Stands occur on floodplains, shallow bays of lakes and streams, and upland depressions. Soils are mineral or well-decomposed peat. Flooding is variable but typically is seasonal. The vegetation is dominated by tall sedges. Shrubs may have up to 25% cover. *Carex lacustris* (lake sedge) forms almost mono-dominant stands. Occasionally other emergents, such as *Typha latifolia* (broadleaf cattail) or *Sagittaria* (arrowhead) spp., may codominate. In Wisconsin this type is common in the northwest, where it typically intermingles with tall shrubs, especially *Salix* (willow) spp. (e.g., *Salix petiolaris* (meadow willow)). Common herbaceous associates at low cover include *Doellingeria umbellata* (parasol whitetop), *Calamagrostis canadensis* (bluejoint), *Carex stricta* (upright sedge), *Solidago canadensis* (Canada goldenrod), *Polygonum sagittatum* (arrowleaf tearthumb), *Verbena hastata* (swamp verbena), *Impatiens capensis* (jewelweed), *Eupatorium maculatum* (spotted joepyeweed), and *Muhlenbergia glomerata* (spiked muhly).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community was sampled once in the park. The site is seasonally flooded/saturated with mineral mucky soil. Plant litter is common on the ground. Some open water is present in the spring and early summer.
Global Environment: Stands occur on floodplains, shallow bays of lakes and streams, and upland depressions. Soils are mineral or well-decomposed peat. Flooding is variable but typically is seasonal.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This community is dominated by *Carex* (sedge) spp., most often *Carex lacustris* (lake sedge), which can form nearly monotypic stands. In other stands, *Phalaris arundinacea* (reed canarygrass) can be common or even co-dominant.
Global Vegetation: The vegetation is dominated by tall sedges. Shrubs may have up to 25% cover. *Carex lacustris* (lake sedge) forms almost mono-dominant stands. Occasionally other emergents, such as *Typha latifolia* (broadleaf cattail) or *Sagittaria* (arrowhead) spp., may codominate. In Wisconsin this type is common in the northwest, where it typically intermingles with tall shrubs, especially *Salix* (willow) spp. (e.g., *Salix petiolaris* (meadow willow)). Common herbaceous associates at low cover include *Doellingeria umbellata* (parasol whitetop), *Calamagrostis canadensis* (bluejoint), *Carex stricta* (upright sedge), *Solidago canadensis* (Canada goldenrod), *Polygonum sagittatum* (arrowleaf tearthumb), *Verbena hastata* (swamp verbena), *Impatiens capensis*

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(jewelweed), *Eupatorium maculatum* (spotted joepyeweed), and *Muhlenbergia glomerata* (spiked muhly) (E. Epstein pers. comm. 1999).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.

Global Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex lacustris* (lake sedge)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: *Carex lacustris* (lake sedge)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Vulnerable: *Polemonium vanbruntiae* (Vanbrunt's polemonium, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: The *Carex* species at Cuyahoga Valley NP appear to be more variable than is typical for this association. The *Carex*-dominated community or communities may not fit this global type but further information about them is needed to determine that.
Global Comments: Further characterization of this type is needed to determine whether it is a good type. It may represent a mono-dominant variant of a more broadly defined mixed broad-leaved sedge type (e.g., Bakowsky and Lee 1996). *Carex stricta* (upright sedge), by contrast, is a narrow-leaved sedge. Geographic distribution of this type versus *Carex (rostrata*, *utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257) also needs to be clarified. In Ohio, stands can be very large, especially in northeastern Ohio. *Carex hyalinolepis* (shoreline sedge) can also occur over large areas in Ohio (Greg Schneider pers. comm. 1996). Charles Umbanhowar should be consulted for examples of this type in southeastern Minnesota.
Global Similar Associations:
- *Carex (rostrata, utriculata) - Carex lacustris - (Carex vesicaria)* Herbaceous Vegetation (CEGL002257) a more northern coarse-sedge type.
- *Carex stricta - Carex* spp. Herbaceous Vegetation (CEGL002258) a narrow-leaved sedge type.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This broad-leaved wet sedge meadow type occurs in the north-central and northeastern regions of the United States, extending from New England, Ohio and Ontario to Iowa, the Dakotas, and Manitoba.
Nations: CA, US
States/Provinces: IA:SU, IL, IN, MA, MB:SU, MN, NY, OH, QC:S4?, WI, WV:S1
TNC Ecoregions: 35:C, 46:C, 47:C, 48:C, 59:C, 61:C
USFS Ecoregions (1994/95): 212Hb:CPP, 212Ja:CPP, 212Jb:CP?, 212Jc:CP?, 212Je:CP?, 212Jf:CPP, 212Jj:CP?, 212Jk:CP?, 212Jl:CPP, 212Jm:CPP, 212Ka:CCP, 212Kb:CCC, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 221Aa:CCP, 221Ai:CCC, 221Bc:CCC, 222Jg:CCC, 222Ke:CCC, 222Kf:CCC, 222Lc:CCC, 222Lf:CCC, 222Mb:CCC, 222Mc:CCC, 222Md:CCC, 222Me:CCC, 222Na:CCC, 251Aa:CCC
Federal Lands: NPS (Cuyahoga Valley, Minute Man, Saratoga); USFS (Chippewa, Monongahela); USFWS (Canaan Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HWSM, HMPM
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (1 plot): CUVA.162.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler
References: Bakowsky and Lee 1996, Byers et al. 2007, CDPNQ unpubl. data, Edinger et al. 2002, Edinger et al. 2007, Epstein pers. comm., Faber-Langendoen 2001, Gawler et al. 2005, Greenall 1996, Homoya et al. 1988, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, NRCS 2004a, ONHD unpubl. data, WNHI 2011, WNHIP unpubl. data, White and Madany 1978

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Northern Buttonbush Swamp

***Cephalanthus occidentalis / Carex* spp. Northern Shrubland**
Common Buttonbush / Sedge species Northern Shrubland
Identifier: CEGL002190

ELEMENT CONCEPT

Global Summary: This buttonbush swamp shrubland occurs throughout glaciated regions of the midwestern and northeastern United States and adjacent Canada. Stands occupy shallow water depressions, oxbow ponds, and backwater sloughs of stream and river floodplains. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought. Soils are deep (>100 cm) consisting of peat or muck over alluvial parent material. The shrub layer can vary from very open to closed (20-80%). *Cephalanthus occidentalis* (common buttonbush) typically comprises nearly 90% of the shrub layer in waters 1-2 m deep. Other shrubs commonly encountered include *Cornus sericea* (red-osier dogwood), *Decodon verticillatus* (swamp-loosestrife), *Ilex verticillata* (common winterberry), *Rosa palustris* (swamp rose), and *Salix nigra* (black willow). The herbaceous layer can be very sparse, due to flooding. Rooted or floating aquatics may dominate, including *Lemna minor* (common duckweed) and *Nuphar advena* (yellow pond-lily). Herbs present on the shallow margins include *Bidens frondosa* (devil's beggarticks), *Boehmeria cylindrica* (small-spike false nettle), *Carex lacustris* (lake sedge), *Glyceria striata* (fowl mannagrass), and others. A scattered tree canopy may occur, including the following species: *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), and *Ulmus americana* (American elm). Diagnostic features include the dominance by *Cephalanthus occidentalis* (common buttonbush) in glaciated regions and, typically, the presence of standing water.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Information not available.
Global Environment: This wet shrubland community occupies shallow water depressions, oxbow ponds, and backwater sloughs of stream and river floodplains throughout swampy forested areas in glaciated terrain. Inundation is usually continuous throughout the year, but these sites can become dry in mid or late summer or during periods of prolonged drought (Faber-Langendoen and Maycock 1989). Soils are deep (>100 cm) consisting of peat or muck over alluvial parent material.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This community is has an open to closed shrub layer dominated by *Cephalanthus occidentalis* (common buttonbush). Other shrubs, such as *Salix* (willow) spp. and *Cornus foemina* (stiff dogwood), may be present. Stands tend to be small and trees may occur in these stands or overhang them. *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Acer rubrum* (red maple), *Acer negundo* (box-elder), and *Ulmus rubra* (slippery elm) are common.
Global Vegetation: The shrub layer can vary from very open to closed (20-80%). *Cephalanthus occidentalis* (common buttonbush) typically comprises nearly 90% of the shrub layer in waters 1-2 m deep. Other shrubs commonly encountered include *Cornus sericea* (red-osier dogwood), *Decodon verticillatus* (swamp-loosestrife), *Ilex verticillata* (common winterberry), *Rosa palustris* (swamp rose), and *Salix nigra* (black willow). The herbaceous layer can be very sparse, due to flooding. Rooted or floating aquatics may dominate, including *Lemna minor* (common duckweed) and *Nuphar advena* (yellow pond-lily). Herbs present on the shallow margins include *Bidens frondosa* (devil's beggarticks), *Boehmeria cylindrica* (small-spike false nettle), *Carex lacustris* (lake sedge), *Glyceria striata* (fowl mannagrass), and others. In Missouri *Hibiscus laevis* (halberdleaf rosemallow) is common. A scattered tree canopy may occur, including the following species: *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), *Fraxinus nigra* (black ash), *Fraxinus pennsylvanica* (green ash), and *Ulmus americana* (American elm) (Anderson 1996, Faber-Langendoen and Maycock 1989).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (3-Oct-1996).

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: The limits of glaciation used to define the southern boundary of this type include all glacial periods. It may, however, be more practical to use the ecoregion map divisions, such that the southern limit is approximately equal to the southern boundaries of Sections 251C, 222G, 222H and 221F. A rule as to the percentage dominance of *Cephalanthus occidentalis* (common

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buttonbush) (e.g., at least 50% cover) is probably needed to distinguish this type from dogwood-willow swamps. See also *Cephalanthus occidentalis - Decodon verticillatus* Shrubland (CEGL006069), found in Lower New England and the mid-Atlantic and central Appalachian regions of the eastern United States.

Global Similar Associations:

- *Cephalanthus occidentalis - Decodon verticillatus* Shrubland (CEGL006069) northeastern type.
- *Cephalanthus occidentalis / Carex* spp. - *Lemna* spp. Southern Shrubland (CEGL002191) southern buttonbush swamp type.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.

Global Range: This buttonbush swamp shrubland occurs throughout glaciated regions of the midwestern and northeastern United States and adjacent Canada, ranging from northern Missouri north to southern Michigan, east to Ohio and southern Ontario, and south to Indiana and Illinois.

Nations: CA, US

States/Provinces: IA, IL, IN, MI:S3, MO, NY, OH, ON, QC?

TNC Ecoregions: 36:C, 44:C, 45:C, 46:C, 48:C, 49:C

USFS Ecoregions (1994/95): 212Hv:CCC, 221Ec:CPP, 221Ed:CPP, 221Ef:CPP, 221Fa:CCC, 221Fc:CCC, 222Ga:CCC, 222Gb:CCC, 222Ge:CCC, 222Ha:CCC, 222Hb:CCC, 222Hf:CCP, 222Ib:CCC, 222Jb:CCC, 222Jc:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 251Cc:CCC, 251Cf:CCC, 251Cj:CCC, 251Ck:CCC, 251Dd:CCP, 251De:CCP, 251Dg:CCC, 251Dh:CCP, M221:P

Federal Lands: NPS (Cuyahoga Valley, Effigy Mounds, Indiana Dunes); USFWS (Iroquois)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: SWSM

Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist. Five sites were visited during Accuracy Assessment.

Cuyahoga Valley National Park Plots and Observation Points: Information not available.

Local Description Authors: J. Drake

Global Description Authors: D. Faber-Langendoen

References: Anderson 1996, CDPNQ unpubl. data, Chapman et al. 1989, Faber-Langendoen and Maycock 1989, Homoya et al. 1988, Hop et al. 2005, Hop et al. 2009, Kost et al. 2007, Midwestern Ecology Working Group n.d., Nelson 2010, ONHD unpubl. data, White and Madany 1978

Central Appalachian Cutgrass Marsh

***Leersia oryzoides - Sagittaria latifolia* Herbaceous Vegetation**

Rice Cutgrass - Broadleaf Arrowhead Herbaceous Vegetation

Identifier: CEGL006461

ELEMENT CONCEPT

Global Summary: This community occupies wet alluvial bottomlands and beaver ponds in the Central Appalachians and adjacent ecoregions. Parent materials are alluvium derived mainly from acidic sandstones and shales. Surface soils are poorly drained, acidic clay loams. This small-patch wetland community is dominated by grasses and forbs, with scattered trees and shrubs. The dominant grasses are *Leersia oryzoides* (rice cutgrass) and *Phalaris arundinacea* (reed canarygrass) with *Leersia* (cutgrass) strongly dominant at most sites. *Sagittaria latifolia* (broadleaf arrowhead) has high constancy and cover, except at higher elevations. *Scirpus cyperinus* (woolgrass) has high constancy. Additional characteristic herbs include *Boehmeria cylindrica* (small-spike false nettle), *Carex gynandra* (nodding sedge), *Carex intumescens* (greater bladder sedge), *Carex baileyi* (Bailey's sedge), *Dichanthelium clandestinum* (deertongue), *Dulichium arundinaceum* (threeway sedge), *Eupatorium fistulosum* (trumpetweed), *Galium tinctorium* (stiff marsh bedstraw), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Lobelia siphilitica* (great blue lobelia), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Lycopus virginicus* (Virginia water horehound), *Lysimachia terrestris* (earth loosestrife), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum sagittatum* (arrowleaf tearthumb), *Scirpus atrovirens* (green bulrush), and *Typha latifolia* (broadleaf cattail). Areas with longer standing water may have aquatic species, including *Callitriche heterophylla* (twoheaded water-starwort) and *Sparganium* (bur-reed) spp. Scattered small trees include *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), and *Fraxinus pennsylvanica* (green ash). The exotic shrub *Rosa multiflora* (multiflora rose) is sometimes invasive in this community. *Cornus amomum* (silky dogwood) is a characteristic native shrub.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Information not available.

Global Environment: This community occupies wet alluvial bottomlands, beaver ponds, and disturbed flats in the Central Appalachians and adjacent ecoregions. Parent materials at documented sites are alluvium derived mainly from acidic sandstones and shales. Surface soils described from sampled plots are somewhat to very poorly drained clay, clay loam, muck, sandy clay, sandy

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loam, or silty clay. Hydric soil indicators include Histosols, histic epipedon, depleted matrix, and redox depressions. Soil pH averages 4.0 (n=2). The unvegetated surface is predominantly litter, with small amounts of downed wood and standing water, and frequent patches of bare soil. Elevations of documented stands range up to 1300 m.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This herbaceous wetland is dominated by *Leersia oryzoides* (rice cutgrass) and *Sagittaria latifolia* (broadleaf arrowhead). Other wetland species can occur, including *Phalaris arundinacea* (reed canarygrass), *Carex* (sedge) spp., *Typha* (cattail) spp., and *Scirpus atrovirens* (green bulrush).

Global Vegetation: This small-patch wetland community is dominated by grasses and forbs, with scattered trees and shrubs. The dominant grasses are *Leersia oryzoides* (rice cutgrass) and *Phalaris arundinacea* (reed canarygrass). Both of these are native species, however, introduction of Eurasian ecotypes and cultivars of *Phalaris arundinacea* (reed canarygrass) and subsequent hybridization with native stock have been blamed for the current invasive capacity of this species. *Leersia* (cutgrass) is strongly dominant at most sites. *Sagittaria latifolia* (broadleaf arrowhead) has high constancy and cover but drops out at the highest elevations. *Scirpus cyperinus* (woolgrass) has high constancy. Additional characteristic herbs include *Boehmeria cylindrica* (small-spike false nettle), *Carex gynandra* (nodding sedge), *Carex intumescens* (greater bladder sedge), *Carex baileyi* (Bailey's sedge), *Dichanthelium clandestinum* (deertongue), *Dulichium arundinaceum* (threeway sedge), *Eupatorium fistulosum* (trumpetweed), *Galium tinctorium* (stiff marsh bedstraw), *Impatiens capensis* (jewelweed), *Juncus effusus* (common rush), *Lobelia siphilitica* (great blue lobelia), *Ludwigia palustris* (marsh seedbox), *Lycopus uniflorus* (northern bugleweed), *Lycopus virginicus* (Virginia water horehound), *Lysimachia terrestris* (earth loosestrife), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum sagittatum* (arrowleaf tearthumb), *Scirpus atrovirens* (green bulrush), and *Typha latifolia* (broadleaf cattail). Cover by nonvascular plants is generally insignificant. Scattered small trees include *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), and *Fraxinus pennsylvanica* (green ash). The exotic shrub *Rosa multiflora* (multiflora rose) may be invasive in this community. *Cornus amomum* (silky dogwood) and *Cephalanthus occidentalis* (common buttonbush) are characteristic native shrubs. Areas with longer standing water may have aquatic species, including *Callitriche heterophylla* (twoheaded water-starwort) and *Sparganium* (bur-reed) spp. Mean species richness of vascular plants in 19 WV plots was 16 taxa per 400 square meters.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.

Global

Stratum	Lifeform	Species
Herb (field)	Forb	*Sagittaria latifolia* (broadleaf arrowhead)
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.

Global: *Cephalanthus occidentalis* (common buttonbush), *Cornus amomum* (silky dogwood), *Leersia oryzoides* (rice cutgrass), *Scirpus cyperinus* (woolgrass)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.

Global: Invasive/Exotic: *Phalaris arundinacea* (reed canarygrass, invasive, High), *Rosa multiflora* (multiflora rose, invasive/exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (5-Jun-2006). Need more complete information on range and occurrences before ranking.

CLASSIFICATION

Status: Standard

Classification Confidence: 3 – Weak

Cuyahoga Valley National Park Comments: Information not available.

Global Comments: This association is based on 19 plots and anecdotal data from West Virginia, but it is likely wider ranging.

Global Similar Associations:

- *Leersia oryzoides - Boehmeria cylindrica - Ranunculus flabellaris* Herbaceous Vegetation (CEGL006903) sinkhole ponds in New Jersey.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.

Global Range: This association is currently documented from several areas in West Virginia; it is likely in other parts of the Central Appalachians from Pennsylvania to Virginia.

Nations: US

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States/Provinces: DE, MA, MD, NY, OH, PA, VA, WV:S3
TNC Ecoregions: 48:C, 49:C, 50:C, 58:C, 59:C, 61:C
USFS Ecoregions (1994/95): 221Ae:CCC, 221Db:CCC, 221E:CC, 222Ic:CCC, M221Bb:CCC, M221Cb:CCC
Federal Lands: NPS (Cuyahoga Valley, New River Gorge); USFS (Monongahela); USFWS (Canaan Valley, Montezuma, Patuxent)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HMPM
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: S.C. Gawler
References: Byers et al. 2007, Eastern Ecology Working Group n.d., Eichelberger 2011h, Fike 1999, Grafton and Eye 1982, Putnam 1995, Vanderhorst 2001a, Vanderhorst 2001b, Vanderhorst and Streets 2006, Vanderhorst et al. 2007, Walbridge 1982, Walbridge and Lang 1982, Walton et al. 1996, Zimmerman et al. 2012

M160. Northern & Central Tall Shrub Wetland

G167. Northern & Central Shrub Swamp

Gray Alder Swamp

***Alnus incana* Swamp Shrubland**
Gray Alder Swamp Shrubland
Identifier: CEGL002381

ELEMENT CONCEPT

Global Summary: This alder swamp community is widespread in the midwestern and northeastern United States and southern Canada. Stands occur on shores, edges of beaver meadows in stream floodplains, swales associated with small streams in peatlands, or upland forests. Soils are well-decomposed peat, muck or mineral soils. The hydrology is typically seasonally flooded, with most sites remaining saturated. The vegetation is dominated by tall shrubs, 2-8 m in height, with a moderately open to dense shrub canopy. There is an understory of shorter shrubs and herbaceous species. The density of the understory varies inversely with the tall-shrub canopy. The overstory is usually overwhelmingly dominated by *Alnus incana* (gray alder), but in the more southeastern portions of this type's range, *Alnus serrulata* (hazel alder) can occur with *Alnus incana* (gray alder). Where alder is not as dominant, other shrubs, such as *Cornus sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Rubus idaeus* (American red raspberry), *Salix* (willow) spp., *Spiraea alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush), and *Viburnum* (viburnum) spp., can be found. At the southern range limit of this type in West Virginia, shrub layers may by be dominated or codominated by the Central Appalachian endemic *Ilex collina* (longstalk holly). The herbaceous layer contains species such as *Symphyotrichum lanceolatum var. lanceolatum* (white panicle aster), *Symphyotrichum puniceum* (purplestem aster), *Calamagrostis canadensis* (bluejoint), *Caltha palustris* (yellow marsh-marigold), *Carex lacustris* (lake sedge), *Carex prairea* (prairie sedge), *Carex trisperma* (three-seeded sedge), *Doellingeria umbellata* (parasol whitetop), *Eupatorium maculatum* (spotted joepyeweed), *Glyceria melicaria* (melic mannagrass), *Glyceria striata* (fowl mannagrass), *Impatiens capensis* (jewelweed), *Lycopus uniflorus* (northern bugleweed), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Rubus pubescens* (dwarf red blackberry), *Scirpus atrovirens* (green bulrush), *Symplocarpus foetidus* (skunk-cabbage), *Thelypteris palustris* (eastern marsh fern), *Typha* (cattail) spp., and *Viola* (violet) spp. Mosses include *Climacium dendroides* (tree climacium moss) and *Sphagnum* (sphagnum) spp. Where the tall-shrub canopy is open, graminoids can become dense. Scattered trees are found in many stands, including *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), and *Thuja occidentalis* (northern white-cedar).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: Information not available.
Global Environment: Sites are typically along streams, lakeshores, edges of beaver meadows, swales associated with small streams in peatlands or upland forests, or near seeps. Most have little to no slope, but some sites are on moderate slopes. Hydrologic conditions can range from temporarily flooded to seasonally flooded, or even saturated, but are typically seasonally flooded/saturated. The water ranges from non-stagnant, nutrient-rich, and often slightly calcareous (Curtis 1959) to rather stagnant and nutrient-poor where over acidic bedrock or till. Soils are wet, often mucks or peats (Anderson 1982, Chapman et al. 1989). In the upper Midwest, this community is found on Precambrian Shield bedrock that is overlaid with sandy loam soils, which are moderately well-drained and deep (>60 cm). In northeastern Minnesota stands can occur on northeast- and south-facing slopes that are moderate to steep, with slopes ranging from 4 to 45% (Ohmann and Ream 1971). The climate is highly variable, with temperature extremes between -46 and 38 degrees C and 58-91 cm precipitation.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This community has a moderate to dense tall-shrub layer dominated by *Alnus incana* (gray alder). *Frangula alnus* (glossy buckthorn), *Rosa palustris* (swamp rose), and *Toxicodendron vernix* (poison-sumac) were noted in the shrub canopy, as well. The herbaceous stratum is moderate to dense.

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Global Vegetation: The vegetation is dominated by tall shrubs, 2-8 m in height, with a moderately open to dense shrub canopy. There is an understory of shorter shrubs and herbaceous species. The density of the understory varies inversely with the tall-shrub canopy. The overstory is usually overwhelmingly dominated by *Alnus incana* (gray alder), but in the more southeastern portions of this type's range, *Alnus serrulata* (hazel alder) can occur with *Alnus incana* (gray alder). Where alder is not as dominant, other shrubs, such as *Cornus sericea* (red-osier dogwood), *Ilex verticillata* (common winterberry), *Rubus idaeus* (American red raspberry), *Salix* (willow) spp., *Spiraea alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush), and *Viburnum* (viburnum) spp., can be found. The herbaceous layer contains species such as *Symphyotrichum lanceolatum var. lanceolatum* (white panicle aster), *Symphyotrichum puniceum* (purplestem aster), *Calamagrostis canadensis* (bluejoint), *Caltha palustris* (yellow marsh-marigold), *Carex lacustris* (lake sedge), *Carex prairea* (prairie sedge), *Carex trisperma* (three-seeded sedge), *Doellingeria umbellata* (parasol whitetop), *Eupatorium maculatum* (spotted joepyeweed), *Impatiens capensis* (jewelweed), *Lycopus uniflorus* (northern bugleweed), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Rubus pubescens* (dwarf red blackberry), *Scirpus atrovirens* (green bulrush), *Symplocarpus foetidus* (skunk-cabbage), *Thelypteris palustris* (eastern marsh fern), *Typha* (cattail) spp., and *Viola* (violet) spp. Mosses include *Climacium dendroides* (tree climacium moss) and *Sphagnum* (sphagnum) spp. Where the tall-shrub canopy is open, the graminoids can become dense. Scattered trees are found in many stands, including *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), and *Thuja occidentalis* (northern white-cedar) (Curtis 1959, Anderson 1982, MNNHP 1993, Harris et al. 1996, Sperduto 2000b, Thompson and Sorenson 2000, Gawler 2002). Where stands border on saturated conditions with peaty soils, peatland species such as *Chamaedaphne calyculata* (leatherleaf), *Rhododendron canadense* (rhodora), and *Sphagnum* (sphagnum) spp. may be present.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)

Global

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Alnus incana* (gray alder)
Global: *Alnus incana* (gray alder)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Vulnerable: *Ilex collina* (longstalk holly, Southern Blue Ridge endemic, G3), *Polemonium vanbruntiae* (Vanbrunt's polemonium, G3G4)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (23-Jun-2006). This association is widely distributed and considered secure in many states.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Type has a very broad distribution, and there may be a need to separate a northern (more boreal) type from a southern (more temperate) type, or perhaps an enriched versus lower-nutrient type, based on floristic differences. Hydrology may be quite variable, ranging from temporarily flooded to semipermanently flooded. In Ohio, this association sometimes merges with *Alnus serrulata* (hazel alder) stands in *Alnus serrulata* Swamp Shrubland (CEGL005082); that association is distinguished by somewhat more southern associates, including *Rhododendron viscosum* (swamp azalea), *Lindera benzoin* (northern spicebush), *Peltandra virginica* (green arrow-arum), etc.. With increasing tree canopy cover, this association can be similar to *Larix laricina* (tamarack) forest types, *Thuja occidentalis* (northern white-cedar) saturated forest types, and *Fraxinus nigra - Acer rubrum* saturated forest types.
Global Similar Associations:

- *Alnus incana - Cornus (amomum, sericea) / Clematis virginiana* Shrubland (CEGL006062)
- *Alnus incana ssp. rugosa - Nemopanthus mucronatus / Sphagnum* spp. Shrubland (CEGL006158)
- *Alnus serrulata* Swamp Shrubland (CEGL005082)

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Only one site is known for this community near the intersection of Akron-Peninsula Rd and Wetmore Rd.
Global Range: This alder swamp shrubland is widespread in the midwestern and northeastern United States and southern Canada, ranging from Maine west to Manitoba, south to Iowa, and east to New York and perhaps northern New Jersey.
Nations: CA, US

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States/Provinces: IA:S3?, IL, IN?, MA, MB?, ME, MI:S5, MN:S5, ND:S2?, NH:S3S4, NJ?:S2S4, NY, OH, ON, PA, QC:S4S5, VT, WI:S4, WV:S3, WY
TNC Ecoregions: 34:C, 35:C, 46:C, 47:C, 48:C, 60:C, 61:C, 62:C, 63:C, 64:C
USFS Ecoregions (1994/95): 212Cb:CCC, 212Da:CCC, 212Db:CCC, 212Dc:CCC, 212Fc:CCC, 212Ha:CCP, 212Hb:CCP, 212He:CCP, 212Hh:CCP, 212Hi:CCC, 212Hj:CCP, 212Hk:CCP, 212Hl:CCC, 212Hm:CCP, 212Hn:CCP, 212Ho:CCC, 212Hp:CCP, 212Hq:CCC, 212Hr:CCP, 212Hs:CCP, 212Ht:CCC, 212Hv:CCP, 212Hw:CCC, 212Hy:CCP, 212Ia:CCC, 212Ib:CCC, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCC, 212Jj:CCP, 212Jk:CCP, 212Jl:CCP, 212Jm:CCP, 212Jn:CCP, 212Jo:CCP, 212Jr:CCC, 212Ka:CCP, 212Kb:CCC, 212La:CCC, 212Lb:CCC, 212Mb:CPP, 212Na:CCC, 212Nb:CCP, 212Nc:CCC, 221Ae:CCC, 221Ak:CCP, 221Al:CCP, 221Bc:CCC, 222Je:CCC, 222Lb:CCC, 222Lc:CCC, 222Mc:CCC, 222Md:CCC, 222Na:CCC, 251Aa:CCC, 251Ab:CCC, M212Aa:CCC, M212Ac:CCC, M212Ae:CCC, M212Af:CCC, M212B:CC, M212C:CC, M212D:CP
Federal Lands: NPS (Acadia, Apostle Islands, Appalachian Trail [Lower New England], Appalachian Trail [Northern Appalachians], Cuyahoga Valley, Grand Portage, Isle Royale, Pictured Rocks, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Chippewa, Huron, Huron-Manistee, Manistee, Nicolet, Ottawa, Superior); USFWS (Aroostook, Assabet River, Carlton Pond, Moosehorn?, Nulhegan Basin)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: SWSM
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist. Four sites were visited during Accuracy Assessment.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen, mod. S.C. Gawler
References: Anderson 1982, Anderson and Schwegman 1991, Breden et al. 2001, Byers et al. 2007, CDPNQ unpubl. data, Chapman et al. 1989, Curtis 1959, Darlington 1943, DeMeo et al. 1998, Edinger et al. 2002, Edinger et al. 2007, Faber-Langendoen 2001, Fike 1999, Fortney 1975, Fortney et al. 2005, Gawler 2002, Gawler and Cutko 2010, Greenall 1996, Harris et al. 1996, Homoya et al. 1988, Hop et al. 1999, Hop et al. 2010a, Hop et al. 2010b, Hop et al. 2010c, INAI unpubl. data, Kost et al. 2007, Lubinski et al. 2003, MNNHP 1993, Midwestern Ecology Working Group n.d., Minnesota DNR 2005a, NDNHI unpubl. data, NRCS 2004a, ONHD unpubl. data, Ohmann and Ream 1971, Perles et al. 2008, Rentch unpubl. data 2003, Robinette 1966, Sperduto 2000b, Sperduto and Nichols 2004, Swain and Kearsley 2001, TNC 1999b, Thompson and Sorenson 2000, WNDD unpubl. data, WNHI 2011, WNHIP unpubl. data, Walbridge 1982, Walbridge and Lang 1982, White and Madany 1978

Dogwood - Willow - Wild Indigo Shrubland

***Cornus racemosa - Salix* spp. - *Baptisia australis* Shrubland**
Gray Dogwood - Willow species - Blue Wild Indigo Shrubland
Identifier: CEGL005206

ELEMENT CONCEPT

Global Summary: Information not available.

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This community is found on flat floodplains but in sites that do not receive regular scouring. Sites may be flooded periodically, but the soil surface is not saturated for much of the growing season. Soils are alluvial silt and sand.
Global Environment: Information not available.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This wetland shrubland has a moderate to dense shrub canopy 2-5 m tall. *Cornus racemosa* (gray dogwood), *Baptisia australis* (blue wild indigo), *Amorpha fruticosa* (desert false indigo), and *Salix* (willow) spp. are dominant. Scattered trees common to the floodplain may be present. *Platanus occidentalis* (American sycamore), *Populus deltoides* (eastern cottonwood), *Salix nigra* (black willow), and *Acer negundo* (box-elder) are among these. Herbaceous species are varied, but common ones are *Alliaria petiolata* (garlic mustard), *Phalaris arundinacea* (reed canarygrass), *Solidago canadensis* (Canada goldenrod), and *Verbesina alternifolia* (wingstem).
Global Vegetation: Information not available.

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Amorpha fruticosa* (desert false indigo), *Baptisia australis* (blue wild indigo), *Cornus racemosa* (gray dogwood)

Global: Information not available.

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CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Amorpha fruticosa* (desert false indigo), *Baptisia australis* (blue wild indigo), *Cornus racemosa* (gray dogwood)
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (11-Jan-2013).

CLASSIFICATION

Status: Provisional
Classification Confidence: Information not available.
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Information not available.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This shrubland is found mostly along the Cuyahoga River, though it can occur on larger tributaries.
Global Range: Information not available.
Nations: US
States/Provinces: OH
TNC Ecoregions: Information not available.
USFS Ecoregions (1994/95): Information not available.
Federal Lands: NPS (Cuyahoga Valley)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: SWSM
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (3 plots): CUVA.164, CUVA.180, CUVA.210.
Local Description Authors: J. Drake
Global Description Authors:
References: Midwestern Ecology Working Group n.d.

5. AQUATIC VEGETATION

5.B.2. Temperate & Boreal Freshwater Aquatic Vegetation

5.B.2.Na. North American Freshwater Aquatic Vegetation

M108. Eastern North American Freshwater Aquatic Vegetation

G114. Eastern North American Freshwater Aquatic Vegetation

Water-lily Aquatic Wetland

***Nuphar advena - Nymphaea odorata* Herbaceous Vegetation**
Broadleaf Pond-lily - American White Water-lily Herbaceous Vegetation
Identifier: CEGL002386

ELEMENT CONCEPT

Global Summary: This rooted aquatic or open marsh community occupies shallow-water depressions, oxbow ponds, backwater sloughs of river floodplains, slow-moving streams, ponds, and small lakes throughout the central and eastern United States. It is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar advena* (yellow pond-lily) and *Nymphaea odorata* (American white waterlily) are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi* (watershield), various *Potamogeton* (pondweed) and *Stuckenia* (pondweed) spp., *Eleocharis robbinsii* (Robbins' spikerush) and other *Eleocharis* (spikerush) spp., *Polygonum amphibium* (water knotweed),

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Polygonum amphibium var. emersum (longroot smartweed), *Sparganium americanum* (American bur-reed), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), *Typha latifolia* (broadleaf cattail), and *Saururus cernuus* (lizard's-tail). Submerged aquatics more common in the southern part of the range include *Cabomba caroliniana* (Carolina fanwort), *Ceratophyllum demersum* (coon's-tail), and *Heteranthera dubia* (grassleaf mudplantain).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This water-lily aquatic wetland was sampled twice in the park. The sites are permanently flooded basin floors with very poorly drained muck or sand soils. The unvegetated surface is made up entirely of standing water. Evidence of disturbance includes the presence of man-made structures (boardwalk), trails and exotic species.
Global Environment: This community occupies shallow-water depressions, oxbow ponds, sluggish streams, and backwater sloughs of river floodplains, ponds (natural and artificial), and small lakes. In pools and slow-flowing stretches of river, at Obed River (TN), *Nuphar advena* (yellow pond-lily) is rooted in sandy substrate (Schmalzer and DeSelm 1982).

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: The floating aquatic vegetation of this community includes dominants *Nymphaea odorata* (American white waterlily) and *Nuphar advena* (yellow pond-lily) along with lesser amounts of *Lemna minor* (common duckweed) and *Myriophyllum spicatum* (Eurasian watermilfoil) (exotic). This constitutes all the taxa that were observed.
Global Vegetation: This community is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar advena* (yellow pond-lily) and *Nymphaea odorata* (American white waterlily) are dominants, either in combination together, or each singly. Other species present include *Brasenia schreberi* (watershield), various *Potamogeton* (pondweed) and *Stuckenia* (pondweed) spp., *Eleocharis robbinsii* (Robbins' spikerush) and other *Eleocharis* (spikerush) spp., *Polygonum amphibium* (water knotweed), *Polygonum amphibium var. emersum* (longroot smartweed), *Sparganium americanum* (American bur-reed), *Lemna* (duckweed) spp., *Spirodela polyrrhiza* (common duckmeat), *Typha latifolia* (broadleaf cattail), and *Saururus cernuus* (lizard's-tail) (Anderson 1982, G. Fleming pers. comm.). Submerged aquatic species more common in the southern part of the range include *Cabomba caroliniana* (Carolina fanwort), *Ceratophyllum demersum* (coon's-tail), and *Heteranthera dubia* (grassleaf mudplantain). This broadly conceived type may include ponds, or zones of ponds, dominated by *Nymphaea odorata* (American white waterlily), with or without *Nuphar advena* (yellow pond-lily).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park

Stratum	Lifeform	Species
Floating aquatic	Aquatic herb (floating & submergent)	*Nuphar advena*, *Nymphaea odorata* (American white waterlily)

Global

Stratum	Lifeform	Species
Floating aquatic	Aquatic herb (floating & submergent)	*Nuphar advena* (yellow pond-lily), *Nymphaea odorata* (American white waterlily)

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: *Nuphar advena*, *Nymphaea odorata* (American white waterlily)
Global: *Nuphar advena* (yellow pond-lily), *Nymphaea odorata* (American white waterlily)

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Invasive/Exotic: *Myriophyllum spicatum* (Eurasian watermilfoil, invasive/exotic, High)
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G4G5 (15-Oct-2002). The dominant species in stands of this vegetation are widespread across the eastern and central United States and adjacent Canada. This is not a rare or imperiled vegetation type, even though its occurrence is poorly documented. Stands may occur in natural lakes and ponds or in artificial impoundments.

CLASSIFICATION

Status: Standard
Classification Confidence: 2 - Moderate
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: Can occur in mostly natural ponded wetlands as well as artifactual ones such as borrow pits. On the Conecuh National Forest (Alabama), vegetation of this association occurs in Gum Pond and Open Pond as a mix of *Nymphaea odorata* (American white waterlily) and *Nuphar advena* (yellow pond-lily).
Global Similar Associations:

- *Equisetum fluviatile - (Eleocharis palustris)* Herbaceous Vegetation (CEGL005258)
- *Nuphar advena* Tidal Herbaceous Vegetation (CEGL004472)
- *Nuphar polysepala* Herbaceous Vegetation (CEGL002001)
- Semipermanent Impoundment (CEPS006581)

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OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: This community was sampled along Towpath Trail at Beaver Marsh and at the Terra Vista Natural Study Area.
Global Range: This rooted aquatic community occupies shallow, quiet waters throughout the central and eastern United States, extending from Maine to Ontario and Minnesota, south to Oklahoma and east to Georgia.
Nations: CA, US
States/Provinces: AL, AR, CT, DE, FL, GA, IA:SU, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH:S4S5, NJ:S4, NY, OH, OK, ON, PA:S4, RI, SC, TN, TX, VA:SU, VT, WI, WV
TNC Ecoregions: 31:C, 32:P, 36:C, 37:C, 39:C, 40:P, 41:C, 42:C, 43:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C, 51:C, 52:C, 53:C, 55:P, 56:C, 57:C, 58:C, 59:C, 60:C, 61:C, 62:C, 63:C
USFS Ecoregions (1994/95): 212Aa:CCC, 212Ba:CCC, 212Bb:CCC, 212Ca:CCC, 212Cb:CCC, 212Da:CCC, 212Db:CCP, 212Dc:CCC, 212Fa:CCP, 212Fb:CCP, 212Fc:CCP, 212Fd:CCP, 212Ga:CCP, 212Gb:CCP, 212Hb:CPP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 221Aa:CCP, 221Ab:CCC, 221Ah:CCC, 221Ai:CCC, 221Al:CCC, 221Am:CCC, 221Bd:CCP, 221Da:CCC, 221Db:CCC, 221Ea:CCC, 221Ed:CC?, 221Ef:CCC, 221Fa:CCC, 221Hc:CCC, 221He:CCC, 222Ch:CCC, 222Db:CCC, 222Gc:C??, 222Ha:CCC, 222Ja:CCC, 222Jb:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222Kg:CCC, 222Kh:CCC, 222Kj:CCC, 222L:CC, 231Bc:CCC, 231Bd:CCC, 231Ga:CCC, 231Gb:CCC, 231Gc:CCC, 232Bf:CCC, 232C:CC, 232D:CC, 234Aa:CCC, 234Ac:CCC, 234Ad:CCC, 234Af:CCC, 234Ag:CCC, 234Ai:CCC, 234Al:CCC, 234Am:CCC, 234An:CCC, 251Cf:CCC, 251Dd:CCC, 251Dg:CCC, 251Eb:CCC, M212Af:CCC, M212Bb:CCC, M212Bc:CCC, M212Bd:CCC, M212Cb:CCC, M212Cc:CCC, M212Ea:CCP, M212Eb:CCP, M221Aa:CCC, M221Ab:CCC, M221Ac:CCC, M221Ad:CCC, M221Ba:CCC, M221Bb:CCC, M221Bc:CCC, M221Bd:CCC, M221Be:CCC, M221Bf:CCC, M221Da:CCC, M221Dc:CCC
Federal Lands: DOD (Fort Benning); NPS (Acadia, Appalachian Trail [Lower New England], Appalachian Trail [Northern Appalachians], C&O Canal, Carl Sandburg Home, Cuyahoga Valley, Effigy Mounds, George Washington Parkway, Indiana Dunes, Minute Man, Natchez Trace, Obed River, Ozark Riverways, Saint Croix, Saint-Gaudens, Shiloh); USFS (Angelina, Chequamegon, Chequamegon-Nicolet, Conecuh, Davy Crockett, Kisatchie, Nicolet, Ocala, Ozark, Sabine, Sam Houston?, Talladega, Talladega (Oakmulgee), Talladega (Talladega)); USFWS (Back Bay, Erie, Great Swamp, Monomoy, Patuxent, Reelfoot)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HWLY, HMPM
Cuyahoga Valley National Park Inventory Notes: Information not available.
Cuyahoga Valley National Park Plots and Observation Points: (2 plots): CUVA.05, CUVA.151.
Local Description Authors: M.J. Russo
Global Description Authors: D. Faber-Langendoen, mod. C.W. Nordman, S.C. Gawler, M. Pyne
References: Ambrose 1990a, Anderson 1982, Breden et al. 2001, Chapman et al. 1989, Chastain et al. 2006, Clancy 1996, Coxe 2009, Edinger et al. 2002, Eichelberger 2011a, FNAI 1990, Faber-Langendoen 2001, Fike 1999, Fleming 2007, Fleming and Coulling 2001, Fleming and Patterson 2011a, Fleming et al. 2001, Foti et al. 1994, Gawler 2002, Gawler and Cutko 2010, Gawler et al. 2005, Harrison 2004, Harrison 2011, Hoagland 2000, Homoya et al. 1988, Hop et al. 2005, Hop et al. 2009, INAI unpubl. data, LNHP 2009, Lubinski et al. 2003, MNNHP 1993, Metzler and Barrett 2006, Midwestern Ecology Working Group n.d., NAP pers. comm. 1998, NatureServe Ecology - Southeastern U.S. unpubl. data, Nelson 1985, Nelson 2010, Nordman et al. 2011, ONHD unpubl. data, Peet et al. unpubl. data, Penfound 1953, Rawinski 1984, Schafale 2011, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Smith 1996a, Sperduto and Nichols 2004, Swain and Kearsley 2001, TDNH unpubl. data, TNHS unpubl. data, Thompson and Jenkins 1992, Thompson and Sorenson 2000, WNHIP unpubl. data, White 2003, White and Madany 1978, Zanoni et al. 1979, Zimmerman et al. 2012

Midwest Pondweed Submerged Aquatic Wetland

***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation**
Pondweed species - Hornwort species Midwest Herbaceous Vegetation
Identifier: CEGL002282

ELEMENT CONCEPT

Global Summary: This broadly defined submerged aquatic or open marsh type is found throughout the midwestern region of the United States and adjacent Canada. Based on information in the northern parts of the Midwest, several vegetation subgroups can be recognized that may be separate associations. Subgroup A is a shallow (<50 cm), sparsely vegetated, open water marsh found on sand, or organic and mineral material trapped in rocky bottoms. Stands are often exposed to wave action and found in oligotrophic lakes. Dominant plants often have basal rosettes that are resistant to wave action. Typical species include *Elatine minima* (small waterwort), *Eriocaulon aquaticum* (sevenangle pipewort), *Gratiola aurea* (golden hedgehyssop), *Isoetes tenella* (spiny-spore quillwort), *Isoetes lacustris* (lake quillwort), *Juncus pelocarpus* (brownfruit rush), and *Lobelia dortmanna* (Dortmann's cardinalflower). Subgroup B is a shallow (<50 cm) open water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is a mineral soil (often

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sand), boulders, or a mixture of sedimentary peat and fine mineral soil. Stands can be exposed to waves or are in stream channels. Stands may often be dominated by a single species. Typical dominants include *Eleocharis acicularis* (needle spikerush), *Myriophyllum* (watermilfoil) spp., *Potamogeton amplifolius* (largeleaf pondweed), *Potamogeton gramineus* (variableleaf pondweed), *Potamogeton praelongus* (whitestem pondweed), *Potamogeton robbinsii* (Robbins' pondweed), *Sparganium fluctuans* (floating bur-reed), and *Utricularia macrorhiza* (common bladderwort). Subgroup C includes open water marsh with emergent cover <25% and floating leaved aquatics >25%. Substrate is sedimentary peat and stands are often found in sheltered bays of lakes and streams that do not have high wave energy. Stands may often be dominated by a single species. Typical dominants include *Ceratophyllum demersum* (coon's-tail), *Elodea canadensis* (Canadian waterweed), *Lemna* (duckweed) spp., *Myriophyllum sibiricum* (shortspike watermilfoil), *Myriophyllum verticillatum* (whorl-leaf watermilfoil), *Potamogeton natans* (floating pondweed), *Stuckenia pectinata* (sago pondweed), *Potamogeton richardsonii* (Richardson's pondweed), *Potamogeton zosteriformis* (flatstem pondweed), *Ranunculus aquatilis* (whitewater crowfoot), *Utricularia macrorhiza* (common bladderwort), and *Vallisneria americana* (American eel-grass).

ENVIRONMENTAL DESCRIPTION

Cuyahoga Valley National Park Environment: This herbaceous wetland occurs in semi-permanently or permanently flooded areas. It is only known from artificial ponds or backwaters with relatively calm water; not from the main channel of the Cuyahoga River or its tributaries.

Global Environment: Curtis (1959) [see also Swindale and Curtis (1957)] noted that the major environmental controls on submerged aquatic vegetation are water depth (as it relates to light intensity), water chemistry, water movement, and nature of the substrate. Various combinations of these factors can interact in a variety of ways to influence the local composition of the community. As a result, a single lake may contain a number of relatively homogeneous stands, each with a different species makeup, which depends on depth, nature of adjoining shoreline, degree of protection from waves, etc. Water chemistry may be one of the few constants. Assessment of water conductivity and alkalinity are two measured parameters that can provide some understanding of the influence of water chemistry on species composition.

VEGETATION DESCRIPTION

Cuyahoga Valley National Park Vegetation: This herbaceous wetland is dominated by floating-leaved plants. Dominants vary and can include *Potamogeton* (pondweed) spp., *Ceratophyllum* (hornwort) spp., *Myriophyllum* (watermilfoil) spp., and *Elodea* (waterweed) spp.

Global Vegetation: Based on information in the northern parts of the Midwest, several vegetation subgroups can be recognized that may be separate associations. Subgroup A is a shallow (<50 cm), sparsely vegetated, open-water marsh found on sand, or organic and mineral material trapped in rocky bottoms. Stands are often exposed to wave action and found in oligotrophic lakes. Dominant plants often have basal rosettes that are resistant to wave action. Typical species include *Elatine minima* (small waterwort), *Eriocaulon aquaticum* (sevenangle pipewort), *Gratiola aurea* (golden hedgehyssop), *Isoetes tenella* (spiny-spore quillwort), *Isoetes lacustris* (lake quillwort), *Juncus pelocarpus* (brownfruit rush), and *Lobelia dortmanna* (Dortmann's cardinalflower) (Curtis 1959, Harris et al. 1996). Subgroup B is a shallow (<50 cm), open-water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is a mineral soil (often sand), boulders, or a mixture of sedimentary peat and fine mineral soil. Stands can be exposed to waves or are in stream channels. Stands may often be dominated by a single species. Typical dominants include *Eleocharis acicularis* (needle spikerush), *Myriophyllum* (watermilfoil) spp., *Potamogeton amplifolius* (largeleaf pondweed), *Potamogeton gramineus* (variableleaf pondweed), *Potamogeton praelongus* (whitestem pondweed), *Potamogeton robbinsii* (Robbins' pondweed), *Sparganium fluctuans* (floating bur-reed), and *Utricularia macrorhiza* (common bladderwort). Subgroup C includes open-water marsh with emergent cover <25% and floating-leaved aquatics >25%. Substrate is sedimentary peat, and stands are often found in sheltered bays of lakes and streams that do not have high wave energy. Stands may often be dominated by a single species. Typical dominants include *Ceratophyllum demersum* (coon's-tail), *Elodea canadensis* (Canadian waterweed), *Lemna* (duckweed) spp., *Myriophyllum sibiricum* (shortspike watermilfoil), *Myriophyllum verticillatum* (whorl-leaf watermilfoil), *Potamogeton natans* (floating pondweed), *Stuckenia pectinata* (sago pondweed), *Potamogeton richardsonii* (Richardson's pondweed), *Potamogeton zosteriformis* (flatstem pondweed), *Ranunculus aquatilis* (whitewater crowfoot), *Utricularia macrorhiza* (common bladderwort), and *Vallisneria americana* (American eel-grass) (Curtis 1959, Harris et al. 1996).

MOST ABUNDANT SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CHARACTERISTIC SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

OTHER NOTEWORTHY SPECIES

Cuyahoga Valley National Park: Information not available.
Global: Information not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (3-Oct-1996).

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CLASSIFICATION

Status: Standard
Classification Confidence: 3 - Weak
Cuyahoga Valley National Park Comments: Information not available.
Global Comments: This type is based on information in the more northern parts of the range. However, it may need to be split into a boreal/sub-boreal type (subgroup A above) and a Midwestern type (subgroups B and C), and even within the Midwest there may be substantial differences between western and eastern stands (Robert Dana pers. comm. 1999). In Wisconsin, Subgroup A is considered distinctive, and could be ranked an S3 type. It is locally common there in deep, hard-bottomed seepage lakes of the Northern Highlands Pitted Outwash subsection (212Jm of Keys et al. 1995) (E. Epstein pers. comm. 1999).
Global Similar Associations:
- *Stuckenia pectinata - Ruppia maritima* Herbaceous Vegetation (CEGL002004) Prairie pothole type.

OTHER COMMENTS

Other Comments: Information not available.

ELEMENT DISTRIBUTION

Cuyahoga Valley National Park Range: Information not available.
Global Range: This pondweed submerged aquatic type is found widely throughout the midwestern United States and adjacent Canada, ranging from Ohio and Ontario west to North Dakota and south to Iowa.
Nations: CA, US
States/Provinces: IA:SU, IL, IN, MI:S4, MN, ND, OH, ON, SD, WI, WY
TNC Ecoregions: 35:C, 36:C, 44:C, 45:C, 46:C, 47:C, 48:C, 49:C, 50:C
USFS Ecoregions (1994/95): 212Hb:CCP, 212Hi:CCC, 212Ho:CCC, 212Hs:CCC, 212Hv:CCC, 212Hw:CCC, 212Ia:CCC, 212Ib:CCP, 212Ja:CCP, 212Jb:CCP, 212Jc:CCP, 212Je:CCP, 212Jf:CCP, 212Jj:CCP, 212Jl:CCP, 212Jm:CCC, 212Ka:CPP, 212La:CPP, 212Mb:C??, 221Ef:CCC, 221Fc:CCC, 221He:CCC, 222Ao:CPP, 222Ch:CPP, 222Gc:CPP, 222Ha:CCC, 222Jg:CCC, 222Jh:CCC, 222Ji:CCC, 222Jj:CCC, 222Kf:CCC, 222L:CC, 251Aa:???, 251Ba:???
Federal Lands: NPS (Apostle Islands, Cuyahoga Valley, Effigy Mounds, Grand Portage, Indiana Dunes, Isle Royale, Pictured Rocks, Saint Croix, Sleeping Bear Dunes, Voyageurs); USFS (Chequamegon, Chequamegon-Nicolet, Nicolet, Shawnee, Superior?)

ELEMENT SOURCES

Cuyahoga Valley National Park Map Code: HPWD, HMPM
Cuyahoga Valley National Park Inventory Notes: This community was found during photo reconnaissance so no plots exist. Ten sites were visited during Accuracy Assessment.
Cuyahoga Valley National Park Plots and Observation Points: Information not available.
Local Description Authors: J. Drake
Global Description Authors: D. Faber-Langendoen
References: Chapman et al. 1989, Curtis 1959, Faber-Langendoen 2001, Harris et al. 1996, Homoya et al. 1988, Hop et al. 1999, Hop et al. 2005, Hop et al. 2009, Hop et al. 2010a, Hop et al. 2010b, Hop et al. 2010c, INAI unpubl. data, Keys et al. 1995, Kost et al. 2007, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, ONHD unpubl. data, Swindale and Curtis 1957, TNC 1999b, WNDD unpubl. data, White and Madany 1978

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Appendix C: Field Key to Vegetation Types

Explanation and Use of the Key

This is a field key to natural and semi-natural vegetation types of Cuyahoga Valley National Park (CUVA). The vegetation types are based on the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008) and were derived from field data collected during the CUVA vegetation mapping project. The key does not include cultural vegetation types of the NVCS (e.g., agriculture, developed lands).

The key is dichotomous, or paired, in arrangement and includes brief descriptions for navigating through it to ultimately reach a classification conclusion. Classification results are depicted at the association (plant community) level, the lowest level of the NVCS, and include the vegetation association name (in scientific nomenclature) followed by the community element code for the association.

For best results, assessments of vegetation types in the field should be done within a single vegetation type of uniform vegetation and, if possible, on an area of 5,000 m^2 (i.e., a 40-m radius around a point or a rectangle of 50 by 100 m). Appendix B: Descriptions of Vegetation Types is recommended to complement this key to ascertain correct assessment of types.

The term "dominant" means greater than 50% relative cover within a given stratum unless otherwise noted. When the term "total" is used in correlation with cover, it is in reference to the absolute cover. All other cover values refer to relative canopy cover; e.g., if total cover of the tree canopy is 40%, then a notation of >25% cover of a particular tree species refers to 25% of the 40% total cover.

GENERAL KEY

1A. Absence of standing water and/or peat soil. Mineral soil not saturated throughout the growing season. Upland soils and vegetation prevalent. Wetlands absent or limited to occasional vernal pools. **2**

1B. Wetland soils and vegetation prevalent. Presence of standing water or saturated mineral, muck, or organic soils; <u>includes</u> floodplain sites that flood frequently. **28**

UPLAND

2A. Total tree canopy >25%. Forest or woodland. **3**

2B. Total tree canopy <25%. Dominated by shrubs or herbaceous vegetation. **23**

UPLAND FOREST

3A. Tree canopy >75% deciduous hardwood species. **4**

3B. Tree canopy <75% deciduous hardwood species. **14**

4A. Tree canopy >40% oaks (*Quercus* spp.) and/or hickories (*Carya* spp.). **5**

4B. Tree canopy <40% oaks (*Quercus* spp.) and/or hickories (*Carya* spp.). **8**

5A. Sites on thin soil over sandstone bedrock, eastern hemlock (*Tsuga canadensis*) often present in the tree canopy or subcanopy, blueberries (*Vaccinium* spp.) often present in ground layer. ..... ***Quercus velutina* - *Quercus alba* / *Vaccinium* (*angustifolium*, *pallidum*) / *Carex pensylvanica* Forest (CEGL005030)**

5B. Sites not on thin soil over bedrock, eastern hemlock absent to sparse in the tree canopy or subcanopy. **6**

6A. Tree canopy OR tree subcanopy >33% chinkapin oak (*Quercus muehlenbergii*), sites on moderate to steep slopes. ..... ***Acer saccharum* - *Quercus muehlenbergii* Forest (CEGL005010)**

6B. Tree canopy AND tree subcanopy <33% chinkapin oak (*Quercus muehlenbergii*). **7**

7A. In the tree canopy, northern red oak (*Quercus rubra*) more abundant than black oak (*Quercus velutina*) and/or black gum (*Nyssa sylvatica*); shagbark hickory (*Carya ovata*) common. Typically on mid to lower slopes, shallow slopes or flats, or other dry-mesic to mesic settings. ..... ***Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest (CEGL002068)**

7B In the tree canopy, black oak (*Quercus velutina*) and black gum (*Nyssa sylvatica*) more abundant than northern red oak (*Quercus rubra*). Typically on upper slopes, ridges, or other dry to dry-mesic settings. ..... ***Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest (CEGL002076)**

8A. Tree canopy >40% American beech (*Fagus grandifolia*) and/or sugar maple (*Acer saccharum*). ..... ***Fagus grandifolia* - *Acer saccharum* Glaciated Midwest Forest (CEGL005013)**

8B. Tree canopy <40% American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*). **9**

9A. Tree canopy >40% hickory (*Carya* spp.), associated trees typically early successional/ruderal including red maple (*Acer rubrum*), bigtooth aspen (*Populus grandidentata*), tuliptree (*Liriodendron tulipifera*). ..... ***Quercus alba - Quercus rubra - Carya ovata*** **Glaciated Forest (CEGL002068)**

9B. Tree canopy <40% hickory (*Carya* spp.).....**10**

10A. Tree canopy >50% black locust (*Robinia pseudoacacia*)..... .....***Robinia pseudoacacia*** **Semi-natural Forest (CEGL007279)**

10B. Tree canopy <50% black locust (*Robinia pseudoacacia*).....**11**

11A. Tree canopy >50% cottonwood (*Populus deltoides*), often woodland or open forest physiognomy and evidence of wet or wet-mesic conditions but NOT in floodplains..... .....***Populus deltoides*** **Early-Successional Semi-natural Forest [Park Special] (CEPS006689)**

11B. Tree canopy <50% cottonwood (*Populus deltoides*).....**12**

12A. Tree canopy >30% elm (*Ulmus* spp.) OR >40% elm (*Ulmus* spp.), and/or boxelder (*Acer negundo*), and/or green ash (*Fraxinus pennsylvanica*), tuliptree (*Liriodendron tulipifera*) often common to co-dominant in the canopy; sites near streams or wetlands or have wet soils OR tuliptree (*Liriodendron tulipifera*) dominant and on relatively flat floodplain near permanent or intermittent streams.....***Liriodendron tulipifera - Ulmus*** **spp. -** ***Fraxinus pennsylvanica*** **Forest [Park Special] (CEPS006684)**

12B. Tree canopy <30% elm (*Ulmus* spp.) OR <40% elm (*Ulmus* spp.), and/or boxelder (*Acer negundo*), and/or green ash (*Fraxinus pennsylvanica*) OR tuliptree (*Liriodendron tulipifera*) dominant but NOT on relatively flat floodplain near permanent or intermittent streams. **13**

13A. Canopy usually >50% red maple (*Acer rubrum*) and/or black cherry (*Prunus serotina*), sometimes no dominant but a relatively even mix of maples (*Acer* spp.), black cherry (*Prunus serotina*), ash (*Fraxinus* spp.), sassafras (*Sassafras albidum*), oak (*Quercus* spp.), and sycamore (*Platanus occidentalis*); canopy <20% tuliptree (*Liriodendron tulipifera*) and aspen species (*Populus grandidentata, P. tremuloides*); understory typically contains Ohio buckeye (*Aesculus glabra*), multiflora rose (*Rosa multiflora*), wingstem (*Verbesina alterniflora*).....***Acer rubrum - Prunus serotina*** **/** ***Rosa multiflora*** **Forest [Park Special] (CEPS006687)**

13B. Canopy >50% tuliptree (*Liriodendron tulipifera*), red maple (*Acer rubrum*), white ash (*Fraxinus americana*), and aspen species (*Populus* spp.); canopy >20% tuliptree (*Liriodendron tulipifera*) and aspen species (*Populus grandidentata, P. tremuloides*); associated trees in canopy or subcanopy include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*); sites NOT on wet to wet-mesic floodplains. ..... ***Liriodendron tulipifera - Acer rubrum - Populus*** **spp. Forest [Park Special] (CEPS006693)**

14A. Tree canopy >75% conifers. **15**
14B. Tree canopy a mixture of conifers and deciduous species with >25% cover of each. **21**

15A. Sites current or former tree plantations, evidence of planting typical (i.e., trees in rows) **16**
15B. Sites not current or former tree plantations; canopy dominated by hemlock (*Tsuga canadensis*), sites with thin soil over sandstone bedrock. ..... ***Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043)**

16A. Canopy >75% Norway spruce (*Picea abies*). ..... ***Picea abies* Planted Forest (CEGL007167)**
16B. Canopy <75% Norway spruce (*Picea abies*). **17**

17A. Canopy >75% Scotch pine (*Pinus sylvestris*). ..... ***Pinus sylvestris* Planted Forest (CEGL006686)**
17B. Canopy <75% Scotch pine (*Pinus sylvestris*). **18**

18A. Canopy >75% Virginia pine (*Pinus virginiana*). ..... ***Pinus virginiana* Planted Forest (CEGL004730)**
18B. Canopy <75% Virginia pine (*Pinus virginiana*). **19**

19A. Canopy >75% red pine (*Pinus resinosa*). ..... ***Pinus resinosa* Planted Forest (CEGL007177)**
19B. Canopy <75% red pine (*Pinus resinosa*). **20**

20A. Canopy >75% European larch (*Larix decidua*). ..... ***Larix* (*laricina*, *decidua*) Planted Forest (CEGL006408)**
20B. Canopy >75% eastern white pine (*Pinus strobus*). ..... ***Pinus strobus* Planted Forest (CEGL007178)**

21A Conifer component of canopy dominated by planted, usually non-native, species including Norway spruce (*Picea abies*), Scotch pine (*Pinus sylvestris*), Virginia pine (*Pinus virginiana*), red pine (*Pinus resinosa*), eastern white pine (*Pinus strobus*), and European larch (*Larix decidua*), deciduous trees typically early successional species such as red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and tuliptree (*Liriodendron tulipifera*). ..... ***Pinus* spp. - *Picea abies* - *Acer rubrum* - *Liriodendron tulipifera* Ruderal Forest (CEGL005208)**
21B. Conifer component of canopy dominated by native species not planted. **22**

22A. Conifer component of canopy >50% eastern white pine (*Pinus strobus*) and/or hemlock (*Tsuga canadensis*); deciduous component dominated by oaks (*Quercus* spp.) and red maple (*Acer rubrum*)..... ***Liriodendron tulipifera - Pinus strobus - Tsuga canadensis - Quercus* (*rubra*, *alba*) / *Polystichum acrostichoides* Forest (CEGL006304)**

22B. Conifer component of canopy >50% hemlock (*Tsuga canadensis*); deciduous component of canopy dominated by American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and yellow birch (*Betula alleghaniensis*); oaks (*Quercus* spp.) sometimes abundant but not dominant in canopy..... ***Tsuga canadensis* - Fagus grandifolia - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest (CEGL005043)**

UPLAND SHRUBLAND

23A. Shrubs >25% total cover; mix of ruderal shrubs dominant, typical shrubs include Autumn olive (*Elaeagnus umbellata*), hawthorn (*Crataegus* spp.), honeysuckle, (*Lonicera* spp.), glossy buckthorn (*Rhamnus frangula*), stiff dogwood (*Cornus foemina*), and multiflora rose (*Rosa multiflora*); small trees including sycamore (*Platanus americanus*) and ash (*Fraxinus* spp.) may also be present. ..... ***Elaeagnus umbellata - Crataegus* spp. - *Rosa multiflora* Ruderal Shrubland (CEGL005207)**

23B. Shrubs <25% total cover. **24**

UPLAND HERBACEOUS VEGETATION

24A. >50% Japanese knotweed (*Polygonum cuspidatum*). ..... ***Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation (CEGL008472)**

24B. <50% Japanese knotweed (*Polygonum cuspidatum*). **25**

25A. Herbaceous canopy >50% redtop (*Agrostis gigantea*), timothy (*Phleum pratense*), and Kentucky bluegrass (*Poa pratensis*); sites often mowed or otherwise managed..... ..... ***Phleum pratense* - (*Calamagrostis canadensis*) Semi-natural Herbaceous Vegetation (CEGL005249)**

25B. Herbaceous canopy <50% redtop (*Agrostis gigantea*), timothy (*Phleum pratense*), and Kentucky bluegrass (*Poa pratensis*). **26**

26A. >40% native prairie species, including little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), Junegrass (*Koeleria macrantha*), and Indiangrass (*Sorghastrum nutans*)..... ..... ***Schizachyrium scoparium - Andropogon gerardii - Poa* spp. Semi-natural Herbaceous Vegetation [Park Special] (CEPS006691)**

26B. <40% native prairie species, including little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), Junegrass (*Koeleria macrantha*), and Indiangrass (*Sorghastrum nutans*)..... **27**

27A. Mesic to wet-mesic sites dominated by ruderal or exotic forbs including jewelweed (*Impatiens capensis*), goldenrods (*Solidago* spp.), wingstem (*Verbesina alternifolia*), Canada thistle (*Cirsium arvense*), and stinging nettle (*Urtica dioica*). ..... ***Impatiens capensis* - *Solidago* spp. - *Verbesina alternifolia* Semi-natural Herbaceous Vegetation [Park Special] (CEPS006690)**

27B. Dry-mesic to mesic sites dominated by ruderal or exotic species including Queen Anne's lace (*Daucus carota*), Oxeye daisy (*Leucanthemum vulgare*), red clover (*Trifolium pratense*), goldenrod (*Solidago* spp.), and broomsedge bluestem (*Andropogon virginicus*); grasses may be abundant but sites not actively managed. ....***Daucus carota* - *Leucanthemum vulgare* Semi-natural Herbaceous Vegetation [Park Special] (CEPS006692)**

WETLAND

28A. Total tree canopy >25%. Forest or woodland. **29**

28B. Total tree canopy <25%. Shrubland, herbaceous vegetation, or sparsely vegetated. **37**

WETLAND FOREST

29A. >50% cottonwood (*Populus deltoides*) and willow (*Salix* spp.) trees. **30**

29B. <50% cottonwood (*Populus deltoides*) and willow (*Salix* spp.) trees. **31**

30A. Sites on floodplains; alluvial soils. ....***Populus deltoides* - *Salix nigra* Forest (CEGL002018)**

30B. Sites not on floodplains; evidence of extensive past disturbance. ..... ***Populus deltoides* Early-Successional Semi-natural Forest [Park Special] (CEPS006689)**

31A. >50% cottonwood (*Populus deltoides*), willow (*Salix* spp.), and sycamore (*Platanus occidentalis*) trees; sites not on floodplains; evidence of extensive past disturbance. ..... ***Populus deltoides* Early-Successional Semi-natural Forest [Park Special] (CEPS006689)**

31B. <50% cottonwood (*Populus deltoides*), willow (*Salix* spp.), and sycamore (*Platanus occidentalis*) trees. **32**

32A. Canopy >50% silver maple (*Acer saccharinum*). ..... ***Acer saccharinum* - *Ulmus americana* Forest (CEGL002586)**

32B. Canopy <50% silver maple (*Acer saccharinum*). **33**

33A. Canopy >50% black ash (*Fraxinus nigra*), sites on muck soils. .....***Fraxinus nigra* - *Acer rubrum* / *Rhamnus alnifolia* / *Carex leptalea* Forest (CEGL007441)**

33B. Canopy <50% black ash (*Fraxinus nigra*). **34**

34A. Sites >50% swamp white oak (*Quercus bicolor*), pin oak (*Quercus palustris*), and possibly red maple (*Acer rubrum*); very rarely shagbark hickory (*Carya ovata*) can be abundant in this community. ..... ***Quercus palustris - Quercus bicolor - Acer rubrum*** **Flatwoods Forest (CEGL005037)**

34B. Sites <50% swamp white oak (*Quercus bicolor*), pin oak (*Quercus palustris*), and possibly red maple (*Acer rubrum*). **35**

35A. Canopy >50% sycamore (*Platanus occidentalis*) and black walnut (*Juglans nigra*), sometimes in combination with American basswood (*Tilia americana*) and white ash (*Fraxinus americana*). ..... ***Platanus occidentalis - Juglans nigra - (Fraxinus americana)*** **Forest [Park Special] (CEPS006688)**

35B. Canopy <50% sycamore (*Platanus occidentalis*) and black walnut (*Juglans nigra*), sometimes in combination with American basswood (*Tilia americana*) and white ash (*Fraxinus americana*). **36**

36A. Canopy >50% elm (*Ulmus americana, Ulmus rubra*) and/or green ash (*Fraxinus pennsylvanica*); sites in small valleys/ravines with moderate to minimal signs of disturbance; uncommon community at CUVA..... ***Fraxinus pennsylvanica - Ulmus*** **spp. -** ***Celtis occidentalis*** **Forest (CEGL002014)**

36B. Tree canopy >30% elm (*Ulmus* spp.) OR >40% elm (*Ulmus* spp.), and/or boxelder (*Acer negundo*), and/or green ash (*Fraxinus pennsylvanica*), and/or tuliptree (*Liriodendron tulipifera*); sites on relatively flat floodplains with moderate to extensive signs of disturbance; common community at CUVA..... ***Liriodendron tulipifera - Ulmus*** **spp. -** ***Fraxinus pennsylvanica*** **Forest [Park Special] (CEPS006684)**

WETLAND SHRUBLAND

37A. >25% shrub canopy **38**

37B. <25% shrub canopy **41**

38A. Shrub canopy >50% gray dogwood (*Cornus racemosa*), desert false indigo (*Amorpha fruticosa*), and wild indigo (*Baptisia australis*). ..... ***Cornus racemosa - Salix*** **spp. -** ***Baptisia australis*** **Shrubland (CEGL005206)**

38B. Shrub canopy <50% gray dogwood (*Cornus racemosa*) desert false indigo (*Amorpha fruticosa*), and wild indigo (*Baptisia australis*). **39**

39A. Shrub canopy >50% gray alder (*Alnus incana*). ..... ***Alnus incana*** **Swamp Shrubland (CEGL002381)**

39B. Shrub canopy <50% gray alder (*Alnus incana*). **40**

40A. Shrub canopy >50% buttonbush (*Cephalanthus occidentalis*). ....***Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland (CEGL002190)**

40B. Shrub canopy >50% sandbar willow (*Salix interior*). ....***Salix interior* - *Salix eriocephala* Sandbar Shrubland (CEGL005078)**

WETLAND HERBACEOUS VEGETATION

41A. >10% total vegetation cover. **42**

41B. <10% total vegetation cover, sites along rivers and streams; gravel/cobble substrate. .... **Midwest Gravel Wash River Sparse Vegetation (CEG002408)**

42A. >80% cattail (*Typha* spp.). ....***Typha* spp. Midwest Herbaceous Vegetation (CEGL002233)**

42B. <80% cattail (*Typha* spp.). **43**

43A. >80% reed canary grass (*Phalaris arundinacea*)..... .....***Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044)**

43B. <80% reed canary grass (*Phalaris arundinacea*).....**44**

44A. >80% common reed (*Phragmites australis*). .....***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141)**

44A. <80% common reed (*Phragmites australis*). **45**

45A. >50% Japanese knotweed (*Polygonum cuspidatum*). ..... ***Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation (CEGL008472)**

45B. <50% Japanese knotweed (*Polygonum cuspidatum*). **46**

46A. >50% cover by sedges (*Carex* spp.). ....***Carex lacustris* Herbaceous Vegetation (CEGL002256)**

46A. <50% cover by sedges (*Carex* spp.). **47**

47A. >50% rice cutgrass (*Leersia oryzoides*) and arrowhead (*Sagittaria* spp.). ....***Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation (CEGL006461)**

47B. <50% rice cutgrass (*Leersia oryzoides*) and arrowhead (*Sagittaria* spp.). **48**

48A. >50% cover by bur-reed (*Sparganium* spp.), rush (*Juncus* spp.), and cattail (*Typha* spp.)... .....***Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026)**

48B. <50% cover by bur-reed (*Sparganium* spp.), rush (*Juncus* spp.), and cattail (*Typha* spp.). **49**

49A. Sites on seeps or swamps, often partially or completely under canopy of surrounding trees; dominated by skunk cabbage (*Symplocarpus foetidus*). ..... ***Symplocarpus foetidus* Herbaceous Vegetation (CEGL002385)**

49B. Sites flooded throughout the growing season, not dominated by skunk cabbage (*Symplocarpus foetidus*).....**50**

50A. >50% yellow pond-lily (*Nuphar lutea*), American white waterlily (*Nymphaea odorata*), and/or watershield (*Brasenia schreberi*)..... ***Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386)**

50B. >50% pondweed (*Potamogeton* spp.) and/or hornwort (*Ceratophyllum* spp.)..... ***Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282)**

Some herbaceous wetland areas might not have a single vegetation type that is dominant within an area of a minimum mapping unit (MMU). (The MMU for herbaceous wetlands was an area of 0.25 ha for the CUVA vegetation mapping project). These wetland areas likely will not fit well into this key to vegetation types due to the fine-scaled mosaic of the vegetation. Therefore, a unique map class was developed to classify these areas, namely, the Mixed Herbaceous Pond Mosaic (map-class code of HMPM). This map class includes several vegetation types listed below, of which any two or more might occur as a fine-scaled mosaic:

- *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233),
- *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026),
- *Carex lacustris* Herbaceous Vegetation (CEGL002256),
- *Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation (CEGL006461),
- *Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044),
- *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141),
- *Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386), and
- *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282).

Appendix D: List of Plant Species

Explanation of the Species List

Plant taxa were identified and documented from vegetation plots and accuracy assessment sites collected for the Cuyahoga Valley National Park (CUVA) vegetation mapping project. Plant taxa, along with other sample data, were entered into the National Park Service (NPS) PLOTS Database, Version 2.0 (NatureServe 2005) for subsequent analyses to characterize vegetation associations in the National Vegetation Classification Standard, Version 2 (Federal Geographic Data Committee [FGDC] 2008) and to make assessment of the vegetation map accuracy. These data were eventually converted to the PLOTS Database, Version 3.2 (Colorado Natural Heritage Program [CNHP] 2011) for the NPS. Table D-1 is an export of all plant taxa generated from the PLOTS Database for this project. Note that this list includes taxa identified to the genus, species, and sub-species level. This list is not intended to be comprehensive of every taxon at CUVA. The plant taxa list is organized alphabetically by scientific name. Nomenclature follows the PLANTS database managed by the U.S. Department of Agriculture at, which can be accessed at <http://plants.usda.gov>.

Table D-1. Plant species list of Cuyahoga Valley National Park, Ohio.

Scientific Name	Common Name	Family	Sites
Abutilon theophrasti	velvetleaf	Malvaceae	1
Acer negundo	boxelder	Aceraceae	88
Acer nigrum	black maple	Aceraceae	53
Acer rubrum	red maple	Aceraceae	305
Acer saccharinum	silver maple	Aceraceae	64
Acer saccharum	sugar maple	Aceraceae	260
Achillea millefolium	common yarrow	Asteraceae	15
Acorus americanus	sweetflag	Acoraceae	1
Actaea pachypoda	white baneberry	Ranunculaceae	17
Actaea rubra	red baneberry	Ranunculaceae	1
Adiantum pedatum	northern maidenhair	Pteridaceae	2
Aegopodium podagraria	bishop's goutweed	Apiaceae	1
Aesculus glabra	Ohio buckeye	Hippocastanaceae	60
Ageratina altissima	white snakeroot	Asteraceae	4
Ageratina altissima var. *altissima*	white snakeroot	Asteraceae	1
Agrimonia	agrimony	Rosaceae	3
Agrimonia parviflora	harvestlice	Rosaceae	5
Agrostis	bentgrass	Poaceae	21
Agrostis gigantea	redtop	Poaceae	39
Agrostis hyemalis	winter bentgrass	Poaceae	1
Agrostis stolonifera	creeping bentgrass	Poaceae	1
Ajuga reptans	common bugle	Lamiaceae	1
Alisma	water plantain	Alismataceae	1
Alisma subcordatum	American water plantain	Alismataceae	1
Alliaria petiolata	garlic mustard	Brassicaceae	186
Allium	onion	Liliaceae	4
Allium canadense	meadow garlic	Liliaceae	8
Allium tricoccum	ramp	Liliaceae	23
Alnus glutinosa	European alder	Betulaceae	6
Alnus incana	gray alder	Betulaceae	19
Alopecurus aequalis	shortawn foxtail	Poaceae	9

Scientific Name	Common Name	Family	Sites
Amaranthus retroflexus	redroot amaranth	Amaranthaceae	2
Ambrosia	ragweed	Asteraceae	1
Ambrosia trifida	great ragweed	Asteraceae	1
Amelanchier	serviceberry	Rosaceae	6
Amelanchier alnifolia	Saskatoon serviceberry	Rosaceae	1
Amelanchier arborea	common serviceberry	Rosaceae	9
Amelanchier canadensis	Canadian serviceberry	Rosaceae	1
Amorpha fruticosa	desert false indigo	Fabaceae	15
Amphicarpaea bracteata	American hogpeanut	Fabaceae	14
Andropogon gerardii	big bluestem	Poaceae	2
Andropogon virginicus	broomsedge bluestem	Poaceae	19
Anemone virginiana	tall thimbleweed	Ranunculaceae	3
Angelica atropurpurea	purplestem angelica	Apiaceae	15
Anthoxanthum odoratum	sweet vernalgrass	Poaceae	55
Apocynum cannabinum	Indianhemp	Apocynaceae	80
Aralia nudicaulis	wild sarsaparilla	Araliaceae	1
Arctium lappa	greater burdock	Asteraceae	1
Arctium minus	lesser burdock	Asteraceae	2
Arisaema dracontium	green dragon	Araceae	3
Arisaema triphyllum	Jack in the pulpit	Araceae	79
Arisaema triphyllum ssp. *triphyllum*	Jack in the pulpit	Araceae	1
Arnoglossum atriplicifolium	pale Indian plantain	Asteraceae	10
Artemisia absinthium	absinthium	Asteraceae	1
Artemisia vulgaris	common wormwood	Asteraceae	16
Asarum canadense	Canadian wildginger	Aristolochiaceae	2
Asclepias incarnata	swamp milkweed	Asclepiadaceae	7
Asclepias syriaca	common milkweed	Asclepiadaceae	12
Asclepias tuberosa	butterfly milkweed	Asclepiadaceae	1
Asclepias variegata	redring milkweed	Asclepiadaceae	1
Asimina triloba	pawpaw	Annonaceae	2
Asparagus officinalis	garden asparagus	Liliaceae	1
Asplenium platyneuron	ebony spleenwort	Aspleniaceae	1
Asplenium resiliens	blackstem spleenwort	Aspleniaceae	1
Aster	aster	Asteraceae	2
Athyrium	ladyfern	Dryopteridaceae	3
Athyrium filix-femina	common ladyfern	Dryopteridaceae	12
Atrichum	atrichum moss	Polytrichaceae	1
Baptisia australis	blue wild indigo	Fabaceae	1
Barbarea vulgaris	garden yellowrocket	Brassicaceae	5
Berberis thunbergii	Japanese barberry	Berberidaceae	152
Betula	birch	Betulaceae	1
Betula alleghaniensis	yellow birch	Betulaceae	13
Betula lenta	sweet birch	Betulaceae	2
Betula populifolia	gray birch	Betulaceae	1
Betula pumila	bog birch	Betulaceae	1
Bidens	beggarticks	Asteraceae	1
Bidens aristosa	bearded beggarticks	Asteraceae	1
Blephilia hirsuta	hairy pagoda-plant	Lamiaceae	2

Scientific Name	Common Name	Family	Sites
Boehmeria cylindrica	smallspike false nettle	Urticaceae	14
Botrychium	grapefern	Ophioglossaceae	3
Brachyelytrum erectum	bearded shorthusk	Poaceae	3
Bromus	brome	Poaceae	9
Bromus ciliatus	fringed brome	Poaceae	2
Bromus commutatus	meadow brome	Poaceae	1
Bromus inermis	smooth brome	Poaceae	6
Bryoandersonia illecebra	bryoandersonia moss	Brachytheciaceae	3
Calamagrostis canadensis	bluejoint	Poaceae	34
Calystegia	false bindweed	Convolvulaceae	1
Campsis radicans	trumpet creeper	Bignoniaceae	2
Cardamine concatenata	cutleaf toothwort	Brassicaceae	6
Cardamine hirsuta	hairy bittercress	Brassicaceae	1
Carex	sedge	Cyperaceae	160
Carex albursina	white bear sedge	Cyperaceae	14
Carex bebbii	Bebb's sedge	Cyperaceae	3
Carex blanda	eastern woodland sedge	Cyperaceae	13
Carex bromoides	brome-like sedge	Cyperaceae	1
Carex comosa	longhair sedge	Cyperaceae	3
Carex crinita	fringed sedge	Cyperaceae	17
Carex cristatella	crested sedge	Cyperaceae	1
Carex emoryi	Emory's sedge	Cyperaceae	1
Carex gracillima	graceful sedge	Cyperaceae	2
Carex granularis	limestone meadow sedge	Cyperaceae	5
Carex grayi	Gray's sedge	Cyperaceae	5
Carex hystericina	bottlebrush sedge	Cyperaceae	4
Carex intumescens	greater bladder sedge	Cyperaceae	1
Carex lurida	shallow sedge	Cyperaceae	4
Carex molesta	troublesome sedge	Cyperaceae	1
Carex normalis	greater straw sedge	Cyperaceae	1
Carex pensylvanica	Pennsylvania sedge	Cyperaceae	28
Carex plantaginea	plantainleaf sedge	Cyperaceae	14
Carex radiata	eastern star sedge	Cyperaceae	1
Carex rosea	rosy sedge	Cyperaceae	1
Carex scoparia	broom sedge	Cyperaceae	7
Carex squarrosa	squarrose sedge	Cyperaceae	1
Carex stipata	awlfruit sedge	Cyperaceae	9
Carex stricta	upright sedge	Cyperaceae	1
Carex swanii	Swan's sedge	Cyperaceae	1
Carex tribuloides	blunt broom sedge	Cyperaceae	5
Carex typhina	cattail sedge	Cyperaceae	6
Carex vulpinoidea	fox sedge	Cyperaceae	31
Carpinus caroliniana	American hornbeam	Betulaceae	86
Carya	hickory	Juglandaceae	33
Carya alba	mockernut hickory	Juglandaceae	3
Carya cordiformis	bitternut hickory	Juglandaceae	28
Carya glabra	pignut hickory	Juglandaceae	21
Carya laciniosa	shellbark hickory	Juglandaceae	5

Scientific Name	Common Name	Family	Sites
Carya ovata	shagbark hickory	Juglandaceae	84
Castanea dentata	American chestnut	Fagaceae	3
Catalpa speciosa	northern catalpa	Bignoniaceae	15
Caulophyllum thalictroides	blue cohosh	Berberidaceae	16
Celastrus orbiculata	Asian bittersweet	Celastraceae	10
Celastrus scandens	American bittersweet	Celastraceae	4
Cephalanthus occidentalis	common buttonbush	Rubiaceae	20
Cerastium fontanum ssp. *vulgare*	big chickweed	Caryophyllaceae	7
Chimaphila maculata	striped prince's pine	Pyrolaceae	2
Cicuta maculata	spotted water hemlock	Apiaceae	2
Cimicifuga racemosa	black bugbane	Ranunculaceae	4
Circaea alpina	small enchanter's nightshade	Onagraceae	2
Circaea lutetiana	broadleaf enchanter's nightshade	Onagraceae	82
Cirsium	thistle	Asteraceae	1
Cirsium arvense	Canada thistle	Asteraceae	52
Cirsium vulgare	bull thistle	Asteraceae	1
Claytonia virginica	Virginia springbeauty	Portulacaceae	2
Clematis virginiana	devil's darning needles	Ranunculaceae	4
Clinopodium vulgare	wild basil	Lamiaceae	1
Conopholis americana	American cancer-root	Orobanchaceae	24
Convallaria majalis	European lily of the valley	Liliaceae	1
Convolvulus	bindweed	Convolvulaceae	3
Convolvulus arvensis	field bindweed	Convolvulaceae	1
Coreopsis tripteris	tall tickseed	Asteraceae	2
Cornus	dogwood	Cornaceae	6
Cornus amomum	silky dogwood	Cornaceae	26
Cornus drummondii	roughleaf dogwood	Cornaceae	3
Cornus florida	flowering dogwood	Cornaceae	45
Cornus foemina	stiff dogwood	Cornaceae	91
Cornus obliqua	silky dogwood	Cornaceae	1
Cornus racemosa	gray dogwood	Cornaceae	20
Cornus rugosa	roundleaf dogwood	Cornaceae	1
Cornus sericea	redosier dogwood	Cornaceae	4
Coronilla varia	purple crownvetch	Fabaceae	16
Corylus americana	American hazelnut	Betulaceae	2
Crataegus	hawthorn	Rosaceae	183
Crataegus crus-galli	cockspur hawthorn	Rosaceae	7
Crataegus intricata	Copenhagen hawthorn	Rosaceae	3
Crataegus mollis	downy hawthorn	Rosaceae	3
Crataegus pruinosa	waxyfruit hawthorn	Rosaceae	3
Crataegus punctata	dotted hawthorn	Rosaceae	6
Crataegus succulenta	fleshy hawthorn	Rosaceae	1
Cryptotaenia canadensis	Canadian honewort	Apiaceae	8
Cynoglossum virginianum	wild comfrey	Boraginaceae	1
Cyperus	flatsedge	Cyperaceae	13
Cyperus esculentus	yellow nutsedge	Cyperaceae	2
Cyperus strigosus	strawcolored flatsedge	Cyperaceae	1
Cystopteris	bladderfern	Dryopteridaceae	1

Scientific Name	Common Name	Family	Sites
Dactylis glomerata	orchardgrass	Poaceae	39
Danthonia compressa	flattened oatgrass	Poaceae	1
Danthonia spicata	poverty oatgrass	Poaceae	3
Daucus carota	Queen Anne's lace	Apiaceae	35
Dennstaedtia punctilobula	eastern hayscented fern	Dennstaedtiaceae	2
Dianthus armeria	Deptford pink	Caryophyllaceae	1
Dichanthelium	rosette grass	Poaceae	2
Dichanthelium clandestinum	deertongue	Poaceae	5
Dipsacus	teasel	Dipsacaceae	5
Dipsacus fullonum	Fuller's teasel	Dipsacaceae	28
Dipsacus laciniatus	cutleaf teasel	Dipsacaceae	1
Dryopteris	woodfern	Dryopteridaceae	53
Dryopteris carthusiana	spinulose woodfern	Dryopteridaceae	4
Dryopteris intermedia	intermediate woodfern	Dryopteridaceae	2
Dryopteris marginalis	marginal woodfern	Dryopteridaceae	17
Duchesnea indica	Indian strawberry	Rosaceae	2
Dulichium arundinaceum	threeway sedge	Cyperaceae	1
Echinochloa	cockspur grass	Poaceae	4
Elaeagnus angustifolia	Russian olive	Elaeagnaceae	6
Elaeagnus umbellata	autumn olive	Elaeagnaceae	99
Eleocharis	spikerush	Cyperaceae	2
Eleocharis erythropoda	bald spikerush	Cyperaceae	1
Eleusine indica	Indian goosegrass	Poaceae	1
Elodea	waterweed	Hydrocharitaceae	1
Elymus	wildrye	Poaceae	21
Elymus canadensis	Canada wildrye	Poaceae	4
Elymus hystrix	eastern bottlebrush grass	Poaceae	27
Elymus repens	quackgrass	Poaceae	1
Elymus riparius	riverbank wildrye	Poaceae	2
Elymus virginicus	Virginia wildrye	Poaceae	5
Epipactis helleborine	broadleaf helleborine	Orchidaceae	1
Equisetum arvense	field horsetail	Equisetaceae	20
Equisetum hyemale	scouringrush horsetail	Equisetaceae	4
Equisetum sylvaticum	woodland horsetail	Equisetaceae	1
Eragrostis	lovegrass	Poaceae	1
Erigeron	fleabane	Asteraceae	1
Erigeron philadelphicus	Philadelphia fleabane	Asteraceae	11
Erythronium	fawnlilly	Liliaceae	1
Erythronium americanum	dogtooth violet	Liliaceae	1
Euonymus atropurpurea	eastern wahoo	Celastraceae	9
Euonymus fortunei	winter creeper	Celastraceae	1
Euonymus obovata	running strawberry bush	Celastraceae	2
Eupatorium fistulosum	trumpetweed	Asteraceae	1
Eupatorium maculatum	spotted joepyeweed	Asteraceae	4
Eupatorium maculatum var. *maculatum*	spotted joepyeweed	Asteraceae	1
Eupatorium perfoliatum	common boneset	Asteraceae	2
Eupatorium purpureum	sweetscented joe pye weed	Asteraceae	2
Eurybia macrophylla	bigleaf aster	Asteraceae	3

Scientific Name	Common Name	Family	Sites
Euthamia graminifolia	flat-top goldentop	Asteraceae	18
Fagus grandifolia	American beech	Fagaceae	248
Festuca	fescue	Poaceae	1
Floerkea proserpinacoides	false mermaidweed	Limnanthaceae	2
Fragaria	strawberry	Rosaceae	1
Fragaria vesca	woodland strawberry	Rosaceae	1
Fragaria virginiana	Virginia strawberry	Rosaceae	5
Frangula alnus	glossy buckthorn	Rhamnaceae	75
Frasera caroliniensis	American columbo	Gentianaceae	1
Fraxinus	ash	Oleaceae	25
Fraxinus americana	white ash	Oleaceae	234
Fraxinus nigra	black ash	Oleaceae	7
Fraxinus pennsylvanica	green ash	Oleaceae	257
Galium	bedstraw	Rubiaceae	34
Galium aparine	stickywilly	Rubiaceae	30
Galium circaezans	licorice bedstraw	Rubiaceae	1
Galium concinnum	shining bedstraw	Rubiaceae	1
Galium labradoricum	northern bog bedstraw	Rubiaceae	1
Galium mollugo	false baby's breath	Rubiaceae	2
Galium odoratum	sweetscented bedstraw	Rubiaceae	1
Galium palustre	common marsh bedstraw	Rubiaceae	1
Galium tinctorium	stiff marsh bedstraw	Rubiaceae	4
Galium triflorum	fragrant bedstraw	Rubiaceae	25
Gaultheria procumbens	eastern teaberry	Ericaceae	2
Gaylussacia baccata	black huckleberry	Ericaceae	1
Geranium maculatum	spotted geranium	Geraniaceae	19
Geranium robertianum	Robert geranium	Geraniaceae	3
Geum	avens	Rosaceae	12
Geum aleppicum	yellow avens	Rosaceae	2
Geum canadense	white avens	Rosaceae	27
Ginkgo biloba	maidenhair tree	Ginkgoaceae	1
Glechoma hederacea	ground ivy	Lamiaceae	9
Glyceria striata	fowl mannagrass	Poaceae	77
Hackelia virginiana	beggarslice	Boraginaceae	9
Hamamelis virginiana	American witchhazel	Hamamelidaceae	58
Heliopsis helianthoides	smooth oxeye	Asteraceae	5
Hemerocallis fulva	orange daylily	Liliaceae	1
Hepatica nobilis var. *obtusa*	roundlobe hepatica	Ranunculaceae	1
Hesperis matronalis	dames rocket	Brassicaceae	19
Heuchera americana	American alumroot	Saxifragaceae	2
Hieracium	hawkweed	Asteraceae	2
Hieracium caespitosum	meadow hawkweed	Asteraceae	3
Hieracium pilosella	mouseear hawkweed	Asteraceae	1
Hieracium venosum	rattlesnakeweed	Asteraceae	1
Holcus lanatus	common velvetgrass	Poaceae	49
Houstonia caerulea	azure bluet	Rubiaceae	3
Humulus japonicus	Japanese hop	Cannabaceae	4
Hydrophyllum virginianum	eastern waterleaf	Hydrophyllaceae	8

Scientific Name	Common Name	Family	Sites
Hypericum perforatum	common St. Johnswort	Clusiaceae	5
Ilex	holly	Aquifoliaceae	1
Impatiens capensis	jewelweed	Balsaminaceae	76
Ipomoea	morning-glory	Convolvulaceae	1
Iris pseudacorus	paleyellow iris	Iridaceae	1
Iris versicolor	harlequin blueflag	Iridaceae	7
Jeffersonia diphylla	twinleaf	Berberidaceae	5
Juglans nigra	black walnut	Juglandaceae	98
Juncus	rush	Juncaceae	2
Juncus effusus	common rush	Juncaceae	6
Juncus tenuis	poverty rush	Juncaceae	9
Juncus torreyi	Torrey's rush	Juncaceae	1
Juniperus virginiana	eastern redcedar	Cupressaceae	4
Koeleria macrantha	prairie Junegrass	Poaceae	1
Lactuca floridana	woodland lettuce	Asteraceae	1
Lamium purpureum	purple deadnettle	Lamiaceae	1
Laportea canadensis	Canadian woodnettle	Urticaceae	13
Larix decidua	European larch	Pinaceae	2
Lathyrus vestitus ssp. *laetiflorus*	Pacific pea	Fabaceae	1
Lechea minor	thymeleaf pinweed	Cistaceae	2
Leersia oryzoides	rice cutgrass	Poaceae	34
Lemna minor	common duckweed	Lemnaceae	9
Leucanthemum vulgare	oxeye daisy	Asteraceae	21
Leucobryum	leucobryum moss	Leucobryaceae	4
Leucobryum glaucum	leucobryum moss	Leucobryaceae	1
Ligustrum	privet	Oleaceae	1
Ligustrum sinense	Chinese privet	Oleaceae	24
Ligustrum vulgare	European privet	Oleaceae	82
Lindera benzoin	northern spicebush	Lauraceae	165
Liquidambar styraciflua	sweetgum	Hamamelidaceae	2
Liriodendron tulipifera	tuliptree	Magnoliaceae	202
Lobelia siphilitica	great blue lobelia	Campanulaceae	1
Lolium	ryegrass	Poaceae	1
Lolium pratense	meadow ryegrass	Poaceae	59
Lonicera	honeysuckle	Caprifoliaceae	141
Lonicera ×bella	Bell's honeysuckle	Caprifoliaceae	2
Lonicera japonica	Japanese honeysuckle	Caprifoliaceae	5
Lonicera maackii	Amur honeysuckle	Caprifoliaceae	25
Lonicera morrowii	Morrow's honeysuckle	Caprifoliaceae	5
Lonicera tatarica	Tatarian honeysuckle	Caprifoliaceae	6
Lotus corniculatus	bird's-foot trefoil	Fabaceae	24
Ludwigia palustris	marsh seedbox	Onagraceae	1
Luzula	woodrush	Juncaceae	1
Luzula multiflora	common woodrush	Juncaceae	1
Lycopus americanus	American water horehound	Lamiaceae	7
Lysimachia	yellow loosestrife	Primulaceae	1
Lysimachia nummularia	creeping jenny	Primulaceae	69
Lysimachia punctata	large yellow loosestrife	Primulaceae	1

Scientific Name	Common Name	Family	Sites
Lysimachia quadrifolia	whorled yellow loosestrife	Primulaceae	2
Lythrum salicaria	purple loosestrife	Lythraceae	18
Maclura pomifera	osage orange	Moraceae	1
Magnolia acuminata	cucumber-tree	Magnoliaceae	54
Maianthemum canadense	Canada mayflower	Liliaceae	7
Maianthemum racemosum	feathery false lily of the valley	Liliaceae	8
Maianthemum racemosum ssp. *racemosum*	feathery false lily of the valley	Liliaceae	2
Maianthemum stellatum	starry false lily of the valley	Liliaceae	2
Malus	apple	Rosaceae	43
Malus coronaria	sweet crab apple	Rosaceae	7
Malus pumila	paradise apple	Rosaceae	4
Matteuccia struthiopteris	ostrich fern	Dryopteridaceae	7
Medicago	alfalfa	Fabaceae	1
Medicago lupulina	black medick	Fabaceae	2
Melilotus alba	white sweetclover	Fabaceae	1
Melilotus officinalis	yellow sweetclover	Fabaceae	4
Menispermum canadense	common moonseed	Menispermaceae	2
Mentha ×piperita	peppermint	Lamiaceae	1
Mentha arvensis	wild mint	Lamiaceae	8
Mertensia virginica	Virginia bluebells	Boraginaceae	1
Milium effusum	American milletgrass	Poaceae	2
Mimulus ringens	Allegheny monkeyflower	Scrophulariaceae	1
Mitchella repens	partridgeberry	Rubiaceae	56
Monotropa hypopithys	pinesap	Monotropaceae	1
Monotropa uniflora	Indianpipe	Monotropaceae	8
Morus alba	white mulberry	Moraceae	1
Myosotis	forget-me-not	Boraginaceae	1
Myosotis laxa	bay forget-me-not	Boraginaceae	1
Myosotis scorpioides	true forget-me-not	Boraginaceae	11
Myriophyllum	watermilfoil	Haloragaceae	10
Myriophyllum spicatum	Eurasian watermilfoil	Haloragaceae	3
Myrrhis odorata	anise	Apiaceae	4
Nepeta cataria	catnip	Lamiaceae	2
Nuphar lutea	yellow pond-lily	Nymphaeaceae	5
Nymphaea odorata	American white waterlily	Nymphaeaceae	8
Nyssa sylvatica	blackgum	Cornaceae	70
Oenothera	evening-primrose	Onagraceae	1
Oenothera biennis	common evening primrose	Onagraceae	1
Oligoneuron ohioense	Ohio goldenrod	Asteraceae	1
Onoclea sensibilis	sensitive fern	Dryopteridaceae	65
Ophioglossum engelmannii	limestone adderstongue	Ophioglossaceae	1
Ornithogalum umbellatum	sleepydick	Liliaceae	2
Oryzopsis asperifolia	roughleaf ricegrass	Poaceae	1
Osmunda cinnamomea	cinnamon fern	Osmundaceae	6
Osmunda claytoniana	interrupted fern	Osmundaceae	2
Ostrya virginiana	hophornbeam	Betulaceae	84
Oxalis	woodsorrel	Oxalidaceae	5
Oxalis stricta	common yellow oxalis	Oxalidaceae	5

Scientific Name	Common Name	Family	Sites
Pachysandra terminalis	Japanese pachysandra	Buxaceae	1
Packera aurea	golden ragwort	Asteraceae	11
Packera obovata	roundleaf ragwort	Asteraceae	5
Panicum	panicgrass	Poaceae	10
Panicum virgatum	switchgrass	Poaceae	1
Parthenocissus	creeper	Vitaceae	5
Parthenocissus quinquefolia	Virginia creeper	Vitaceae	174
Parthenocissus tricuspidata	Boston ivy	Vitaceae	2
Peltandra virginica	green arrow arum	Araceae	7
Pennisetum glaucum	pearl millet	Poaceae	1
Penstemon digitalis	talus slope penstemon	Scrophulariaceae	7
Phalaris arundinacea	reed canarygrass	Poaceae	128
Phaseolus polystachios	thicket bean	Fabaceae	3
Phegopteris connectilis	long beechfern	Thelypteridaceae	2
Phegopteris hexagonoptera	broad beechfern	Thelypteridaceae	4
Phleum pratense	timothy	Poaceae	38
Phlox divaricata	wild blue phlox	Polemoniaceae	2
Photinia floribunda	purple chokeberry	Rosaceae	1
Photinia melanocarpa	black chokeberry	Rosaceae	3
Phragmites australis	common reed	Poaceae	46
Phytolacca americana	American pokeweed	Phytolaccaceae	3
Picea abies	Norway spruce	Pinaceae	38
Picea pungens	blue spruce	Pinaceae	4
Pilea fontana	lesser clearweed	Urticaceae	1
Pilea pumila	Canadian clearweed	Urticaceae	30
Pinus	pine	Pinaceae	1
Pinus banksiana	jack pine	Pinaceae	8
Pinus nigra	Austrian pine	Pinaceae	1
Pinus resinosa	red pine	Pinaceae	24
Pinus rigida	pitch pine	Pinaceae	1
Pinus strobus	eastern white pine	Pinaceae	57
Pinus sylvestris	Scots pine	Pinaceae	26
Pinus virginiana	Virginia pine	Pinaceae	6
Plagiomnium cuspidatum	toothed plagiomnium moss	Mniaceae	1
Plantago lanceolata	narrowleaf plantain	Plantaginaceae	10
Plantago major	common plantain	Plantaginaceae	1
Plantago rugelii	blackseed plantain	Plantaginaceae	1
Platanthera orbiculata	lesser roundleaved orchid	Orchidaceae	1
Platanus occidentalis	American sycamore	Platanaceae	204
Poa	bluegrass	Poaceae	99
Poa annua	annual bluegrass	Poaceae	1
Poa compressa	Canada bluegrass	Poaceae	3
Poa palustris	fowl bluegrass	Poaceae	14
Poa pratensis	Kentucky bluegrass	Poaceae	15
Poa sylvestris	woodland bluegrass	Poaceae	2
Podophyllum peltatum	mayapple	Berberidaceae	98
Polemonium reptans	Greek valerian	Polemoniaceae	2
Polygonatum	Solomon's seal	Liliaceae	1

Scientific Name	Common Name	Family	Sites
Polygonatum biflorum	smooth Solomon's seal	Liliaceae	26
Polygonatum pubescens	hairy Solomon's seal	Liliaceae	8
Polygonum	knotweed	Polygonaceae	22
Polygonum amphibium	water knotweed	Polygonaceae	9
Polygonum arifolium	halberdleaf tearthumb	Polygonaceae	1
Polygonum cilinode	fringed black bindweed	Polygonaceae	1
Polygonum cuspidatum	Japanese knotweed	Polygonaceae	37
Polygonum hydropiper	marshpepper knotweed	Polygonaceae	25
Polygonum hydropiperoides	swamp smartweed	Polygonaceae	1
Polygonum persicaria	spotted ladysthumb	Polygonaceae	1
Polygonum sagittatum	arrowleaf tearthumb	Polygonaceae	1
Polygonum scandens	climbing false buckwheat	Polygonaceae	4
Polygonum virginianum	jumpseed	Polygonaceae	129
Polystichum acrostichoides	Christmas fern	Dryopteridaceae	131
Populus deltoides	eastern cottonwood	Salicaceae	122
Populus grandidentata	bigtooth aspen	Salicaceae	40
Populus heterophylla	swamp cottonwood	Salicaceae	1
Populus tremuloides	quaking aspen	Salicaceae	5
Potamogeton	pondweed	Potamogetonaceae	3
Potamogeton illinoensis	Illinois pondweed	Potamogetonaceae	4
Potentilla	cinquefoil	Rosaceae	3
Potentilla simplex	common cinquefoil	Rosaceae	36
Prenanthes	rattlesnakeroot	Asteraceae	9
Prenanthes alba	white rattlesnakeroot	Asteraceae	33
Prenanthes serpentaria	cankerweed	Asteraceae	1
Prunella vulgaris	common selfheal	Lamiaceae	9
Prunus americana	American plum	Rosaceae	5
Prunus avium	sweet cherry	Rosaceae	1
Prunus pensylvanica	pin cherry	Rosaceae	15
Prunus serotina	black cherry	Rosaceae	272
Prunus virginiana	chokecherry	Rosaceae	23
Pseudotsuga menziesii	Douglas-fir	Pinaceae	1
Pteridium aquilinum	western brackenfern	Dennstaedtiaceae	2
Pycnanthemum	mountainmint	Lamiaceae	2
Pycnanthemum muticum	clustered mountainmint	Lamiaceae	2
Pycnanthemum tenuifolium	narrowleaf mountainmint	Lamiaceae	1
Pyrus	pear	Rosaceae	1
Quercus	oak	Fagaceae	6
Quercus alba	white oak	Fagaceae	112
Quercus bicolor	swamp white oak	Fagaceae	11
Quercus macrocarpa	bur oak	Fagaceae	4
Quercus muehlenbergii	chinkapin oak	Fagaceae	7
Quercus palustris	pin oak	Fagaceae	35
Quercus prinus	chestnut oak	Fagaceae	1
Quercus rubra	northern red oak	Fagaceae	155
Quercus velutina	black oak	Fagaceae	77
Ranunculus abortivus	littleleaf buttercup	Ranunculaceae	1
Ranunculus acris	tall buttercup	Ranunculaceae	5

Scientific Name	Common Name	Family	Sites
Ranunculus hispidus var. *nitidus*	bristly buttercup	Ranunculaceae	2
Rhamnus alnifolia	alderleaf buckthorn	Rhamnaceae	3
Rhamnus cathartica	common buckthorn	Rhamnaceae	46
Rhamnus utilis	Chinese buckthorn	Rhamnaceae	1
Rhus hirta	staghorn sumac	Anacardiaceae	1
Rhus typhina	staghorn sumac	Anacardiaceae	7
Ribes	currant	Grossulariaceae	16
Ribes americanum	American black currant	Grossulariaceae	1
Ribes cynosbati	eastern prickly gooseberry	Grossulariaceae	4
Ribes triste	red currant	Grossulariaceae	1
Robinia pseudoacacia	black locust	Fabaceae	38
Rosa multiflora	multiflora rose	Rosaceae	427
Rosa palustris	swamp rose	Rosaceae	7
Rosa setigera	climbing rose	Rosaceae	2
Rubus	blackberry	Rosaceae	54
Rubus allegheniensis	Allegheny blackberry	Rosaceae	91
Rubus flagellaris	northern dewberry	Rosaceae	24
Rubus hispidus	bristly dewberry	Rosaceae	11
Rubus idaeus ssp. *strigosus*	grayleaf red raspberry	Rosaceae	16
Rubus multifer	kinnickinnick dewberry	Rosaceae	1
Rubus occidentalis	black raspberry	Rosaceae	11
Rudbeckia hirta	blackeyed Susan	Asteraceae	4
Rumex	dock	Polygonaceae	6
Rumex crispus	curly dock	Polygonaceae	8
Rumex patientia	patience dock	Polygonaceae	1
Sagittaria	arrowhead	Alismataceae	1
Sagittaria latifolia	broadleaf arrowhead	Alismataceae	2
Sagittaria rigida	sessilefruit arrowhead	Alismataceae	1
Salix	willow	Salicaceae	34
Salix amygdaloides	peachleaf willow	Salicaceae	1
Salix bebbiana	Bebb willow	Salicaceae	1
Salix discolor	pussy willow	Salicaceae	1
Salix exigua	narrowleaf willow	Salicaceae	6
Salix interior	sandbar willow	Salicaceae	5
Salix nigra	black willow	Salicaceae	80
Salix xpendulina	Wisconsin weeping willow	Salicaceae	1
Salvia lyrata	lyreleaf sage	Lamiaceae	1
Sambucus nigra ssp. *canadensis*	American black elderberry	Caprifoliaceae	3
Sambucus racemosa	red elderberry	Caprifoliaceae	1
Sanguinaria canadensis	bloodroot	Papaveraceae	10
Sanicula	sanicle	Apiaceae	1
Sanicula canadensis	Canadian blacksnakeroot	Apiaceae	5
Sassafras albidum	sassafras	Lauraceae	93
Schizachyrium scoparium	little bluestem	Poaceae	6
Schoenoplectus	bulrush	Cyperaceae	3
Schoenoplectus americanus	chairmaker's bulrush	Cyperaceae	2
Schoenoplectus fluviatilis	river bulrush	Cyperaceae	1
Schoenoplectus pungens	common threesquare	Cyperaceae	1

Scientific Name	Common Name	Family	Sites
Schoenoplectus tabernaemontani	softstem bulrush	Cyperaceae	6
Scirpus	bulrush	Cyperaceae	2
Scirpus atrovirens	green bulrush	Cyperaceae	15
Scirpus cyperinus	woolgrass	Cyperaceae	9
Scirpus pendulus	rufous bulrush	Cyperaceae	1
Senecio	ragwort	Asteraceae	2
Setaria faberi	Japanese bristlegrass	Poaceae	1
Silphium	rosinweed	Asteraceae	1
Silphium perfoliatum	cup plant	Asteraceae	1
Sisyrinchium angustifolium	narrowleaf blue-eyed grass	Iridaceae	2
Smilax	greenbrier	Smilacaceae	27
Smilax herbacea	smooth carrionflower	Smilacaceae	2
Smilax rotundifolia	roundleaf greenbrier	Smilacaceae	2
Smilax tamnoides	bristly greenbrier	Smilacaceae	13
Solanum carolinense	Carolina horsenettle	Solanaceae	2
Solanum dulcamara	climbing nightshade	Solanaceae	3
Solidago	goldenrod	Asteraceae	34
Solidago altissima	Canada goldenrod	Asteraceae	79
Solidago caesia	wreath goldenrod	Asteraceae	10
Solidago canadensis	Canada goldenrod	Asteraceae	14
Solidago canadensis var. *scabra*	Canada goldenrod	Asteraceae	6
Solidago flexicaulis	zigzag goldenrod	Asteraceae	3
Solidago gigantea	giant goldenrod	Asteraceae	16
Solidago juncea	early goldenrod	Asteraceae	1
Solidago rugosa	wrinkleleaf goldenrod	Asteraceae	8
Sorghastrum nutans	Indiangrass	Poaceae	13
Sorghum halepense	Johnsongrass	Poaceae	1
Sparganium americanum	American bur-reed	Sparganiaceae	4
Sparganium eurycarpum	broadfruit bur-reed	Sparganiaceae	16
Sphagnum	sphagnum moss	Sphagnaceae	1
Spiraea alba	white meadowsweet	Rosaceae	3
Spiraea tomentosa	steeplebush	Rosaceae	1
Stachys tenuifolia	smooth hedgenettle	Lamiaceae	1
Stellaria	starwort	Caryophyllaceae	1
Streptopus lanceolatus	twistedstalk	Liliaceae	1
Symphyotrichum	aster	Asteraceae	26
Symphyotrichum cordifolium	common blue wood aster	Asteraceae	1
Symphyotrichum laeve	smooth blue aster	Asteraceae	1
Symphyotrichum lanceolatum	white panicle aster	Asteraceae	8
Symphyotrichum lateriflorum	calico aster	Asteraceae	3
Symphyotrichum puniceum	purplestem aster	Asteraceae	1
Symplocarpus foetidus	skunk cabbage	Araceae	24
Syringa vulgaris	common lilac	Oleaceae	2
Taraxacum officinale	common dandelion	Asteraceae	9
Taxus	yet	Taxaceae	1
Taxus canadensis	Canada yew	Taxaceae	1
Teucrium canadense	Canada germander	Lamiaceae	1
Thalictrum	meadow-rue	Ranunculaceae	1

Scientific Name	Common Name	Family	Sites
Thalictrum dioicum	early meadow-rue	Ranunculaceae	1
Thalictrum thalictroides	rue anemone	Ranunculaceae	9
Thelypteris noveboracensis	New York fern	Thelypteridaceae	1
Thelypteris palustris	eastern marsh fern	Thelypteridaceae	3
Tiarella cordifolia	heartleaf foamflower	Saxifragaceae	6
Tilia americana	American basswood	Tiliaceae	47
Toxicodendron radicans	eastern poison ivy	Anacardiaceae	184
Toxicodendron vernix	poison sumac	Anacardiaceae	2
Tradescantia ohiensis	bluejacket	Commelinaceae	1
Tragopogon pratensis	Jack-go-to-bed-at-noon	Asteraceae	1
Tridens flavus	purpletop tridens	Poaceae	16
Trientalis borealis	starflower	Primulaceae	2
Trifolium pratense	red clover	Fabaceae	9
Trillium	trillium	Liliaceae	1
Trillium cernuum	whip-poor-will flower	Liliaceae	6
Trillium grandiflorum	white trillium	Liliaceae	22
Tsuga	hemlock	Pinaceae	1
Tsuga canadensis	eastern hemlock	Pinaceae	43
Tussilago farfara	coltsfoot	Asteraceae	4
Typha angustifolia	narrowleaf cattail	Typhaceae	52
Typha latifolia	broadleaf cattail	Typhaceae	64
Ulmus	elm	Ulmaceae	17
Ulmus americana	American elm	Ulmaceae	54
Ulmus pumila	Siberian elm	Ulmaceae	1
Ulmus rubra	slippery elm	Ulmaceae	231
Urtica dioica	stinging nettle	Urticaceae	29
Utricularia	bladderwort	Lentibulariaceae	1
Uvularia perfoliata	perfoliate bellwort	Liliaceae	1
Vaccinium	blueberry	Ericaceae	6
Vaccinium angustifolium	lowbush blueberry	Ericaceae	10
Vaccinium pallidum	Blue Ridge blueberry	Ericaceae	3
Verbascum blattaria	moth mullein	Scrophulariaceae	1
Verbascum thapsus	common mullein	Scrophulariaceae	1
Verbena hastata	swamp verbena	Verbenaceae	2
Verbena officinalis	herb of the cross	Verbenaceae	2
Verbesina alternifolia	wingstem	Asteraceae	159
Vernonia gigantea	giant ironweed	Asteraceae	5
Veronica	speedwell	Scrophulariaceae	13
Veronica officinalis	common gypsyweed	Scrophulariaceae	3
Veronica peregrina	neckweed	Scrophulariaceae	3
Veronica serpyllifolia	thymeleaf speedwell	Scrophulariaceae	7
Viburnum	viburnum	Caprifoliaceae	1
Viburnum acerifolium	mapleleaf viburnum	Caprifoliaceae	70
Viburnum dentatum	southern arrowwood	Caprifoliaceae	45
Viburnum lentago	nannyberry	Caprifoliaceae	1
Viburnum opulus var. *americanum*	American cranberrybush	Caprifoliaceae	1
Viburnum rafinesqueanum	downy arrowwood	Caprifoliaceae	11
Vicia	vetch	Fabaceae	1

Scientific Name	Common Name	Family	Sites
Vicia sativa	garden vetch	Fabaceae	2
Vicia tetrasperma	lentil vetch	Fabaceae	2
Vinca minor	common periwinkle	Apocynaceae	5
Viola	violet	Violaceae	21
Viola canadensis	Canadian white violet	Violaceae	28
Viola sororia	common blue violet	Violaceae	3
Viola striata	striped cream violet	Violaceae	3
Vitis	grape	Vitaceae	57
Vitis aestivalis	summer grape	Vitaceae	3
Vitis labrusca	fox grape	Vitaceae	3
Vitis riparia	riverbank grape	Vitaceae	50
Vitis vulpina	frost grape	Vitaceae	1
Waldsteinia fragarioides	Appalachian barren strawberry	Rosaceae	2
Xanthium strumarium	rough cocklebur	Asteraceae	2
Zizia aurea	golden zizia	Apiaceae	3

Appendix E: Verification Form

Verification Form
Cuyahoga National Park (CUVA) Vegetation Mapping Project

Verification Site: _____

Surveyor(s): _____ Survey Date: _____

Ecoregion: _____ General Location: _____ State: _____

Field Coordinates: X (Easting) _____ Y (Northing) _____ Elevation _____ m / ft

Accuracy _____ m / ft UTM Zone _____ Datum _____

Ground Photos: _____

IMPORTANT: Field assessments are based on an area equal to the minimum mapping unit of the vegetation type that was mapped (either 0.5 ha or 0.25 ha, depending on map class)

Validation of the Key to Vegetation Associations

CEGL Code _____

Classification Confidence: ( ) High ( ) Medium ( ) Low (provide explanation)

Key Integrity: ( ) Excellent ( ) Fair ( ) Poor (provide an explanation of why, and recommendations to reconcile or improve the key)

Explanation:

Validation of Vegetation Mapping

Does the classification &/or location of the map polygon agree with the field determined vegetation association for the area? ( ) Yes ( ) No (provide an explanation of why based on field observations)

Explanation:

Additional Comments *(those that might be helpful in the analysis of the vegetation key & the map data)*

National Park Service Vegetation Inventory Program

Appendix F: Descriptions of Map Classes

Explanation of Map-class Descriptions

This appendix to the main report of the Cuyahoga Valley National Park (CUVA) vegetation mapping project provides descriptions of the 44 map classes used to map CUVA for the National Park Service (NPS) Vegetation Inventory Program (VIP). Of these 44 map classes, 29 represent natural/semi-natural vegetation associations in the National Vegetation Classification Standard (NVCS), Version 2 (Federal Geographic Data Committee [FGDC] 2008), 12 map classes represent cultural vegetation (e.g., developed lands) in the NVCS, and three map classes represent non-vegetation features (e.g., open-water bodies). For those map classes representing vegetation associations in the NVCS, Appendix B: Descriptions of Vegetation Types, and Appendix C: Field Key to Vegetation Types, should be used to complement the map-class descriptions in this appendix.

Each map-class description provides the formal map-class code and name used for mapping. For map classes that represent just one vegetation association in the NVCS, the common name provided by NatureServe is used as the map-class name. For map classes that represent more than one vegetation association or a non-vegetation feature, succinct descriptive names were devised to describe the feature.

At the commencement of each map-class description, the official classification name and code that the map class represents in the NVCS is provided; however, for non-vegetation map classes, the classification given in the 2001 version of the National Land Cover Database (NLCD) (Homer et al. 2004) is provided. Each map class is described with a focus on how it presents in the CUVA landscape, noting that this may not reflect how the various NVCS or NLCD types present across their range. Descriptions are from a mapping, rather than an ecological, perspective, but ecological concepts relevant to the mapping effort were integrated into the map-class description. Full ecological descriptions of each vegetation association are available in Appendix B: Descriptions of Vegetation Types.

Throughout the map-class descriptions, “MMU” refers to minimum mapping unit and “AA” refers to accuracy assessment. Hardwood trees refer to all deciduous tree species. Tree species (e.g., northern red oak, white pine, American sycamore) are to be assumed to be of heights >5 m, unless otherwise specified (e.g., shrub-height trees) in the description. The term “tree species” includes general references to trees as conifers and hardwoods. Furthermore, unless otherwise noted, the herbaceous types have >10% herbaceous cover and <25% total tree and shrub canopy closure; shrubland types have >25% shrub canopy closure and <25% tree canopy closure, and forests have >25% tree canopy closure.

Along with text descriptions of the map classes, ground pictures are provided when possible to visually depict the vegetation types and non-vegetation features that the map classes represent. It is worth noting that the pictures are a partial representation; capturing all variations within a map class would not be possible.

Map classes are organized in an ad-hoc classification system that sorts and groups them primarily by physiognomic and/or hydrologic regimes. Map classes that represent non-vegetation features (e.g., open water) are organized using the classification in the NLCD. Map-classification codes, names, and their crosswalk to the NVCS and the NLCD, are listed in Table F-1. Table F-2 shows the map classification set within the official hierarchy of the NVCS. In Table F-2, map

classes that represent more than one vegetation type are noted with an asterisk (*); keep in mind that these map classes may represent vegetation types in more than one location in the NVCS hierarchy. The map classification is listed alphabetically by map-class code in Table F-3 at the end of this appendix.

Minimum Mapping Units

The standard minimum mapping unit (MMU) of 0.5 ha, set by the NPS VIP, was applied to the mapping of forest types. For shrub, herbaceous, and cultural types, as well as non-vegetation features, an MMU of 0.25 ha was applied. Also, when vegetation types were found unique to their immediate surroundings (e.g., perched herbaceous wetland in an otherwise contiguous forest), mapping below the MMU was allowed.

No Map Class

There were three vegetation associations in the NVCS that were not defined by any one map class. These associations were found to always be below the MMU or in a setting that prevented their mapping. The three associations are listed below:

- *Symplocarpus foetidus* Herbaceous Vegetation Association (CEGL002385),
- *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026), and
- *Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation (CEGL006461).

Although the CEGL002385 may occur in any forested location across CUVA, the CEGL002026 and CEGL006461 are limited to wetland locations found within the park and, although they can be an inclusion (an area below MMU) within various map classes representing other wetland associations, they are known specifically to the Mixed Herbaceous Pond Mosaic (HMPM) map class, which includes several vegetation associations that are all below MMU. Locations mapped as HMPM need only contain two of seven vegetation associations that HMPM represents, and so CEGL002026 and CEGL006461 may or may not be present in locations mapped with HMPM. As with those vegetation associations represented by the various map classes described in this appendix, these three associations are described in Appendix B: Descriptions of Vegetation Types. They are also included in Appendix C: Field Key to Vegetation Types.

Table F-1. Map classification and crosswalk to vegetation types in the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Cuyahoga Valley National Park, Ohio vegetation mapping project.

Note: The bold headings within the table (above the map classes) are primarily ad-hoc physiognomic and/or hydrologic categories to help organize the map classes; this category system is an ad-hoc arrangement and not part of any recognized classification hierarchy; however, all map classes except for those under the Open Water category represent vegetation types within the National Vegetation Classification Standard.
[CEGL, Community Element Global; CEPS, Community Element Park Special; NLCD, National Land Cover Database; NVCS, National Vegetation Classification Standard]

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
Hemlock - Oak Forest			
FHMO - Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)			
	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)	*Liriodendron tulipifera* - *Pinus strobus* - *Tsuga canadensis* - *Quercus* (*rubra*, *alba*) / *Polystichum acrostichoides* Forest	CEGL006304
Oak - (Hardwood) Forest			
FBOB - Black Oak - White Oak / Blueberry Forest			
	Black Oak - White Oak / Blueberry Forest	*Quercus velutina* - *Quercus alba* / *Vaccinium* (*angustifolium*, *pallidum*) / *Carex pensylvanica* Forest	CEGL005030
FDMO - Dry-Mesic Oak Forest			
	Midwestern White Oak - Red Oak Forest	*Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest	CEGL002068
	Black Oak - White Oak - Hickory Forest	*Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest	CEGL002076
FCOS - Sugar Maple - Chinkapin Oak Forest			
	Sugar Maple - Chinkapin Oak Forest	*Acer saccharum* - *Quercus muehlenbergii* Forest	CEGL005010
Northern Hardwood Forest			
FBMG - Beech - Maple Glaciated Forest			
	Beech - Maple Glaciated Forest	F*agus grandifolia* - *Acer saccharum* Glaciated Midwest Forest	CEGL005013
Hemlock - Hardwood Forest			
FHBM - East-Central Hemlock - Hardwood Forest			
	East-Central Hemlock - Hardwood Forest	*Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest	CEGL005043
Successional Conifer - (Hardwood) Forest			
FSCP - Successional Conifer Plantation Forest			
	Norway Spruce Plantation	*Picea abies* Planted Forest	CEGL007167
	Larch Plantation	*Larix* (*laricina*, *decidua*) Planted Forest	CEGL006408
	Red Pine Plantation	*Pinus resinosa* Planted Forest	CEGL007177
	White Pine Plantation	*Pinus strobus* Planted Forest	CEGL007178
	Scotch Pine Plantation	*Pinus sylvestris* Planted Forest	CEGL006686
	Virginia Pine Plantation	*Pinus virginiana* Planted Forest	CEGL004730
	Conifer Plantation Breakup Forest	*Pinus* spp. - *Picea abies* - *Acer rubrum* - *Liriodendron tulipifera* Ruderal Forest	CEGL005208
Successional Hardwood Forest			
FSBL - Successional Black Locust Forest			
	Successional Black Locust Forest	*Robinia pseudoacacia* Semi-natural Forest	CEGL007279

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
FSMH - Successional Mixed Hardwood Forest			
	Successional Red Maple - Black Cherry Forest	*Acer rubrum* - *Prunus serotina* / *Rosa multiflora* Forest [Park Special]	CEPS006687
	Successional Tuliptree - Red Maple Forest	*Liriodendron tulipifera* - *Acer rubrum* - *Populus* spp. Forest [Park Special]	CEPS006693
FSEC - Successional Cottonwood Forest			
	Successional Cottonwood Forest	*Populus deltoides* Early-Successional Semi-natural Forest [Park Special]	CEPS006689
Bottomland Hardwood Forest			
FOSW - Northern (Great Lakes) Flatwoods			
	Northern (Great Lakes) Flatwoods	*Quercus palustris* - *Quercus bicolor* - *Acer rubrum* Flatwoods Forest	CEGL005037
FBAS - Red Maple - Black Ash Swamp			
	Red Maple - Black Ash Swamp	*Fraxinus nigra* - *Acer rubrum* / *Rhamnus alnifolia* / *Carex leptalea* Forest	CEGL007441
Riparian Hardwood Forest			
FFSM - Silver Maple - Elm Forest			
	Silver Maple - Elm Forest	*Acer saccharinum* - *Ulmus americana* Forest	CEGL002586
FFCS - Cottonwood - Sycamore Floodplain Forest			
	Sycamore - Walnut Forest	*Platanus occidentalis* - *Juglans nigra* - (*Fraxinus americana*) Forest [Park Special]	CEPS006688
	Midwestern Cottonwood - Black Willow Forest	*Populus deltoides* - *Salix nigra* Forest	CEGL002018
Successional Bottomland - Riparian Hardwood Forest			
FSFH - Successional Floodplain Hardwood Forest			
	Tuliptree - Elm - Ash Forest	*Liriodendron tulipifera* - *Ulmus* spp. - *Fraxinus pennsylvanica* Forest [Park Special]	CEPS006684
	Central Green Ash - Elm - Hackberry Forest	*Fraxinus pennsylvanica* - *Ulmus* spp. - *Celtis occidentalis* Forest	CEGL002014
Successional Shrub Field			
SSDM - Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland			
	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland	*Elaeagnus umbellata* - *Crataegus* spp. - *Rosa multiflora* Ruderal Shrubland	CEGL005207
Shrub Wetland			
SWSM - Mixed Wet Shrubland			
	Midwest Willow Sandbar Shrubland	*Salix interior* - *Salix eriocephala* Sandbar Shrubland	CEGL005078
	Gray Alder Swamp	*Alnus incana* Swamp Shrubland	CEGL002381
	Northern Buttonbush Swamp	*Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland	CEGL002190
	Dogwood - Willow - Wild Indigo Shrubland	*Cornus racemosa* - *Salix* spp. - *Baptisia australis* Shrubland	CEGL005206
Successional Herbaceous Field			
HSFD - Successional Central Dry-Mesic Herbaceous Field			
	Successional Central Dry-Mesic Herbaceous Field	*Daucus carota* - *Leucanthemum vulgare* Semi-natural Herbaceous Vegetation [Park Special]	CEPS006692

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
HSFW - Successional Central Wet-Mesic Herbaceous Field			
	Successional Central Wet-Mesic Herbaceous Field	*Impatiens capensis* - *Solidago* spp. - *Verbesina alternifolia* Semi-natural Herbaceous Vegetation [Park Special]	CEPS006690
HSGD - Successional Grassland Meadow			
	Timothy - Bluejoint Meadow	*Phleum pratense* - (*Calamagrostis canadensis*) Semi-natural Herbaceous Vegetation	CEGL005249
	Restored Tallgrass Prairie	*Schizachyrium scoparium* - *Andropogon gerardii* - *Poa* spp. Semi-natural Herbaceous Vegetation [Park Special]	CEPS006691
Emergent Herbaceous Wetland			
HCTM - Midwest Cattail Deep Marsh			
	Midwest Cattail Deep Marsh	*Typha* spp. Midwest Herbaceous Vegetation	CEGL002233
HWSM - Lake Sedge Wet Meadow			
	Lake Sedge Wet Meadow	*Carex lacustris* Herbaceous Vegetation	CEGL002256
Successional Emergent Herbaceous Wetland			
HRCG - Reed Canarygrass Eastern Marsh			
	Reed Canarygrass Eastern Marsh	*Phalaris arundinacea* Eastern Herbaceous Vegetation	CEGL006044
HCRM - Eastern Reed Marsh			
	Eastern Reed Marsh	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation	CEGL004141
HSJK - Japanese Knotweed Gravelbar			
	Japanese Knotweed Gravelbar	*Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation	CEGL008472
Aquatic Herbaceous Wetland			
HWLY - Water-lily Aquatic Wetland			
	Water-lily Aquatic Wetland	*Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation	CEGL002386
HPWD - Midwest Pondweed Submerged Aquatic Wetland			
	Midwest Pondweed Submerged Aquatic Wetland	*Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation	CEGL002282
Herbaceous Wetland Mosaic			
HMPM - Mixed Herbaceous Pond Mosaic			
	Midwest Cattail Deep Marsh	*Typha* spp. Midwest Herbaceous Vegetation	CEGL002233
	Bulrush - Cattail - Bur-reed Shallow Marsh	*Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation	CEGL002026
	Lake Sedge Wet Meadow	*Carex lacustris* Herbaceous Vegetation	CEGL002256
	Central Appalachian Cutgrass Marsh	*Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation	CEGL006461
	Reed Canarygrass Eastern Marsh	*Phalaris arundinacea* Eastern Herbaceous Vegetation	CEGL006044
	Eastern Reed Marsh	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation	CEGL004141

Map Class Code - Name	Vegetation Association Common Name	Vegetation Association Scientific Name	Vegetation Code
	Water-lily Aquatic Wetland	*Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation	CEGL002386
	Midwest Pondweed Submerged Aquatic Wetland	*Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation	CEGL002282
River Scour Sparse Vegetation			
VRSV - Riverine Gravel Wash			
	Riverine Gravel Wash	Midwest Gravel Wash River Sparse Vegetation	CEGL002408
Cultural Agriculture			
CORD - Orchard			Cultural Class 7
CVYD - Vineyard			Cultural Class 7
CBRY - Berry Crop Field			Cultural Class 7
CCTF - Christmas Tree Farm			Cultural Class 7
CRWC - Cultivated Herbaceous Row Crop			Cultural Class 7
CCGC - Cultivated Herbaceous Close Grown Crop			Cultural Class 7
CPAS - Pasture and Hay Field			Cultural Class 7
Cultural Developed			
CDVO - Developed Area - Open Space			Cultural Class 8
CDVL - Developed Area - Low Intensity			Cultural Class 8
CDVM - Developed Area - Medium Intensity			Cultural Class 8
CDVH - Developed Area - High Intensity			Cultural Class 8
CBRN - Barren Land			Cultural Class 8
Open Water (Non-NVCS)			
NSR - Stream & River			Not applicable
NWL - Open Water Lake			Not applicable
NWP - Open Water Pond			Not applicable

Table F-2. Map classification set into the hierarchy of the National Vegetation Classification Standard, Version 2 (FGDC 2008), for the Cuyahoga National Park, Ohio vegetation mapping project.

[CEGL, Community Element Global; CEPS, Community Element Park Special; NVCS, National Vegetation Classification Standard; NLCD, National Land Cover Database]

Map-class Code	Map-class Name
1. FOREST TO OPEN WOODLAND CLASS	
1.B.2.Na. Eastern North American Cool Temperate Forest Division	
M502. Appalachian & Northeastern Oak - Hardwood & Pine Forest Macrogroup	
G015. Appalachian Oak - Chestnut Forest Group	
Quercus velutina - *Quercus alba* / *Vaccinium* (*angustifolium*, *pallidum*) / Carex *pensylvanica* Forest Association (CEGL005030)	
FBOB	Black Oak - White Oak / Blueberry Forest
G016. Northeastern Chinkapin Oak - Red-cedar Forest & Woodland Group	
Acer saccharum - *Quercus muehlenbergii* Forest Association (CEGL005010)	
FCOS	Sugar Maple - Chinkapin Oak Forest
M153. Central Mesophytic Hardwood Forest Macrogroup	
G021. North-Central Beech - Maple - Basswood Forest Group	
Fagus grandifolia - *Acer saccharum* Glaciated Midwest Forest Association (CEGL005013)	
FBMG	Beech - Maple Glaciated Forest
M013. Eastern North American Ruderal Forest & Plantation Macrogroup	
G032. Northern & Central Conifer & Hardwood Plantation Group	
Picea abies Planted Forest Association (CEGL007167)	
FSCP*	Successional Conifer Plantation Forest
Larix (*laricina*, *decidua*) Planted Forest Association (CEGL006408)	
FSCP*	Successional Conifer Plantation Forest
Pinus resinosa Planted Forest Association (CEGL007177)	
FSCP*	Successional Conifer Plantation Forest
Pinus strobus Planted Forest Association (CEGL007178)	
FSCP*	Successional Conifer Plantation Forest
Pinus sylvestris Planted Forest Association (CEGL006686)	
FSCP*	Successional Conifer Plantation Forest
Pinus virginiana Planted Forest Association (CEGL004730)	
FSCP*	Successional Conifer Plantation Forest
G030. Northern & Central Hardwood & Conifer Ruderal Forest Group	
Robinia pseudoacacia Semi-natural Forest Association (CEGL007279)	
FSBL	Successional Black Locust Forest
Acer rubrum - *Prunus serotina* / *Rosa multiflora* Forest Association [Park Special] (CEPS006687)	
FSMH*	Successional Mixed Hardwood Forest
Liriodendron tulipifera - *Acer rubrum* - *Populus* spp. Forest Association [Park Special] (CEPS006693)	
FSMH*	Successional Mixed Hardwood Forest
Liriodendron tulipifera - *Pinus strobus* - *Tsuga canadensis* - *Quercus* (*rubra*, *alba*) / *Polystichum acrostichoides* Forest Association (CEGL006304)	
FHMO	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)

Map-class Code	Map-class Name
Pinus spp. - *Picea abies* - *Acer rubrum* - *Liriodendron tulipifera* Ruderal Forest Association (CEGL005208)	
FSCP*	Successional Conifer Plantation Forest
M012. North-Central Oak - Hardwood & Pine Forest Macrogroup	
G649. North-Central Oak - Hickory Forest & Woodland Group	
Quercus alba - *Quercus rubra* - *Carya ovata* Glaciated Forest Association (CEGL002068)	
FDMO*	Dry-Mesic Oak Forest
Quercus velutina - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest Association (CEGL002076)	
FDMO*	Dry-Mesic Oak Forest
M014. Northern Mesic Hardwood & Conifer Forest Macrogroup	
G742. Southern & Central Appalachian Northern Hardwoods - Hemlock Forest Group	
Tsuga canadensis - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest Association (CEGL005043)	
FHBM	East-Central Hemlock - Hardwood Forest
1.B.3.Na. Eastern North American Flooded & Swamp Forest Division	
M503. Central & Appalachian Swamp Forest Macrogroup	
G597. Central Flatwoods & Pond Forest Group	
Quercus palustris - *Quercus bicolor* - *Acer rubrum* Flatwoods Forest Association (CEGL005037)	
FOSW	Northern (Great Lakes) Flatwoods
M302. Eastern North American Ruderal Flooded & Swamp Forest Macrogroup	
G552. Northern & Central Ruderal Flooded & Swamp Forest Group	
Liriodendron tulipifera - *Ulmus* spp. - *Fraxinus pennsylvanica* Forest Association [Park Special] (CEPS006684)	
FSFH*	Successional Floodplain Hardwood Forest
Platanus occidentalis - *Juglans nigra* - (*Fraxinus americana*) Forest Association [Park Special] (CEPS006688)	
FFCS*	Cottonwood - Sycamore Floodplain Forest
Populus deltoides Early-Successional Semi-natural Forest Association [Park Special] (CEPS006689)	
FSEC	Successional Cottonwood Forest
M029. Northern & Central Floodplain Forest & Scrub Macrogroup	
G041. Eastern Cottonwood - Black Willow Floodplain Forest Group	
Populus deltoides - *Salix nigra* Forest Association (CEGL002018)	
FFCS*	Cottonwood - Sycamore Floodplain Forest
G652. Silver Maple - Green Ash - Sycamore - Hackberry Floodplain Forest Group	
Acer saccharinum - *Ulmus americana* Forest Association (CEGL002586)	
FFSM	Silver Maple - Elm Forest
Fraxinus pennsylvanica - *Ulmus* spp. - *Celtis occidentalis* Forest Association (CEGL002014)	
FSFH*	Successional Floodplain Hardwood Forest
M504. Northern Swamp Forest Macrogroup	
G046. Northern Conifer & Hardwood Alkaline Swamp Group	
Fraxinus nigra - *Acer rubrum* / *Rhamnus alnifolia* / *Carex leptalea* Forest Association (CEGL007441)	
FBAS	Red Maple - Black Ash Swamp

Map-class Code	Map-class Name
2. SHRUBLAND & GRASSLAND CLASS	
2.B.2.Nc. Eastern North American Grassland, Meadow & Shrubland Division	
M123. Eastern North American Ruderal Shrubland & Grassland Macrogroup	
G059. Northern & Central Ruderal Meadow & Shrubland Group	
Daucus carota - *Leucanthemum vulgare* Semi-natural Herbaceous Vegetation Association [Park Special] (CEPS006692)	
HSFD	Successional Central Dry-Mesic Herbaceous Field
Elaeagnus umbellata - *Crataegus* spp. - *Rosa multiflora* Ruderal Shrubland Association (CEGL005207)	
SSDM	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland
Impatiens capensis - *Solidago* spp. - *Verbesina alternifolia* Semi-natural Herbaceous Vegetation Association [Park Special] (CEPS006690)	
HSFW	Successional Central Wet-Mesic Herbaceous Field
Phleum pratense - (*Calamagrostis canadensis*) Semi-natural Herbaceous Vegetation Association (CEGL005249)	
HSGD*	Successional Grassland Meadow
Schizachyrium scoparium - *Andropogon gerardii* - *Poa* spp. Semi-natural Herbaceous Vegetation Association [Park Special] (CEPS006691)	
HSGD*	Successional Grassland Meadow
2.B.4.Na. Eastern North American Dune & Coastal Grassland & Shrubland Division	
M176. Eastern North American Lake & River Shoreline Vegetation Macrogroup	
G343. Eastern North American River Shoreline [Placeholder] Group	
Midwest Gravel Wash River Sparse Vegetation Association (CEGL002408)	
VRSV	Riverine Gravel Wash
G194. Northern & Central Riverscour Wetland Group	
Salix interior - *Salix eriocephala* Sandbar Shrubland Association (CEGL005078)	
SWSM*	Mixed Wet Shrubland
2.B.5.Na. North American Bog & Fen Division	
M061. Appalachian, Interior Plateau & Prairie Fen Macrogroup	
G183. North-Central Appalachian, Interior & Prairie Fen Group	
Symplocarpus foetidus Herbaceous Vegetation Association (CEGL002385)	
N/A	Skunk-cabbage Seepage Meadow
2.B.6.Na. Eastern North American Freshwater Wet Meadow, Riparian & Marsh Division	
M303. Eastern North American Ruderal Wet Meadow & Marsh Macrogroup	
G556. Northern & Central Ruderal Wet Meadow & Marsh Group	
Phalaris arundinacea Eastern Herbaceous Vegetation Association (CEGL006044)	
HRCG / HMPM*	Reed Canarygrass Eastern Marsh / Mixed Herbaceous Pond Mosaic
Phragmites australis Eastern North America Temperate Semi-natural Herbaceous Vegetation Association (CEGL004141)	
HCRM / HMPM*	Eastern Reed Marsh / Mixed Herbaceous Pond Mosaic
Polygonum cuspidatum Temporarily Flooded Herbaceous Vegetation Association (CEGL008472)	
HSJK	Japanese Knotweed Gravelbar

Map-class Code	Map-class Name
M069. Eastern North American Wet Meadow & Marsh Macrogroup	
G125. Eastern North American Freshwater Marsh Group	
Schoenoplectus tabernaemontani - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation Association (CEGL002026)	
N/A / HMPM*	Bulrush - Cattail - Bur-reed Shallow Marsh / Mixed Herbaceous Pond Mosaic
Typha spp. Midwest Herbaceous Vegetation Association (CEGL002233)	
HCTM / HMPM*	Midwest Cattail Deep Marsh / Mixed Herbaceous Pond Mosaic
G112. Eastern North American Wet Meadow Group	
Carex lacustris Herbaceous Vegetation Association (CEGL002256)	
HWSM / HMPM*	Lake Sedge Wet Meadow / Mixed Herbaceous Pond Mosaic
Cephalanthus occidentalis / *Carex* spp. Northern Shrubland Association (CEGL002190)	
SWSM*	Mixed Wet Shrubland
Leersia oryzoides - *Sagittaria latifolia* Herbaceous Vegetation Association (CEGL006461)	
N/A / HMPM*	Central Appalachian Cutgrass Marsh / Mixed Herbaceous Pond Mosaic
M160. Northern & Central Tall Shrub Wetland Macrogroup	
G167. Northern & Central Shrub Swamp Group	
Alnus incana Swamp Shrubland Association (CEGL002381)	
SWSM*	Mixed Wet Shrubland
Cornus racemosa - *Salix* spp. - *Baptisia australis* Shrubland Association (CEGL005206)	
SWSM*	Mixed Wet Shrubland
5. AQUATIC VEGETATION CLASS	
5.B.2.Na. North American Freshwater Aquatic Vegetation Division	
M108. Eastern North American Freshwater Aquatic Vegetation Macrogroup	
G114. Eastern North American Freshwater Aquatic Vegetation Group	
Nuphar advena - *Nymphaea odorata* Herbaceous Vegetation Association (CEGL002386)	
HWLY / HMPM*	Water-lily Aquatic Wetland / Mixed Herbaceous Pond Mosaic
Potamogeton spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282)	
HPWD / HMPM*	Midwest Pondweed Submerged Aquatic Wetland / Mixed Herbaceous Pond Mosaic
7. AGRICULTURAL VEGETATION CULTURAL CLASS (NLCD 2001; 82)	
Woody Agricultural Vegetation Subclass (L2)	
Woody Horticultural Crop Formation (L3)	
Orchard (tree) Subformation (L4)	
Fruit - Orchards Subgroup (L6)	
CORD	Orchard
Vineyard (vine) Subformation (L4)	
Vineyard Subgroup (L6)	
CVYD	Vineyard
Bush Fruit & Berries (shrub) Subformation (L4)	
Bush-fruit Subgroup (L6)	
CBRY	Berry Crop Field

Map-class Code	Map-class Name
Other Woody Farmland / Rural Vegetation Subformation (L4)	
Other Land In Farms Subgroup (L6)	
CCTF	Christmas Tree Farm
Herbaceous Agricultural Vegetation Subclass (L2)	
Cultivated Crop Formation (L3)	
Row Crop Subformation (L4)	
CRWC	Cultivated Herbaceous Row Crop
Close Grown Crop Subformation (L4)	
CCGC	Cultivated Herbaceous Close Grown Crop
Pasture / Hay Formation (L3)	
Permanent Pasture & Hayland Subformation (L4)	
CPAS	Pasture and Hay Field
8. DEVELOPED VEGETATION CULTURAL CLASS	
Herbaceous & Woody Developed Vegetation Cultural Subclass (L2)	
Other Developed Urban / Built Up Vegetation Formation (L3)	
Other Urban / Build Up Vegetation Subformation (L4)	
Developed Area (NLCD 2001; 21-24)	
CDVO	Developed Area - Open Space
CDVL	Developed Area - Low Intensity
CDVM	Developed Area - Medium Intensity
CDVH	Developed Area - High Intensity
Barren Land (NLCD 2001; 31)	
CBRN	Barren Land
NON-NVCS UNITS	
Non-Vegetated Land & Water (<1% vegetated)	
Non-Vegetated Land	
Non-Vegetated Water	
Open Water (NLCD 2001; 11)	
NSR	Stream & River
NWL	Open Water Lake
NWP	Open Water Pond

*Map class also represents other vegetation types.

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FHMO – Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)

The Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type) (FHMO) map class represents the *Liriodendron tulipifera* - *Pinus strobus* - *Tsuga canadensis* - *Quercus* (*rubra*, *alba*) / *Polystichum acrostichoides* Forest Association (CEGL006304) in the NVCS. This map class is structurally similar to the Black Oak - White Oak / Blueberry Forest (FBOB) map class with the addition of eastern hemlock (*Tsuga canadensis*) and/or eastern white pine (*Pinus strobus*) in the canopy. FHMO is quite rare, totaling 2.7 ha and making up only 0.02% of the mapped area at CUVA. It is limited to the Kendall Ledges area at the park.

Eastern hemlock and/or eastern white pine were present with at least 25% relative dominance in the canopy and have a relative dominance of >50% to other conifers; the hardwood tree component should be dominated by oak species (*Quercus* spp.) and red maple (*Acer rubrum*). This map class was found exclusively at the Kendall Ledges, usually in close connection with FBOB. It tended to be found in small pockets in more mesic areas, such as ravines or near rock faces.

The AA results show that FHMO was mapped with a high level of accuracy; this was likely due to its extremely limited footprint and ease of distinguishing this type on aerial imagery.



The above images show two examples of the FHMO map class with the image on the left showing sandstone bedrock and the image on the right showing the similarity of structure and understory plants to the FBOB map class.

FBOB – Black Oak - White Oak / Blueberry Forest

The Black Oak - White Oak / Blueberry Forest (FBOB) map class represents the *Quercus velutina* - *Quercus alba* / *Vaccinium* (*angustifolium*, *pallidum*) / *Carex pensylvanica* Forest Association (CEGL005030) in the NVCS. This is a rare and spatially limited map class having only been found at the Kendall Ledges area at CUVA. As a rare vegetation association at the park, it makes up a correspondingly small 0.06% of the park, represented in one 7.3-ha polygon.

Although generally associated with sandy soils, at CUVA the FBOB was found on thin soils over sandstone bedrock. Requiring a canopy cover of at least 50%, white oak (*Quercus alba*) and/or black oak (*Q. velutina*), this map class is generally dominated by a mixture of the two oak species. The FBOB also often contained red maple (*Acer rubrum*) and eastern hemlock (*Tsuga canadensis*) in the canopy or sub-canopy layers. Lowbush blueberry (*Vaccinium angustifolium*) and common serviceberry (*Amelanchier arborea*) were also common in the sparsely covered understory. The Kendall Ledges area where this type is found has many trails and is subject to heavy foot traffic, so this map class is likely more anthropogenically influenced than many map classes at the park.

The AA results indicate that this uncommon map class was mapped well and is unlikely to be more abundant. This agrees well with the understanding of CUVA geology and soils, which suggest a highly limited range for the map class at the park.





The above images provide two examples of the FBOB map class with the image on the left showing characteristic rocky sandstone areas and the image on the right showing a sparse layer of lowbush blueberry shrubs often present in the understory.

FDMO – Dry-Mesic Oak Forest

The Dry-Mesic Oak Forest (FDMO) map class represents two forest associations in the NVCS: the *Quercus alba* - *Quercus rubra* - *Carya ovata* Glaciated Forest (CEGL002068) and the *Quercus velutina* - *Quercus alba* - *Carya* (*glabra*, *ovata*) Forest (CEGL002076). These two associations were mapped together from the beginning due to the difficulty of distinguishing many oak species (*Quercus* spp.) from one another on the digital aerial imagery, their similar environmental positions, and the tendency of the two associations to intergrade in the areas they overlap. Occurring throughout the park, FDMO is most commonly presented as a large-patch late-successional closed-canopy forest, often found in connection with the Beech - Maple Glaciated Forest (FBMG) map class. FDMO is found on dry to dry-mesic soils with good drainage, usually on slopes or high terraces. FDMO covers 3,088.3 ha, accounting for 23.2% of the mapped area of CUVA, behind only the Successional Mixed Hardwood Forest (FSMH) map class in mapped area of the park.

The FDMO map class requires a minimum canopy cover of 40% oak species, except for chinkapin oak (*Q. muehlenbergii*) and/or hickory species (*Carya* spp.), and normally presents as a dense, oak species-rich forest. American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*) could be entirely absent to somewhat common, but they were never dominant. Typical FDMO had a high density of oak species and hickory species with few red maple or sugar maple, but some more disturbed examples of FDMO have a fairly high density of red maple (*Acer rubrum*) and other successional trees. Several areas were found in the park where hickory species dominated with a low density of oak species (likely due to past logging activity/other disturbance), and these areas were mapped as FDMO. Occasional eastern hemlock (*Tsuga canadensis*) or pine species (*Pinus* spp.) were sometimes included in this map class, but always at <25% dominance.

Estimating the relative dominance of oak species to maple species and American beech within the forest was a potential source of error with FDMO. The AA results show that FDMO was occasionally confused with FBMG; in these cases it was generally in close connection with FBMG, and these are oak species-rich examples of FBMG. More rarely, FDMO was confused with the FSMH map class when the level of disturbance to the forest and invasion by successional species was underestimated.



The above images show various aspects of the Dry-Mesic Oak Forest (FDMO) map class, from images upper left clockwise: a dry upland forest showing significant American beech; a wooded oak draw heading down into the Beech - Maple Glaciated Forest (FBMG) map class; a lower, wetter and richer FDMO with a sugar maple understory; and a mesic FDMO with co-dominant hickory species.

FCOS – Sugar Maple - Chinkapin Oak Forest

The Chinkapin Oak - Sugar Maple Forest (FCOS) map class represents the *Acer saccharum* - *Quercus muehlenbergii* Forest Association (CEGL005010) in the NVCS. This class is rare and spatially limited at CUVA, covering just 9.9 ha (0.08%) of the park. The only mapped locations are on a steep hillside above the area known as Stumpy Basin, just south of Interstate 80 and on the east side of the Cuyahoga River.

The FCOS map class requires a minimum canopy cover of 33% chinkapin oak (*Quercus muehlenbergii*) and generally presents as a moderately dense and rich oak species-hardwood forest with scattered openings of dry grasses and/or shrubs. At CUVA this class was found on moderately steep to steep rocky hillsides with calcareous soils. Sugar maple (*Acer saccharum*) was present to co-dominant along with many other plants indicative of significantly enriched soils. White oak (*Q. alba*) and northern red oak (*Q. rubra*) were generally present, but only as a component to the chinkapin oak and sugar maple.

The AA results indicate that this map class was mapped well and is likely limited to the Stumpy Basin area within CUVA.



The above image shows an example of the FCOS map class with chinkapin and white oak trees.

FBMG – Beech - Maple Glaciated Forest

The Beech - Maple Glaciated Forest (FBMG) map class represents the varying faces of the *Fagus grandifolia* - *Acer saccharum* Glaciated Midwest Forest Association (CEGL005013) in the NVCS. Representing the matrix non-disturbed northern hardwood forest of CUVA, FBMG covers about 11.8% of the park (1,570.8 ha) and is most commonly a large-patch late-successional closed-canopy forest found in connection with the Dry-Mesic Oak Forest (FDMO) map class. FBMG occurs throughout the park and is generally found on sheltered north-facing slopes with good drainage, but it can occur on any upland topographic position in the park that presents deeper mesic soils.

The FBMG map class requires a minimum canopy cover of 40% American beech (*Fagus grandifolia*) and/or sugar maple (*Acer saccharum*) and generally presents as a northern hardwood-dominated forest with sparse oak species (*Quercus* spp.). Oak species may be entirely absent to somewhat common, but never dominant. The species richness of FBMG also varies greatly, with some areas exhibiting a monotypic sugar maple or American beech canopy, while other areas clearly show a much richer canopy composed of a mix of six to eight distinct canopy associates. Eastern hemlock (*Tsuga canadensis*) may occasionally be present in this forest in the most sheltered locations, but at <25% relative dominance.

Estimating the relative dominance of oak species within the forest is a potential source of error, because FBMG is occasionally confused with FDMO. In these cases FBMG is generally in close connection with FDMO, and these are hardwood-rich examples of FDMO.

The FBMG map class was rarely observed in a successional state. However, mature versions of the Successional Mixed Hardwood Forest (FSMH) map class occasionally presented a signature similar to FBMG. These locations generally represent forests in the process of succeeding to vegetation associations not defined by disturbance.

Estimating the relative dominance of maple and beech to oak dominance within the forest was a potential source of error with FDMO. The AA results found FBMG was occasionally confused with FDMO; in these cases it was generally in close proximity to FDMO, and these are hardwood-rich examples of FDMO. Additionally, FBMG was confused with the FSMH map class when the level of disturbance to the forest and invasion by successional species was underestimated. A final source of confusion was when hydrologic influence was judged incorrectly. In these few instances, the FBMG map class was confused with the Cottonwood - Sycamore Floodplain Forest (FFCS) and Successional Floodplain Hardwood Forest (FSFH) map classes.





The above images show the varying composition of the FBMG map class. The image on the left shows a younger sugar maple-dominated forest. The image on the right shows a much more mature example with excellent canopy structure and a highly heterogeneous canopy composition.

FHBM – East-Central Hemlock - Hardwood Forest

The East-Central Hemlock - Hardwood Forest (FHBM) map class represents the *Tsuga canadensis* - *Fagus grandifolia* - *Acer saccharum* / (*Hamamelis virginiana*, *Kalmia latifolia*) Forest Association (CEGL005043) in the NVCS. This map class is very structurally similar to the Beech - Maple Glaciated Forest (FBMG) map class with the addition of eastern hemlock (*Tsuga canadensis*) and/or eastern white pine (*Pinus strobus*) to the canopy. The FHBM map class is relatively rare within CUVA, representing only 0.2% of the area mapped at the park, with 28.7 ha mapped. Much of FHBM is represented by relatively small patches tucked into the more mesic or sheltered areas of the FBMG.

Eastern hemlock and /or eastern white pine were present at >25% relative dominance in the canopy and have a relative dominance of >50% to other conifers; American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and/or yellow birch (*Betula alleghaniensis*) make up >50% of the deciduous component of FHBM. Oak species (*Quercus* spp.) may be present but do not dominate. FHBM was generally constrained to ravines, draws, or other more mesic and sheltered areas within FBMG. Areas with <25% canopy hemlock and /or white pine, but with hemlock or white pine, present in the sub-canopy or understory layers were mapped as FBMG.

Due to its distinctive appearance in aerial imagery and the limited habitat of FHBM, the AA results show little confusion in the mapping of FHBM.





The above images show two examples of the FHBM map class in sheltered, mesic sights.

FSCP – Successional Conifer Plantation Forest

The Successional Conifer Plantations Forest (FSCP) map class represents seven plantation-based forest associations in the NVCS, including six planted conifer forests and one forest meant to encompass the variety of successional pathways a conifer plantation takes after the cessation of active management:

- *Larix* (*laricina*, *decidua*) Planted Forest (CEGL006408),
- *Picea abies* Planted Forest (CEGL007167),
- *Pinus resinosa* Planted Forest (CEGL007177),
- *Pinus strobus* Planted Forest (CEGL007178),
- *Pinus sylvestris* Planted Forest (CEGL006686),
- *Pinus virginiana* Planted Forest (CEGL004730), and
- *Pinus* spp. - *Picea abies* - *Acer rubrum* - *Liriodendron tulipifera* Ruderal Forest (CEGL005208).

The six conifer planted forest associations represented by the FSCP map class are conifer plantations that still readily resemble a managed forest, irrespective of the management the forest is receiving. Early in the field reconnaissance effort it was discovered that a significant proportion of the conifer plantations in CUVA were a mixture of different species, and the mappers determined that reliably splitting these apart would not be successful. Upon consultation with park staff, it was determined that this was not an effort the park also thought necessary, so all conifer plantations forests were grouped together. Generally, this map class entails an even-aged, often square-sided grove of conifers growing in orderly rows with depauperate undergrowth. Succession towards other forest association types was generally well established with a well-developed subcanopy of shade-tolerant hardwoods, but the conifer canopy was still the controlling aspect these systems.

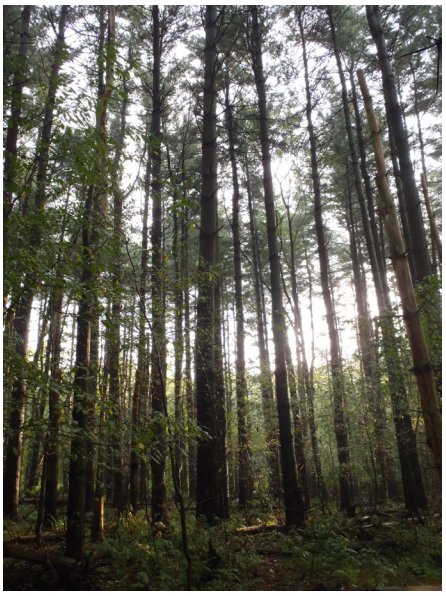
In instances where the conifer component of the plantation was failing or had been partially removed, it became appropriate to utilize a ruderal type to capture the wide variety of successional forests that could result. The FSCP map class excels at this by accepting the majority of possible conifer plantation species and major successional hardwood species in one place.

Initially, the six conifer plantation associations (as a group) were mapped separately from the successional plantation type. The mappers assumed that successional plantations should be readily distinguishable from non-successional plantations based upon canopy closure and the presence of hardwood trees in the canopy. During the analysis process for AA, however, it was determined that successional plantations were being consistently mapped as non-successional plantations based upon the understory characteristics otherwise invisible to the mappers. A consultation between the AA team and park staff determined that grouping these seven conifer plantation-based associations into one map class would result in very little information loss, and this resulted in the final composition of the FSCP map class.

Overall, the FSCP map class generally presents as a conifer-dominated landscape clearly resulting from planting and management, even if that management has stopped. The species of conifer and hardwood were determined to be irrelevant as long as the relative dominance of conifers to hardwoods was >25% of the canopy and the forest had clearly been planted at one

time. Relatively common across CUVA, the FSCP map class covers just over 378.8 ha, or 2.9%, of the park.






The above images show four of the seven conifer plantation-based forest associations, which are represented, in part, by the FSCP map class, from top left clockwise: CEGL006408; CEGL007167; CEGL007177; and CEGL007178.




The above images show two different examples of CEGL005208, which is represented, in part, by the FSCP map class.

FSBL – Successional Black Locust Forest

The Successional Black Locust Forest (FSBL) map class represents a single disturbance-orientated forest association in the NVCS: the *Robinia pseudoacacia* Semi-natural Forest (CEGL007279). Although it is rare in CUVA (covering 7.9 ha or 0.06% of the park), this vegetation association is found throughout the eastern United States as the black locust (*Robinia pseudoacacia*) was valued by farmers for its quick growth and rot resistant wood, making it excellent fencepost stock. Thus, in areas with a history of farming, it is common to find monotypic stands of old, even-aged black locust that never made it to the fencerow. Several of these stands exist within the park, with black locust otherwise present in many of the upland successional forests and old fields of the park.

Black locust is a small-leaved tree that loses its leaves very early in the fall. It also exhibits a clonal growth form. Because of this, monotypic stands of black locust often appear as stands of senesced or dead trees in the CIR digital aerial imagery obtained for the CUVA vegetation mapping project. This is true for the stands found within CUVA, which are often found in close proximity to old farmsteads or pastures.

Because FSBL requires the absolute dominance (>50%) of black locust in the canopy and other successional tree species quickly overtake black locust, only eight instances of FSBL were mapped in the park. Since determining absolute canopy dominance from imagery is particularly problematic, it is likely that this map class was confused with various other successional hardwood forests in the park.

The AA results show two distinct things for the FSBL map class. The first is that areas mapped as FSBL were mapped very reliably. The second is that FSBL may be more common in CUVA than mapped owing to confusion among the other hardwood tree map classes when the relative dominance of black locust to other tree species was underestimated.



The above image provides an example of the FSBL map class, clearly showing the disturbed successional nature in this older example of CEGL007279.

FSMH – Successional Mixed Hardwood Forest

The Successional Mixed Hardwood Forest (FSMH) map class represents two successional forest associations in the NVCS: the *Acer rubrum* - *Prunus serotina* / *Rosa multiflora* Forest [Park Special] (CEPS006687) and the *Liriodendron tulipifera* - *Acer rubrum* - *Populus* spp. Forest [Park Special] (CEPS006693). This is the matrix upland disturbed and successional hardwood forest of CUVA, and it covers just over 26.3% of the park (3,496.2 ha). Additionally, FSMH is an exceptionally diverse map class composed of most of the tree species found in the park and presented in a wide variety of age-classes across in almost every environmental setting. The one aspect that ties this heterogeneous upland forest map class together is a history of site disturbance.

Site disturbance in CUVA encompasses a huge variety of events beginning long before the creation of the park, but the majority of the area mapped as FSMH is <50 years old, and most of the mapped area is substantially younger. Logging and agriculture are the primary types of disturbance in the park, and most of the disturbances occurred before the creation of the park in 1974. Generally, this history results in FSMH presenting as an even-aged forest. Species composition is highly variable and includes monocultures to highly heterogeneous forests. Canopy closure is also highly variable, though it trends towards a more broken canopy than the non-disturbed hardwoods forests of the park.

Initially, mappers attempted to map the two vegetation associations (CEPS006687 and CEPS006693) separate from each other, in their own individual map classes. The expectation was that these two associations could be split in the imagery based upon a combination of the relative dominance of tuliptree (*Liriodendron tulipifera*) and topographic position, where CEPS006693 is dominated by tuliptree and generally occurs on dryer sites. During the analysis process for AA, however, it became clear that the degree of environmental tolerance and species overlap between these two associations was too broad to allow for consistent mapping. The two associations were thus combined into one upland hardwood disturbed-forest map class after AA.

Because of the highly-heterogeneous presentation of FSMH, it was also widely confused with other map classes. In a few instances this confusion resulted from mappers underestimating the hydrologic influence at a site. In these cases the forest was found to be represented by the Successional Floodplain Hardwood Forest (FSFH) map class. The reverse was also true when mappers overestimated the hydrologic influence and mapped FSMH as FSFH.

However, the majority of the confusion came when mappers overestimated the level of site disturbance from the imagery, associated this apparent disturbance with canopy heterogeneity, and concluded that a forest was FSMH. In these cases the errors represent a scattershot of other map classes that likely represent disturbed versions of other map classes or instances of old FSMH maturing into non-disturbance forest types.



The above images show various examples of the FSMH map class, from top left clockwise: a monotypic stand of upland tuliptree nearing a half century in age and representing a classic CEPS006693; a forest of quarter-century old red maple (*Acer rubrum*) with one lager black cherry (*Prunus serotina*) (frame right) representing a classic CEPS006687; a young mixed canopy red maple and tuliptree over impenetrable multiflora rose (*Rosa multiflora*) indicating aspects of both CESP006687 and CESP006693; a successional pasture with a very heterogeneous canopy of red maple, tuliptree, white ash (*Fraxinus americana*), and sparse oak species (*Quercus* spp.) indicating aspects of both CESP006687 and CESP006693.

FSEC – Successional Cottonwood Forest

The Successional Cottonwood Forest (FSEC) represents the *Populus deltoides* Early-Successional Semi-natural Forest [Park Special] Association (CESP006689) in the NVCS. This is a rather odd forest that presents a signature identical to a native floodplain, but in the completely wrong location. Resulting from a combination of local geomorphology and site disturbance, FSEC is found in uplands far removed from any riparian influence. The apparent hydrologic influence allowing cottonwood to dominate these sites is a combination of soil removal (often from mining) and clay lenses. This combines to present a set of conditions similar to primary regeneration after a severe flood, which the eastern cottonwood (*Populus deltoides*) is especially adapted to utilizing.

This set of characteristics also allows for the consistent identification of this map class given the familiar signature in the inappropriate location. The FSEC map class was particularly common at the Terra Vista Natural Study Area in the northern end of CUVA, covering just over 0.2% of the park (31.0 ha). This site was formerly a clay mine, where the surface soil was removed to expose the clay. After closure the site was abandoned, and eastern cottonwood regenerated across a substantial swath of the site.

The AA analysis shows that FSEC was generally mapped well, occasionally confused with FSMH when the dominance of eastern cottonwood was under/overestimated. There was also occasional confusion with Cottonwood - Sycamore Floodplain Forest (FFCS) and Successional Floodplain Hardwood Forest (FSFH) when hydrologic influence was over/underestimated.



The above image shows an example of the FSEC map class, exhibiting eastern cottonwood regeneration at a location devoid of riparian influence.

FOSW – Northern (Great Lakes) Flatwoods

The Northern (Great Lakes) Flatwoods (FOSW) map class represents the *Quercus palustris* - *Quercus bicolor* - *Acer rubrum* Flatwoods Forest Association (CEGL005037) in the NVCS. A very rare map class in CUVA, this map class covers just 10.3 ha or 0.08% of the park. Resulting from shallow soils over clay lens, this map class is generally a resident of lower glacial outwash plains and the Lake Erie lake plain, but it can also reside in uplands where clay lenses occur and impound water for extended periods.

Historically, FOSW was likely a relatively more common forest in the area in connection with the lake plain of Lake Erie; however, FOSW is now highly restricted to small disconnected patches. It presents as an oak (*Quercus*) forest in a basin, depression, or other topographic position that clearly retains water or hydric soils nearly year-round. Generally, these are not locations where upland oak species are capable of growing, so having oak species present in this habitat is indicative of FOSW.

The AA results indicate that the FOSW map class was mapped well, but potentially too conservatively. The AA suggest that FOSW is likely to occur in isolated patches in both the Successional Mixed Hardwood Forest (FSMH) and the Cottonwood - Sycamore Floodplain Forest (FFCS) map classes where mappers likely discounted the likelihood of this rare FOSW map class being present in an area >MMU and erred on the side of the more common map classes of FSMH and FFCS.





The above images show two examples of the FOSW map class; the forest in the left image is dominated by pin oak (*Quercus palustris*) next to an acidic wetland on a perched clay lens upland, and the forest the right image is dominated by swamp white oak *(Quercus bicolor*) in a more basic setting along a small stream more representative of the lake plain setting.

FBAS – Red Maple - Black Ash Swamp

The Red Maple - Black Ash Swamp (FBAS) map class represents the *Fraxinus nigra* - *Acer rubrum* / *Rhamnus alnifolia* / *Carex leptalea* Forest Association (CEGL007441) in the NVCS. FBAS was the rarest vegetation type mapped. It is found in only one location at CUVA, and this single location encompassed a polygon of only 0.8 ha, representing only 0.006% of the park.

The FBAS map class occurs in an isolate seep with rich, wet muck soils and has a somewhat sparse canopy dominated by >50% black ash (*Fraxinus nigra*). Red maple (*Acer rubrum*) is present in the wetland. Tall poison sumac (*Toxicodendron vernix*) and alder species (*Alnus* spp.) occur in the shrub layer. The understory is rich and contains a variety of wetland plants indicative of the rich saturated soils.

Mapping of FBAS was limited to the one known location. Neither the original vegetation plots nor the AA located any additional locations, so it is likely that FBAS at CUVA is limited to the single known and mapped location.





The above images provide two examples of the FBAS map class showing the short-statured trees with dense and diverse undergrowth of ferns, herbs, and shrubs.

FFSM – Silver Maple - Elm Forest

The Silver Maple - Elm Forest (FFSM) map class represents the *Acer saccharinum* - *Ulmus americana* Forest Association (CEGL002586) in the NVCS. The FFSM map class was much less common than the ubiquitous Cottonwood-Sycamore Floodplain Forest (FFCS) map class that dominates forested floodplains at CUVA. FFSM was mapped over only 11.4 ha (0.09%) of the park, mostly in small patches of slightly over 1 ha.

The FFSM map class captures floodplain forests dominated by silver maple (*Acer saccharinum*) (>50% relative dominance to other deciduous trees) with eastern cottonwood (*Populus deltoides*), American sycamore (*Platanus occidentalis*), boxelder (*Acer negundo*), black walnut (*Juglans nigra*), and/or willow species (*Salix* spp.) often present, but never dominant.

The AA results reveal a high level of confusion between the FFSM and FFCS map classes, resulting in low accuracy for the FFSM map class; there was no evidence of confusion of FFSM with any other map class. In the case of a choice between FFSM or FFCS, the dominance of silver maple was over/underestimated, because FFSM can contain eastern cottonwood and/or American sycamore and FFCS can contain silver maple—but silver maple may only and must be dominate in the FFSM map class. In theory the FFSM map class should (and sometimes does) present a consistent signature due to the dominant and sometimes even monotypic nature of silver maple. Upon review of the two map classes, mappers hypothesized that early senescence of floodplain tree species and excessive ecological introgression between the two map classes resulted in reduced mapping accuracy. Despite the lower level of confidence in the FFSM map class, staff from CUVA decided to retain the FFSM map class to highlight locations of this rarer floodplain forest.





The above images show two examples of the FFSM map class dominated by silver maple; the areas are frequently inundated.

FFCS – Cottonwood - Sycamore Floodplain Forest

The Cottonwood - Sycamore Floodplain Forest (FFCS) map class represents two floodplain forest associations in the NVCS: the *Platanus occidentalis* - *Juglans nigra* - (*Fraxinus americana*) Forest [Park Special] (CEPS006688) and the *Populus deltoides* - *Salix nigra* Forest (CEGL002018). The FFCS map class is the most common floodplain forest in CUVA and the fourth-most common map class overall, covering 944.8 ha, which is approximately 7.1% of the park.

Representing the most common of natural floodplain forest associations found in CUVA, the FFCS map class comprises a wide variety of vegetation ages, structures, and levels of disturbance all tied together by the dominance of eastern cottonwood (*Populus deltoides*) or American sycamore (*Platanus occidentalis*). Initially, the two associations (CEPS006688 and CEGL002018) were mapped separately in individual map classes based upon the relative dominance of cottonwood to sycamore. However, the analysis process for AA determined that there was an unacceptably high level of confusion between the two map classes and, after consultation with park staff, the AA team concluded that grouping these two similar floodplain forest associations would be the best solution. Upon review of the two map classes, mappers hypothesized that early senescence of floodplain tree species and excessive ecological introgression between the two associations resulted in reduced mapping accuracy.

The analysis for AA also revealed several other points of map class confusion within the FFCS map class. There was significant confusion between FFCS and the two other forested floodplain map classes: the Successional Mixed Hardwood Forest (FFSM) and the Successional Floodplain Hardwood Forest (FSFH). In the case of FFSM, the dominance of silver maple (*Acer saccharinum*) was over/under estimated; FFSM can contain both eastern cottonwood and/or American sycamore, but silver maple must dominate the forest. In the case of FSFH, the level of cottonwood and/or sycamore was over/under estimated; FSFH can have these two tree species, but they cannot dominate the forest. Additionally, on occasion the level of riparian influence was wrongly assessed, and in these cases FFCS was confused with a variety of upland forests.

In general the FFCS map class presents a variety of signatures with the potential for monotypic stands of eastern cottonwood or American sycamore, mixed stands of the two, and much more heterogeneous forests in areas of transition to upland forests or where disturbances has allowed the invasion of other tree species amongst the cottonwood and sycamore. The foremost characteristic of FFCS is its presence in the floodplain. The FFCS map class can occur from the high-velocity edge of the Cuyahoga River bank to the isolated back channels and extended riverine flats found throughout the Cuyahoga Valley.



The above images show various examples of the FFCS map class. From top left clockwise: a classic example of CEGL002018 dominated by a mixture of eastern cottonwood and black willow (*Salix nigra*); a classic and open example of CEPS006688 dominated by large American sycamore; a more heterogeneous FFCS with cottonwood, sycamore, and sparse silver maple sharing the floodplain; a highly heterogeneous FFCS along one of the Cuyahoga River tributaries with cottonwood and sycamore dominating the canopy and some associated black walnut black walnut (*Juglans nigra*), sugar maple, red maple red maple (*Acer rubrum*), and tuliptree (*Liriodendron tulipifera*).

FSFH – Successional Floodplain Hardwood Forest

The Successional Floodplain Hardwood Forest (FSFH) map class represents two floodplain forest associations in the NVCS: the *Liriodendron tulipifera* - *Ulmus* spp. - *Fraxinus pennsylvanica* Forest [Park Special] (CEPS006684) and the *Fraxinus pennsylvanica* - *Ulmus* spp. - *Celtis occidentalis* Forest (CEGL002014). Occurring on the flats along low-gradient streams and in the saturated soils of larger river backwaters, this map class represents a mixture of hardwood trees adapted to seasonal flooding and disturbance.

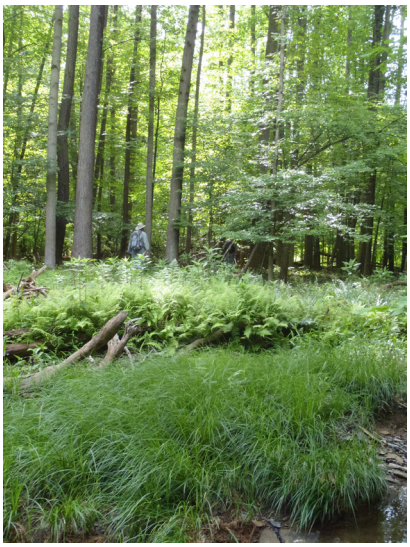
Initially, the two associations (CEGL002014 and CESP006684) were mapped separately in individual map classes based upon the significant difference in site history and understory diversity, but these characteristics proved insufficient to reliably separate the very similar canopies shared by aspects of each association. Strictly speaking, CEGL002014 is not a successional forest, but it is an example of a rich, mixed hardwood floodplain and backwaters forest. However, the signature it presents is consistently confused with that of the much more common CESP006684, which is successional in nature and inhabits similar settings. Additionally, it must be noted that CEGL002014 has a significant range across the central United States, covering a wide range of tree species, but in this portion of the range, ash species (*Fraxinus* spp.) and elm species (*Ulmus* spp.) define the association, and hackberry species (*Celtis* spp.) are absent.

The FSFH map class presents as a hardwood forest occurring in areas influenced by low-velocity riparian flooding, seasonal inundation, or occasional soil saturation such as along small stream corridors, riverine backwaters, and occasionally along the edges of wetlands. Composed of a variety of species, the map class tended to be dominated by tuliptree (*Liriodendron tulipifera*), including a few monoculture stands of tuliptree, with associated ash species and other successional tree species tolerant of saturated soils. Overall, this set of characteristics makes for a common forest at CUVA that covers 299.8 ha (2.3%) of the park.

The AA results for the FSFH map class showed confusion primarily along two different lines. The first line of confusion was with disturbed upland forest, specifically FSMH. In these cases mappers overestimated the hydrologic influence of the site; FSMH was also occasionally confused with FSFH when hydrologic influence was underestimated. The second line of confusion was with other riparian forests, specifically FFCS. In these instances the hydrologic influence was correctly assessed, but the relative dominance of species was not. A significant challenge is posed when determinations are made of the relative dominance of eastern cottonwood (*Populus deltoides*), American sycamore (*Platanus occidentalis*), and/or black walnut (*Juglans nigra*) to that of elm species, ash species, and/or tuliptree due to patterns of senescence, and it is not surprising that these two map classes occasionally cross.



The above image provides an example of the FSFH map class, showing a young-aged CEGL002014, with American elm (*U. americana*) and green ash (*F. pennsylvanica*) co-dominating the canopy.







The above three images further show examples of the FSFH map class, clockwise from top left: an old-successional CEPS006684 with tuliptree perched on a bench above a small stream; a young mixed-hardwood CESP006684 dominated by tuliptree with associated red maple (*Acer rubrum*); and a CESP006684 composed of a mix of green ash and red maple (notably lacking tuliptree) in an old lower wet pasture.

SSDM – Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland

The Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland (SSDM) map class represents the *Elaeagnus umbellata* - *Crataegus* spp. - *Rosa multiflora* Ruderal Shrubland Association (CEGL005207) in the NVCS. The SSDM map class represents a wide variety of successional shrub vegetation, much of it non-native and/or invasive. The SSDM map class is found in upland areas throughout much of CUVA, and it is especially common in old fields and other areas with a history of disturbance. The SSDM map class represents about 2.2% of the park, or 293.3 ha. The average polygon size was just over 1.0 ha, so although the map class is somewhat common, these successional shrub patches are not extensive in size.

The SSDM map class captures ruderal upland shrublands that are dominated (>25% shrub cover) by a variety of shrub species including, but not limited to: autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), hawthorn species (*Crataegus* spp.), blackberry species (*Rubus* spp.), gray dogwood (*Cornus racemosa*), and others. The herbaceous component is typically a mix of weedy graminoids and forbs remaining from the past land uses. Total hardwood tree coverage is <25%.

The AA results show that SSDM was mapped with a high accuracy and little confusion with other types. When confusion of the SSDM class occurred, it was typically with the successional forest map classes of Successional Floodplain Hardwood Forest (FSFH) and Successional Mixed Hardwood Forest (FSMH). The confusion can be explained by an over/underestimation of relative tree and shrub amounts and the fact that successional shrublands were often intergraded with successional forests. It should be noted that the SSDM map class is the target of ongoing management efforts within the park and that areas mapped as SSDM are likely to revert to an herbaceous upland after management.



The above images show examples of the SSDM map class, presenting a diversity of species compositions found within CEGL005207, from top left clockwise: autumn olive dominated; a hawthorn dominated; diversity with autumn olive and multiflora rose; and upland gray dogwood dominated.

SWSM – Mixed Wet Shrubland

The Mixed Wet Shrubland (SWSM) map class represents four shrubland associations in the NVCS:

- *Salix interior* - *Salix eriocephala* Sandbar Shrubland (CEGL005078),
- *Alnus incana* Swamp Shrubland (CEGL002381),
- *Cephalanthus occidentalis* / *Carex* spp. Northern Shrubland (CEGL002190), and
- *Cornus racemosa* - *Salix* spp. - *Baptisia australis* Shrubland (CEGL005206).

Initially, mappers attempted to distinguish between each of these shrubland associations. They expected that, through a combination of topographic location, apparent hydrologic influence, and signature, these four shrubland associations would separate consistently into four map classes. During the analysis process for AA, however, it became apparent that only one association separated consistently and the three other associations crossed widely. Several factors were assumed to contribute to this:

- Insufficient hydrologic information to reliably assess hydrologic regime,
- Inconsistent and comingled signature and early fall senescence of wetland shrubs,
- Insufficient field data to reliably discern between the various wet shrubland types, and
- A vegetation makeup that was more heterogeneous across the landscape than was initially documented.

After consultation with staff at CUVA, the AA team concluded that the most appropriate course of action was to group all of the wet shrubland associations into one map class that consistently represents wet shrublands and allow future field work and mapping efforts to detail the vegetative makeup of each individual occurrence.

A rare component of the vegetation makeup at CUVA, SWSM comprises just over 0.27% of the park area (36.4 ha). Mapped polygons of the SWSM map class are also small, with an average of 0.7 ha, though this is skewed by a few larger polygons and the median is just under 0.5 ha. Although SWSM is primarily constrained to the saturated-to-inundated soils of the floodplain in CUVA, it does occur across the landscape in the park. Small, wet shrublands in isolated seeps were documented throughout the park, though the majority of these fell well below the MMU. Because of this small size and potential isolation, the SWSM map class was mapped at a 0.25 ha MMU.

Overall, SWSM presents as low-to-mid-statured woody vegetation in low, wet areas of the park. The need for >25% shrub cover and <25% tree cover in hydric soils is the primary constraint of the SWSM map class. Areas with shrub or tree cover near 25% posed a significant challenge to mappers and also represented a primary source of confusion for SWSM with both herbaceous and treed map classes. These errors in classification appeared as an apparently random connection with a variety of wet forest and herbaceous map classes during the AA process, because the tree and herbaceous aspects were not assessed when the SWSM map class was provided.






The above images show various aspects of the SWSM map class, from top left clockwise: a sparsely shrubbed and dogwood-dominated CEGL005206; a more open densely shrubbed and diverse CEGL005206; a willow dominated CEGL005206 along the wet margin of a successional agricultural field; and a more successional, lightly treed CEGL005206.






The above images further show more various aspects of the SWSM map class, from top left clockwise: an isolated nearly closed-canopy CEGL002190 that is of an area <MMU and perched in an upland seep surrounded by mature pin oak (*Quercus palustris*); an open CEGL002190 under a power line right-of-way; an alder-dominated CEGL002381; and a very sparsely vegetated and potentially ephemeral CEGL005078 along the Cuyahoga River.

HSFD – Successional Central Dry-Mesic Herbaceous Field

The Successional Central Dry-Mesic Herbaceous Field (HSFD) map class represents the *Daucus carota* - *Leucanthemum vulgare* Semi-natural Herbaceous Vegetation [Park Special] Association (CESP006692) in the NVCS. This map class is one of a pair of map classes that represent the forb-dominated successional fields found in CUVA. The HSFD map class is the drier, more upland-derived map class of the two. The upland position and distance from standing or flowing water is generally what determined the HSFD map class rather than the Successional Central Wet-Mesic Herbaceous Field (HSFW) map class. Both map classes are represented by a wide variety of species that were often heterogeneously mixed and did not present a consistently distinct signature, other than forb dominance.

These sites are also highly variable in that they can accommodate up to 25% shrub and tree dominance and remain an herbaceous field. Additionally, as long as forbs have simple dominance over graminoids, the field remained forbaceous.

Because the HSFD map class accepts such a wide range of vegetation, there was some confusion within the map-class, though less that would generally be expected. The AA results indicate only two sources of confusion. The first source of confusion was that areas mapped as HSFD are wetter than expected and support the vegetation of HSFW. The second source of confusion was that areas mapped with the Successional Grassland Meadow (HSGD) map classes have more forbs than expected and turn out to be HSFD.

Overall, the HSFD occurs frequently across CUVA, covering 302.7 ha. This accounts for 2.3% of the park.





The above images provide two examples of the HSFD map class showing the generally drier upland setting and forb dominance that ties these highly variable sites together.

HSFW – Successional Central Wet-Mesic Herbaceous Field

The Successional Central Wet-Mesic Herbaceous Field (HSFW) map class represents the *Impatiens capensis* - *Solidago* spp. - *Verbesina alternifolia* Semi-natural Herbaceous Vegetation [Park Special] Association (CESP006690) in the NVCS. This map class is one of a pair of map classes that represent the forb-dominated successional fields found in CUVA. The HSFW map class is the wetter, more lowland-associated map class of the two, the other being the Successional Central Dry-Mesic Herbaceous Field (HSFD) map class. The lowland position and proximity to standing or flowing water is generally what determined the HSFW map class rather than the HSFD map class. Both map classes are represented by a wide variety of species that were often heterogeneously mixed and did not present a consistently distinct signature, other than forb dominance.

These sites are also highly variable in that they can accommodate up to 25% shrub and tree dominance and remain an herbaceous field. Additionally, as long as forbs have simple dominance over graminoids, the field remained forbaceous.

Because the HSFW map class accepts such a wide range of vegetation, there was some confusion within the map-class. The AA results indicate two primary sources of confusion along with other smaller, non-systematic errors. The first source of confusion was that areas mapped as HSFD are wetter than expected and support the vegetation of HSFW. The second primary source of confusion was that forb coverage was overestimated in some areas, and these areas turned out to be HSGD. Other errors include underestimating the shrub or tree coverage or underestimating the coverage of a single species, such as reed canarygrass (*Phalaris arundinacea*).

Overall, the HSFW occurs frequently across CUVA, covering 160.7 ha, though this is only half as common as the upland HSFD map class. The HSFW map class accounts for 1.2% of the total area of the park.





The above images provide two examples of the HSFW map class and show the generally wetter setting than in some other classes and the forb dominance that ties these highly variable sites together.

HSGD – Successional Grassland Meadow

The Successional Grassland Meadow (HSGD) map class is composed of two associations in the NVCS: the *Phleum pratense* - (*Calamagrostis canadensis*) Semi-Natural Herbaceous Vegetation (CEGL005249) and the *Schizachyrium scoparium* - *Andropogon gerardii* - *Poa* spp. Semi-natural Herbaceous Vegetation [Park Special] (CEPS006691). Initially, mappers investigated separating these herbaceous vegetation associations into separate map classes, but the prevalence of cool-season grasses in CESP006691 made it impossible to reliably separate the two associations.

The HSGD map class is composed of a wide variety of plants across the full suite of landscapes found in the park. What constrains vegetation to the HSGD map class is <25% cover of woody vegetation and a simple dominance of graminoids over forbs. The HSGD map class is also relatively common in CUVA. It covers 226.9 ha (1.7% of the park), although it does not include managed lawns, which would substantially increase the coverage. The HSGD map class does include many areas formerly managed as open space or as agriculture where past management practices have stopped, but are still clearly visible on the landscape and greatly influence the species composition of the area and successional pathway the area will follow.

Because of this wide definition, it is easy to mistake HSGD as other map classes and for other map classes to occasionally present the same signature as HSGD. A primary source of confusion was with the two map classes where forbs dominate: the Successional Central Dry-Mesic Herbaceous Field (HSFD) map class and the Successional Central Wet-Mesic Herbaceous Field (HSFW) map class. In these instances graminoids coverage was estimated to exceed forb coverage when in reality the opposite was true. A secondary source of confusion was when the species composing the graminoids composition was incorrectly assessed. Generally, this confusion occurred when the dominance of reed canarygrass (*Phalaris arundinacea*) or common reed (*Phragmites australis*) was underestimated, even though this dominance was >80%.

Because of this wide definition, it is easy to mistake HSGD for other map classes and for other map classes to occasionally present the same signature as HSGD. According to AA results, the primary source of confusion was with the two map classes where forbs dominate: the HSFD and the HSFW. In these instances graminoid coverage was estimated to exceed forb coverage, when in reality the opposite was true. A secondary source of confusion was when the species composing the graminoids composition were incorrectly assessed. Generally, this confusion occurred when the dominance of reed canarygrass or common reed was underestimated, even though this dominance was >80%.



The above images show various examples of the HSGD map class, from upper left clockwise: a dryer example of the CEGL005249 dominated by introduced species; a wetter example of the CEGL005249 dominated by introduced species; a very wet example of the CEGL005249 showing a mix of primarily native grasses and some forbs; a dryer mix of restored native warm-season grasses competing with introduced cool-season grasses characteristic of the CESP006691.

HCTM – Midwest Cattail Deep Marsh

The Midwest Cattail Deep Marsh (HCTM) map class represents the *Typha* spp. Midwest Herbaceous Vegetation Association (CEGL002233) in the NVCS. This deep marsh map class occurs on deep muck soils where standing water is present, though during dry years the areas where this map class is found may be completely dry. Vegetative cover ranged from a dense monoculture of cattails to as little as 25% cattail species (*Typha* spp.) cover in standing water with sparse floating leaved and other emergent herbaceous vegetation species. Both broadleaf cattail (*T. latifolia*) and narrowleaf cattail (*T. angustifolia*) may be present as well as the possibility of hybridizing of cattail species. The HCTM map class was found in many wetlands throughout CUVA, most notably a larger patch at Kendall Lake. This map class was applied over 58.4 ha at the park, with an average polygon size of slightly above 1.0 ha. The HCTM map class represents just 0.4% of the park.

Although cattail species can appear as a component in many of the other wetland map classes for CUVA, including the Midwest Emergent Pond mosaic (HMPM), Lake Sedge Wet Meadow (HWSM), Reed Canarygrass Eastern Marsh (HRCG), Eastern Reed Marsh (HCRM), and Successional Central Wet-Mesic Field (HFWM), the HCTM map class should be the only class where cattails predominate (>80% cover) over areas greater than the MMU. If other emergent vegetation was present it typically consisted of bulrush species (*Schoenoplectus* spp.), sessilefruit arrowhead (*Sagittaria rigida*), or common reed (*Phragmites australis*).

The AA results found that areas mapped as HCTM were mapped extremely well, because all AA sites mapped as HCTM also were deemed HCTM by the AA. The AA did, however, reveal a few areas greater than MMU of the HCTM map class that had been labeled as another vegetation type. In these few instances, HCTM was most often confused with another wetland herbaceous type, HCRM, but it was also confused once each with the Mixed Wet Shrubland (SWSM), Successional Central Wet-Mesic Herbaceous Field (HSFW), and HRCG map classes. These misassignments were most likely due to a variety of factors including underestimation by the mapper of the cattail species cover within an area, not mapping areas above the MMU of cattail species, and overestimation of the wetland shrub density of a polygon.





The above images show two examples of the HCTM map class; the left image shows a wetter, more monotypic basin setting, and the right image shows a more drier and diverse setting.

HWSM – Lake Sedge Wet Meadow

The Lake Sedge Wet Meadow (HWSM) map class represents the *Carex lacustris* Herbaceous Vegetation Association (CEGL002256) in the NVCS. This map class captures herbaceous wetland meadows characterized by sedge species (*Carex* spp.) wherein the relative dominance of sedges to other herbaceous vegetation is >50%. At CUVA the HWSM map class was typically associated with wet mineral soils. Hairy sedge (*Carex lacustris*) is the most common sedge specie represented in these meadows in the park, but other wetland sedge species may also be present. Sedge species may be so dense as to almost form a monoculture or be more of a mixed meadow, often with reed canarygrass (*Phalaris arundinacea*) almost co-dominant. The HWSM map class was the rarest herbaceous wetland mapped of the park, with only 5.8 ha mapped in the entire park, representing just 0.04% of the park. The HSWM was mapped in small pockets, with the average polygon size of just 0.6 ha.

The AA results found that HWSM was mapped accurately, but it is potentially underreported as the AA revealed inclusions of HWSM in both the Successional Central Wet Mesic Field (HSFW) and the Successional Grassland Meadow (HSGD). This likely indicates that mappers were erring on the side of caution when applying this rare map class and may have missed inclusions of this type due to paucity of field data and a potentially cryptic signature on the digital aerial imagery that remains unrecognized.





The above images show two different faces of the HWSM map class. The left image shows a more forb rich version of HWSM, and the right image shows a more graminoid and fern dominated version of HWSM.

HRCG – Reed Canarygrass Eastern Marsh

The Reed Canarygrass Eastern Marsh (HRCG) map class represents the *Phalaris arundinacea* Eastern Herbaceous Vegetation Association (CEGL006044) in the NVCS. The HRCG map class was used for wet meadows that were dominated (>80% cover) with reed canarygrass (*Phalaris arundinacea*). These HRCG meadows could include other wetland herbaceous species and trees or shrubs at <25% cover. The HRCG map class covers 128.0 ha, or about 0.96%, of CUVA, making it the second most prevalent wetland herbaceous type in the park after the Successional Central Wet-Mesic Field (HFWM) map class.

The HRCG map class captures nearly monotypic stands of reed canarygrass wherein the relative dominance of reed canarygrass to other herbaceous vegetation is >80%. The HRCG map class was often prolific within floodplain zones that receive regular inundation and was also found in many basin settings. Scattered trees were often present, but they contributed <25% total cover. Likewise, scattered water-tolerant shrubs were often present, but they contributed <25% total cover.

The AA results found that mapping of HRCG was highly accurate from the perspective that areas mapped as HRCG proved to be HRCG, but the AA also found that HRCG was perhaps under-mapped, because areas greater than MMU of HRCG were found in several other vegetation associations during AA. Many of these inclusions were in other wetland herbaceous or shrubland associations, and this suggests that the mapper simply did not discern that there was an area greater than the MMU of HRCG or that a given herbaceous area had the requisite >80% reed canarygrass to make it HRCG. However, several of these misses were found mapped with the Successional Grassland Meadow (HSGD) map class, a class expected to contain upland grasses. This suggests either that there were wetland-patch areas above the MMU of HRCG in these HSGD meadows or that the reed canarygrass was encroaching into upland areas (a common occurrence in lower wet areas of otherwise upland fields) and not being mapped due to a more upland setting.



The above image provides an example of the HRCG map class, showing a fairly monotypic stand of reed canarygrass with some forbs and scattered small shrubs along the margin.

HCRM – Eastern Reed Marsh

The Eastern Reed Marsh (HCRM) map class represents the *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation Association (CEGL004141) in the NVCS. At CUVA, the HCRM was mapped where common reed (*Phragmites australis*) was essentially monotypic (>80% relative dominance to other emergent vegetation). Reed canarygrass (*Phalaris arundinacea*) and cattail (*Typha* spp.), two vegetation species indicative of disturbed wetlands, were commonly found within the HCRM map class, but never in great quantity. The HCRM map class was a relatively common wetland type at the park, covering 36.1 ha or about 0.27% of the park, mostly in patches of slightly less than a hectare.

The AA results show that where HCRM was mapped, it was done with a high level of accuracy, but that HCRM was likely underreported. The AA reports areas greater than the MMU of HCRM in several other wetland vegetation map classes, most notably the Herbaceous Pond Mosaic (HMPM) and the Midwest Cattail Deep Marsh (HCTM). Underreporting of HCRM was most likely either a case of the underestimation by the mapper of reeds dominance in these areas or failure to note that these areas of HCRM exceeded the MMU and should have been mapped separate from HCTM.



The above images provide two examples of the HCRM map class; the left image shows a stand of common reed growing along a power line right-of-way and the right image shows a robust stand of common reed in flower.

HSJK – Japanese Knotweed Gravelbar

The Japanese Knotweed Gravelbar (HSJK) represents the *Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation Association (CEGL008472) in the NVCS. Composed of the highly invasive Japanese knotweed (*Polygonum cuspidatum*), a species that readily colonizes disturbed floodplains and wetlands and that will also invade adjacent uplands, this vegetation association forms large monocultures along the banks of the Cuyahoga River and is a primary management concern for CUVA. Once established, Japanese knotweed readily suppresses the growth of almost all other plants and completely stops natural floodplain succession, which promotes its continued spread.

Covering just 18.5 ha (0.14% of CUVA), the HSJK map class is relatively rare, but also very easy to map. Japanese knotweed exhibits vigorous growth throughout the growing season until killed by a heavy frost, which makes it exceptionally easy to differentiate in CIR digital aerial imagery. This proved true at the park, because monocultures of Japanese knotweed were readily differentiated in the high-velocity portions of the floodplains of the Cuyahoga River, which is the primary location of the ongoing invasion in the park.

The AA results indicate a very high degree of certainty for the mapping of HSJK both in the certainty of areas mapped as HSJK and for the commonness of HSJK across CUVA.



The above image shows the characteristic green wall of the Japanese knotweed along the Cuyahoga River that is so distinctive of the HSJK map class.

HWLY – Water-lily Aquatic Wetland

The Water-lily Aquatic Wetland (HWLY) map class represents the *Nuphar advena - Nymphaea odorata* Herbaceous Vegetation Association (CEGL002386) in the NVCS. The HWLY map class at CUVA represents areas of permanently flooded lakes, ponds, or basins with muck or sandy bottoms and that contain yellow pond-lily (*Nuphar lutea*), watershield (*Brasenia schreberi*), and/or American white waterlily (*Nymphaea odorata*). These rooted floating aquatics may occur in open water or with submersed aquatic species present. This was a rare class at CUVA, representing just 0.05% of the park, occurring over only 7.1 ha, and the average area mapped of HWLY was just over 1.0 ha.

The AA results show HWLY to be mapped with a high level of accuracy from both the producers' and users' standpoint. Therefore the mapping is likely representative of the true extent of HWLY at CUVA.



The above images show four different aspects of the HWLY map class, from top left clockwise: an area predominated by yellow pond-lily with some surrounding submersed aquatics at Kendall Lake; a pond dominated by white waterlily; a small pond dominated by watershield; a pond where yellow pond-lily and white waterlily both abound.

HPWD – Midwest Pondweed Submerged Aquatic Wetland

The Midwest Pondweed Submerged Aquatic Wetland (HPWD) map class represents the *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation Association (CEGL002282) in the NVCS. The HPWD map class at CUVA captures areas that are permanently or semi-permanently flooded wherein submergent vegetation such as pondweed species (*Potamogeton* spp.) and watermilfoil (*Myriophyllum* spp.) contributes >10% cover, with floating-leaved aquatic vegetation contributing <10% cover, and with herbaceous emergent vegetation contributing <10% cover. At the park, the HPWD map class was restricted to the slow moving or still waters of backwater lakes and artificial ponds and was not found on the Cuyahoga River itself. The HPWD map class was relatively rare at the park, covering only 14.6 ha or 0.11% of the park, and was mostly found in small ponds of just less than 1 ha.

The HPWD map class at CUVA was represented by pondweed species, hornwort species (*Ceratophyllum* spp.), waterweed species (*Elodea* spp.), and watermilfoil species in varying combinations or singly. Areas of <MMU of HPWD were likely also captured in the Water Lilly Aquatic Wetland (HWLY) and the Mixed Herbaceous Pond Mosaic (HMPM) map classes.

The AA results show that HPWD was mapped with a high level of accuracy. Only one inclusion of HPWD was found in the HMPM class, and it likely represents the mappers' underestimation of an MMU for HPWD being present.





The above images show two examples of the HPWD map class. The left image shows pondweed species at Kendall Lake, and the right image shows some submersed aquatic vegetation mostly covered with duckweed species (*Lemna* spp.) and algae in a shallow pond.

HMPM – Mixed Herbaceous Pond Mosaic

The Mixed Herbaceous Pond Mosaic (HMPM) map class was created to address the conditions inherent in small, diverse wetlands and wetlands impacted by disturbance. In these wetlands, vegetation associations have not had the time necessary to differentiate into distinct mappable units (considering that the project has an MMU of 0.25 ha for herbaceous wetlands) or, while the vegetation has differentiated into distinct vegetation associations, none of them occur at greater than an MMU, and thus it would be incorrect to classify the wetland as dominated by a single vegetation association. The HMPM map class addresses this by accepting wetlands in which the area is a mix of vegetation associations that share dominance, and all the associations occur in patches below the MMU of 0.25 ha. Locations mapped as the HMPM map class will contain two or more of the following vegetation associations.

- *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233)
- *Schoenoplectus tabernaemontani* - *Typha* spp. - (*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation (CEGL002026)
- *Carex lacustris* Herbaceous Vegetation (CEGL002256)
- *Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation (CEGL006461)
- *Phalaris arundinacea* Eastern Herbaceous Vegetation (CEGL006044)
- *Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation (CEGL004141)
- *Nuphar advena* - *Nymphaea odorata* Herbaceous Vegetation (CEGL002386)
- *Potamogeton* spp. - *Ceratophyllum* spp. Midwest Herbaceous Vegetation (CEGL002282)

The HMPM map class was used very sparingly. There are only 27 occurrences of this map class in CUVA, and they cover just 31.7 ha (0.24% of the park). It is also mapped very consistently. Of the 24 instances surveyed during the AA process, only 4 were found to be mapped incorrectly. In each of these instances, it was determined that another wetland vegetation association was sufficiently dominant within the mapped area to justify labeling the entire area with a single vegetation association. This map class also represents an excellent opportunity for further fine-scale wetland mapping by the park that is beyond the mandate of this vegetation mapping project.



The above images present various aspects of the HMPM map class, all showing the highly variable patchwork mosaic of wetland vegetation associations that ties this map class together.

VRSV – Riverine Gravel Wash

The Riverine Gravel Wash (VRSV) map class represents the Midwest Gravel Wash River Sparse Vegetation Association (CEGL002408) in the NVCS. This is classified as a sparse vegetation type, indicating that it cannot have >10% vegetation cover. Occurring along the larger streams and rivers of CUVA, the VRSV map class is rather common along the waterways in the park, but it rarely occurs at above the MMU of 0.25 ha. Very obvious in appearance, given the landscape position and lack of vegetation, this map class is also exceeding ephemeral in occurrence.

Because of the ephemeral nature of these gravel washes, they should be expected to occur in a dynamic nature along the waterways of CUVA. At the time of mapping, just 16.0 ha of the map class (0.12% of the park) were found above the MMU. Locations will change year-to-year, or even flood-to-flood. For sites that remain stable for even 2 or 3 years, it would be expected that the percent cover of vegetation would quickly exceed the 10% threshold, thus allowing these areas to succeed to another vegetated map classes. One primary concern for this map class is invasion by Japanese knotweed (*Polygonum cuspidatum*). This species is ideally adapted to take advantage of the habitat available on these gravel beds, and this map class should be monitored for Japanese knotweed invasion.

The AA results indicate a very high degree of certainty for the mapping of VRSV both in the certainty of areas mapped as VRSV and for the commonness of VRSV across CUVA. There was one are that was determined to be SWSM; however, given the time between obtaining the digital aerial imagery for the CUVA vegetation mapping project (acquired in October 2010) and the AA field effort, along with the low amount of vegetation needed to move an area away from VRS, it is possible that this incorrectly mapped area was VRSV at the time of mapping and SWSM by the time of AA.





The above images show two examples of the VRSV map class along the Cuyahoga River. Note the rapid revegetation of the gravel bar along with the presence of Japanese knotweed on the river banks in both images.

CORD – Orchard

The Orchard (CORD) map class represents the Fruit - Orchards Subgroup of the Agricultural Vegetation Cultural Class (7) in the NVCS. This map class represents one active orchard within CUVA.

Because the CORD map class is a cultural vegetation map class, it was not assessed for accuracy.

No picture available.

CVYD – Vineyard

The Vineyard (CVYD) map class represents the Vineyard Subgroup of the Agricultural Vegetation Cultural Class (7) in the NVCS. This map class represents one active vineyard within CUVA.

Because the CVYF map class is a cultural vegetation map class, it was not assessed for accuracy.



The above image is of the one vineyard that was mapped with the Vineyard (CVYD) map class.

CBRY – Berry Crop Field

The Berry Crop Field (CBRY) map class represents the Berry-fruit Subgroup of the Agricultural Vegetation Cultural Class (7) in the NVCS. This map class represents one active community supported agriculture berry farm within CUVA.

Because the CBRY map class is a cultural vegetation map class, it was not assessed for accuracy.

No picture available.

CCTF – Christmas Tree Farm

The Christmas Tree Farm (CCTF) map class represents the Other Land in Farms Subgroup of the Agricultural Vegetation Cultural Class (7) in the NVCS. This map class represents one active Christmas tree farm within CUVA.

Because the CCTF map class is a cultural vegetation map class, it was not assessed for accuracy.

No picture available.

CRWC – Cultivated Herbaceous Row Crop

The Cultivated Herbaceous Row Crop (CRWC) map class represents the Row Crop Subformation of the Agricultural Vegetation Cultural Class (7) in the NVCS. This map class represents row crops grown within CUVA, mostly corn/maize. The CCGC map class is scattered around the edges of the park and covers 159.3 ha (1.2% of the park). However, year-to-year CRWC can switch to other cultivated map classes, such as Cultivated Herbaceous Row Crop (CCGC) and Pasture and Hay Field (CPAS), depending on the rotation period of the field.

Because the CRWC map class is a cultural vegetation map class, it was not assessed for accuracy.



The above image shows a corn field as an example of the CRWC map class. At the time of obtaining the digital aerial imagery for the CUVA vegetation mapping project (October 2010), row crops were either much taller than in the image above or already harvested.

CCGC – Cultivated Herbaceous Close Grown Crop

The Cultivated Herbaceous Row Crop (CCGC) map class represents the Close Grown Crop Subformation of the Agricultural Vegetation Cultural Class (7) in the NVCS. This map class represents close-grown crops grown within CUVA, mostly alfalfa and soybeans. The CCGC map class is relatively uncommon in the park, covering only 33.7 ha (0.25% of the park). However, year-to-year CCGC can change to other cultivated map classes, including Cultivated Herbaceous Row Crop (CRWC) and Pasture and Hay Field (CPAS), depending on the rotation period of the field.

Because the CCGC map class is a cultural vegetation map class, it was not assessed for accuracy.

No picture available.

CPAS – Pasture and Hay Field

The Pasture and Hay Field (CPAS) map class represents the Permanent Pasture & Hayland Subformation of the Agricultural Vegetation Cultural Class (7) in the NVCS. This map class represents grass crops either harvested for hay or used for pasturing animals. The CPAS map class is scattered throughout CUVA, covering 118.7 ha (0.89 % of the park). This map class is relatively stable in the park due to the managed horse areas and small-scale agriculture, though it does have the potential to change quickly to the Cultivated Herbaceous Row Crop (CCGC) or Cultivated Herbaceous Row Crop (CRWC) map classes or, after abandonment, to slowly succeed to any of the successional grass or shrub map classes found in the park.

Because the CPAS map class is a cultural vegetation map class, it was not assessed for accuracy.



The above image of a paddock provides an excellent example of the Pasture and Hay Field (CPAS) map class.

CDVO – Developed Area - Open Space

The Developed Area - Open Space (CDVO) map class represents, in part, the Other Urban Build Up Vegetation Subformation of the Developed Vegetation Cultural Class (8) in the NVCS. Four other map classes also represent, in part, the Other Urban Build Up Vegetation Subformation, including: Developed Area - Low Intensity (CDVL), Developed Area - Medium Intensity (CDVM), Developed Area - High Intensity (CDVH), and Barren (CBRN).

The CDVO map class includes areas consisting mostly of vegetation in the form of maintained lawns, but that also have a mixture of some constructed materials. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot, single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion or runoff control, or aesthetic purposes. These areas provide the opportunity to act as critical buffers between public access and natural areas.

The CDVO map class is very common in CUVA and covers 506.3 ha (3.8% of the park). A majority of this cover results from areas managed for outdoor activity such as the golf courses, ski runs, open-air music venues, and numerous paths that wind through the park.

Because the CDVO map class is a cultural vegetation map class, it was not assessed for accuracy.





The above images show two examples of the CDVO map class, including a golf course (image to the left) and a designated picnic area (image to the right).

CDVL – Developed Area - Low Intensity

The Developed Area - Low Intensity (CDVL) map class represents, in part, the Other Urban Build Up Vegetation Subformation of the Developed Vegetation Cultural Class (8) in the NVCS. Four other map classes also represent, in part, the Other Urban Build Up Vegetation Subformation, including: Developed Area - Open Space (CDVO), Developed Area - Medium Intensity (CDVM), Developed Area - High Intensity (CDVH), and Barren (CBRN).

The CDVL class includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20–49% of total cover. These areas most commonly include single-family housing units, smaller roads, some types of parking, and paved pathways. These areas can provide runoff during heavy rain events, but they also provide the opportunity for management owing to the predominance of open vegetated surfaces.

The CDVL map class is very common in CUVA and covers 664.6 ha (5.0% of the park). A majority of this cover results from areas associated with outdoor activity, undeveloped roads, and the numerous single-family residences within the park.

Because the CDVL map class is a cultural vegetation map class, it was not assessed for accuracy.



The above images show two examples of the CDVL map class, including Boston Mills Ski Resort gravel parking (image to the left) and an undeveloped road (image to the right).

CDVM – Developed Area - Medium Intensity

The Developed Area - Medium Intensity (CDVM) map class represents, in part, the Other Urban Build Up Vegetation Subformation of the Developed Vegetation Cultural Class (8) in the NVCS. Four other map classes also represent, in part, the Other Urban Build Up Vegetation Subformation, including: Developed Area - Open Space (CDVO), Developed Area - Low Intensity (CDVL), Developed Area - High Intensity (CDVH), and Barren (CBRN).

The CDVM class includes areas primarily dominated by constructed materials or paved surfaces that still maintain some open vegetated areas. Impervious surfaces account for 50–79% of total cover. These areas most commonly include larger roads and infrastructure, parking lots, newer commercial areas, and light industry. These areas are often key sources of runoff.

The CDVM map class is relatively common in CUVA and covers 219.3 ha (1.65% of the park). A majority of this cover results from the larger two-lane roads throughout the park, commercial areas within the park, some of the more developed residential areas, and larger parking areas.

Because the CDVM map class is a cultural vegetation map class, it was not assessed for accuracy.





The above images show two examples of the CDVM map class, including the headquarters for CUVA (image to the left) and one of the many two-lane winding roads that can be found in the park (image to the right).

CDVH – Developed Area - High Intensity

The Developed Area - High Intensity (CDVH) map class represents, in part, the Other Urban Build Up Vegetation Subformation of the Developed Vegetation Cultural Class (8) in the NVCS. Four other map classes also represent, in part, the Other Urban Build Up Vegetation Subformation, including: Developed Area - Open Space (CDVO), Developed Area - Low Intensity (CDVL), Developed Area - Medium Intensity (CDVM), and Barren (CBRN).

The CDVH map class includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, older commercial zones with extensive parking lots, and heavy industry. Impervious surfaces account for 80–100% of the total cover. These areas are generally key sources of runoff

The CDVH map class is relatively uncommon in the park, but it still covers 88.2 ha (0.66% of the park). A majority of this cover results from the larger parking lots, some industrial areas and intense commercial areas, and portions of the Cuyahoga Valley rail line right-of-way.

Because the CDVH map class is a cultural vegetation map class, it was not assessed for accuracy.



The above images present an example of the CDVH map class, showing the extensive amount of impervious surface associated with parking lots.

CBRN – Barren Land

The Barren (CBRN) map class represents, in part, the Other Urban Build Up Vegetation Subformation of the Developed Vegetation Cultural Class (8) in the NVCS. Four other map classes also represent, in part, the Other Urban Build Up Vegetation Subformation, including: Developed Area - Open Space (CDVO), Developed Area - Low Intensity (CDVL), Developed Area - Medium Intensity (CDVM), and Developed Area - High Intensity (CDVH).

The CBRN map class includes areas of barren land (defined as <10% vegetated and not otherwise developed). The CBRN map class was rare at CUVA, covering only 20.5 ha (0.15% of the park). The CBRN map class was used to define waste rock heaps in the restoration area near Rockside Station and devegetated areas along Hines Hill Road, where a cleanup/restoration was underway when the digital aerial imagery for the CUVA vegetation mapping project was captured in October 2010.

Because the CCGC map class is a cultural vegetation map class, it was not assessed for accuracy.

No picture available.

NSR – Stream & River

The Stream and River (NSR) map class represents, in part, the Open Water (11) class in the NLCD. Two other map classes also represent, in part, the Open Water class in the NLCD: Open Water Lake (NWL) and Open Water Pond (NWP). The NSR map class captures open-water streams and rivers. Wetland vegetation—aquatic and/or emergent—may be present (usually in shallow waters close to shorelines), but it should contribute <10% cover; however, small areas (below the size of an MMU) of wetland vegetation having >10% cover—including herbaceous vegetation, shrubs, and trees—may be present. These small vegetation areas would be captured as inclusions of NSR. When they are distinct from the immediate surroundings, wetland vegetation types occurring in areas less than the size of the standard MMU were mapped. Open rivers and streams are examples of such an environment.

The NSR map class was used throughout CUVA. Streams that were too narrow to map were mapped as inclusions of the map classes used for the surrounding lands. The rivers and streams mapped as the NSR map class include the following: Yellow Creek, Furnace Run, Brandywine Creek, Chippewa Creek, Tinkers Creek, and the Cuyahoga River.

Because of the central position of the Cuyahoga River in CUVA, the NSR map class is relatively common; covering 193.8 ha, this map class accounts for a little over 1.46% of the park.

Because the NSR map class is a cultural vegetation map class, it was not assessed for accuracy.





The above images show two examples of the NSR map class. The image to the left shows Furnace Run, and the image to the right shows the Cuyahoga River.

NWL – Open Water Lake

The Open Water Lake (NWL) map class represents, in part, the Open Water (11) class in the NLCD. Two other map classes also represent, in part, the Open Water class in the NLCD: Stream and River (NSR) and Open Water Pond (NWP). The NWL map class captures open water lakes that are >8 ha in area and have <10% cover of wetland vegetation present. Open water ponds that were <8 ha were mapped as the Open Water Pond (NWP) map class. Open water lakes are deep, such that vegetation is unable to take root. Wetland vegetation—aquatic and/or emergent—may be present (usually in shallow waters close to shorelines), but it should contribute <10% cover; however, small areas (below the size of an MMU) of wetland vegetation having >10% cover—including herbaceous vegetation, shrubs, and trees—may be present. These small vegetation areas would be mapped as inclusions of NWL. When they are distinct from the immediate surroundings, wetland vegetation types occurring in areas less than the size of the standard MMU were mapped. The shores of open water lakes are an example of such an environment.

Because the NWL map class requires such a low vegetation cover in combination with a large area of deep, open water, only one water body in the park was classified as NWL: Litchfield Lake. This lake covers 8.6 ha and accounts for just 0.07% of CUVA.

Because the NWL map class is a cultural vegetation map class, it was not assessed for accuracy.

No picture available.

NWP – Open Water Pond

The Open Water Pond (NWP) map class represents, in part, the Open Water (11) class in the NLCD. Two other map classes also represent, in part, the Open Water class in the NLCD: Open Water Lake (NWL) and Stream and River (NSR). The NWP map class captures open water ponds that are <8 ha in area and have <10% cover of wetland vegetation present. Open water lakes that were >8 ha were mapped as the Open Water Lake (NWL) map class. Open water ponds are usually deep enough such that vegetation is unable to take root. Wetland vegetation—aquatic and/or emergent—may be present (usually in shallow waters close to shorelines), but it should contribute <10% cover; however, small areas (below the size of an MMU) of wetland vegetation having >10% cover—including herbaceous vegetation, shrubs, and trees—may be present. These small vegetation areas would be mapped as inclusions of NWP. When they are distinct from the immediate surroundings, wetland vegetation types occurring in areas less than the size of the standard MMU were mapped. Open water ponds are an example of such an environment. The NWP map class was used throughout CUVA.

Usually, shallow ponds within CUVA were the result of manmade impoundments and generally hosted significant amounts of vegetation, unless they were managed to maintain open water. Some aquatic vegetation had senesced before the digital aerial imagery for the CUVA vegetation mapping project was collected (October 2010); therefore, the capacity to detect it via photography was limited. This posed a problem for mapping the Water-lily Aquatic Wetland (HWLY) and Midwest Pondweed Submerged Aquatic Wetland (HPWD) map classes. Thus, the approach to mapping most shallow ponds appearing as open water on the aerial imagery was to assign such units to the HWLY or HPWD map class if there was any evidence of vegetative cover. This was an aggressive effort to map aquatic vegetation based on likely locations.

Although the NWP map class is uncommon, examples of it are scattered throughout CUVA and cover 35.3 ha, or approximately 0.27% of the park.

Because the NWP map class is a cultural vegetation map class, it was not assessed for accuracy.



The above image shows a classic example of the NWP map class, a pond with deep, open water surrounded by a ring of mixed wetland vegetation.

Table F-3. Map classification listing, sorted alphabetically by map-class code, used for the Cuyahoga National Park (Ohio) vegetation mapping project.

Map-class Code	Map-class Name
CBRN	Barren Land
CBRY	Berry Crop Field
CCGC	Cultivated Herbaceous Close Grown Crop
CCTF	Christmas Tree Farm
CDVH	Developed Area - High Intensity (>80% impervious surface)
CDVL	Developed Area - Low Intensity (20–49% impervious surface)
CDVM	Developed Area - Medium Intensity (50–79% impervious surface)
CDVO	Developed Area - Open Space (<20% impervious surface)
CORD	Orchard
CPAS	Pasture and Hay Field
CRWC	Cultivated Herbaceous Row Crop
CVYD	Vineyard
FBAS	Red Maple - Black Ash Swamp
FBMG	Beech - Maple Glaciated Forest
FBOB	Black Oak - White Oak / Blueberry Forest
FCOS	Sugar Maple - Chinkapin Oak Forest
FDMO	Dry-Mesic Oak Forest
FFCS	Cottonwood - Sycamore Floodplain Forest
FFSM	Silver Maple - Elm Forest
FHBM	East-Central Hemlock - Hardwood Forest
FHMO	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)
FOSW	Northern (Great Lakes) Flatwoods
FSBL	Successional Black Locust Forest
FSCP	Successional Conifer Plantation Forest
FSEC	Successional Cottonwood Forest
FSFH	Successional Floodplain Hardwood Forest
FSMH	Successional Mixed Hardwood Forest
HCRM	Eastern Reed Marsh
HCTM	Midwest Cattail Deep Marsh
HMPM	Mixed Herbaceous Pond Mosaic
HPWD	Midwest Pondweed Submerged Aquatic Wetland
HRCG	Reed Canarygrass Eastern Marsh
HSFD	Successional Central Dry-Mesic Herbaceous Field
HSFW	Successional Central Wet-Mesic Herbaceous Field
HSGD	Successional Grassland Meadow
HSJK	Japanese Knotweed Gravelbar
HWLY	Water-lily Aquatic Wetland
HWSM	Lake Sedge Wet Meadow
NSR	Stream & River
NWL	Open Water Lake
NWP	Open Water Pond
SSDM	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland
SWSM	Mixed Wet Shrubland
VRSV	Riverine Gravel Wash

Appendix G: Accuracy Assessment Form

NATIONAL PARK VEGETATION MAPPING PROGRAM: ACCURACY ASSESSMENT POINT FORM

IDENTIFIERS/LOCATORS

Field Point Code _CUVA_____ Database Point Code_____

State _OH__ Park Name _Cuyahoga Valley NP_____ Park Site Name _____

Primary Veg Assoc Name _____

Secondary Veg Assoc Name _____

Classification Comments (including size and shape of area assessed if not a circle around point. Note ease of keying the site.):

Field UTM X___ ___ ___ ___ ___ ___ mE Field UTM Y___ ___ ___ ___ ___ ___ ___mN

GPS Error _____m UTM Zone _17_ Datum _NAD83_

Camera _____ Number of Images _____ Time of First Photo _____

Survey Date _____2012 Surveyors_____

ENVIRONMENTAL DESCRIPTION

Slope _____ Aspect_____

Topographic Position

Environmental Comments (including hydrology):

Unvegetated Surface: *(please use the cover scale below)*
___ Bedrock
___ Litter, duff
___ Wood (> 1 cm)
___ Large rocks (cobbles, boulders > 10 cm)
___ Small rocks (gravel, 0.2-10 cm)
___ Sand (0.1-2 mm)
___ Bare soil
___ Plant Stems
___ Water
___ Other:_____

	Unvegetated Surface Cover Scale
	P 5%
	01 10%
	02 20%
	03 30%
	04 40%
	05 50%
	06 60%
	07 70%
	08 80%
	09 90%
	10 100%

CUVA.

VEGETATION DESCRIPTION

Stratum	Height	Cover Class	Dominant species	Cover Class
T1 Emergent	_____	_____	_____	
T2 Canopy	_____	_____	_____	
T3 Sub-canopy	_____	_____	_____	
S1 Tall shrub	_____	_____	_____	
S2 Short Shrub	_____	_____	_____	
S3 Dwarf-shrub	_____	_____	_____	
H Herbaceous	_____	_____	_____	
N Non-vascular	_____	_____	_____	
A1 Floating-leaved	_____	_____	_____	
A2 Submergent	_____	_____	_____	

Comments

Cover Scale: Strata and Species

P	5%
01	10%
02	20%
03	30%
04	40%
05	50%
06	60%
07	70%
08	80%
09	90%
10	100%

Height Scale: Strata

01	<0.5 m
02	0.5-1 m
03	1-2 m
04	2-5 m
05	5-10 m
06	10-15 m
07	15-20 m
08	20-35 m
09	35-50 m

Appendix H: Accuracy Assessment Contingency Table

Explanation of the Contingency Table

The accuracy assessment contingency table (or matrix) for the Cuyahoga Valley National Park vegetation map layer is an array of numbers set out in rows and columns to compare results of vegetation types represented on the map layer to vegetation types as verified on the ground. Map-class codes for this project are used in the matrix to identify vegetation types for ease of comparison during the analysis and are listed at the side of each row and the top of each column. A condensed crosswalk between the map classes and codes to the vegetation types is provided within this appendix. The crosswalk shows the various vegetation types assigned to the map-class codes that are used to label vegetation types in this contingency table. For a comprehensive crosswalk between map classes and vegetation types, refer to the main report section or Appendix F: Descriptions of Map Classes.

The columns represent vegetation types in the National Vegetation Classification Standard (NVCS), Version 2 (FGDC 2008). These columns tabulate the producer's accuracy by showing errors of exclusion (omission errors) present in the map. The rows represent the map classes listed by their respective map-class codes. These rows tabulate the users' accuracy by showing errors of inclusion (commission errors) present in the map. (Again, refer to the crosswalk for map class-names and links to vegetation types.) Following the contingency table is a table showing the calculations for the kappa index, which provides for an adjustment for chance agreements.

The following contingency matrix is formatted to a letter-size page (8.5" x 11") in landscape orientation.

National Park Service Vegetation Inventory Program
Cuyahoga Valley National Park

		FIELD SAMPLES - REFERENCE DATA																													COMISSION			
	MAP CODES	FHMO	FBOB	FDMO	FCOS	FBMG	FHBM	FSCP	FSBL	FSMH	FSEC	FOSW	FBAS	FFSM	FFCS	FSFH	SSDM	SWSM	HSFD	HSFW	HSGD	HCTM	HWSM	HRCG	HCRM	HSJK	HWLY	HPWD	HMPM	VRSV	TOTAL	USERS' ACCUR-ACY	90% Confidence Intervals	
																																	-	+
MAP DATA - PREDICTION DATA	FHMO	2																													2	100%	75%	125%
	FBOB		3																												3	100%	83%	117%
	FDMO			23		5		2		1																					31	74%	60%	89%
	FCOS			1	3	1																									5	60%	14%	106%
	FBMG					26	1			3					1	1															32	81%	68%	94%
	FHBM	1					14																								15	93%	79%	107%
	FSCP							60																							60	100%	99%	101%
	FSBL					1			2	1					1																5	40%	-6%	86%
	FSMH			2		5				47	2				1	4															61	77%	67%	87%
	FSEC									3	14				2	1															20	70%	51%	89%
	FOSW									2		2			2																6	33%	-7%	73%
	FBAS												3																		3	100%	83%	117%
	FFSM													5	2																7	71%	36%	107%
	FFCS									3	1			5	50	4				1											64	78%	69%	87%
	FSFH					2				4	1				6	33															46	72%	60%	84%
	SSDM									1						2	27			1											31	87%	76%	99%
	SWSM									1					1		1	17		3		1			1				1	1	27	63%	46%	80%
	HSFD																		24		5										29	83%	69%	96%
	HSFW																		6	22	3	1									32	69%	54%	84%
	HSGD																			1	28			1							30	93%	84%	102%
	HCTM																					30									30	100%	98%	102%
	HWSM																			1	1		2								4	50%	-4%	104%
	HRCG																	1		2	5	1		20					1		30	67%	51%	82%
	HCRM																	1			1	3			13				2		20	65%	45%	85%
	HSJK																									11					11	100%	95%	105%
	HWLY																										4				4	100%	88%	113%
	HPWD																											6			6	100%	92%	108%
	HMPM																											1	20		21	95%	85%	105%
	VRSV																													8	8	100%	94%	106%
OMISSION	TOTAL	3	3	26	3	40	15	62	2	66	18	2	3	10	66	45	28	19	30	31	43	36	2	21	14	11	4	7	24	9	643	Total Samples		
	PRODUCERS' ACCURACY	67%	100%	88%	100%	65%	93%	97%	100%	71%	78%	100%	100%	50%	76%	73%	96%	89%	80%	71%	65%	83%	100%	95%	93%	100%	100%	86%	83%	89%	643			
	90% Confidence Interval -	5%	83%	76%	83%	51%	79%	92%	75%	61%	59%	75%	83%	19%	66%	61%	89%	75%	66%	56%	52%	72%	75%	85%	78%	95%	88%	57%	69%	66%	Total Samples Correct			
	90% Confidence Interval +	128%	117%	101%	117%	79%	107%	101%	125%	81%	97%	125%	117%	81%	85%	85%	104%	104%	94%	86%	78%	95%	125%	105%	108%	105%	113%	115%	98%	112%	519			
		OVERALL ACCURACY = 80.7% KAPPA INDEX = 79.5% KAPPA INDEX LOWER 90% CONFIDENCE LEVEL = 76.8% KAPPA INDEX UPPER CONFIDENCE LEVEL = 82.2%																																

Code	P(row 1)	P(col i)	P(chance i)
FHMO	0.003110	0.004666	0.000015
FBOB	0.004666	0.004666	0.000022
FDMO	0.048212	0.040435	0.001949
FCOS	0.007776	0.004666	0.000036
FBMG	0.049767	0.062208	0.003096
FHBM	0.023328	0.023328	0.000544
FSCP	0.093313	0.096423	0.008997
FSBL	0.007776	0.003110	0.000024
FSMH	0.094868	0.102644	0.009738
FSEC	0.031104	0.027994	0.000871
FOSW	0.009331	0.003110	0.000029
FBAS	0.004666	0.004666	0.000022
FFSM	0.010886	0.015552	0.000169
FFCS	0.099533	0.102644	0.010216
FSFH	0.071540	0.069984	0.005007
SSDM	0.048212	0.043546	0.002099
SWSM	0.041991	0.029549	0.001241
HSFD	0.045101	0.046656	0.002104
HSFW	0.049767	0.048212	0.002399
HSGD	0.046656	0.066874	0.003120
HCTM	0.046656	0.055988	0.002612
HWSM	0.006221	0.003110	0.000019
HRCG	0.046656	0.032659	0.001524
HCRM	0.031104	0.021773	0.000677
HSJK	0.017107	0.017107	0.000293
HWLY	0.006221	0.006221	0.000039
HPWD	0.009331	0.010886	0.000102
HMPM	0.032659	0.037325	0.001219
VRSV	0.012442	0.013997	0.000174
P(chance)	Total	1	0.058184

P(correct)	0.807154
P(chance)	0.058184

Kappa	0.795240
90%CI -	0.768285
90%CI+	0.822196

Code	Map-class Name	NVCS Codes
FHMO	Central Appalachian Acidic Cove Forest (White Pine - Hemlock - Mixed Hardwoods Type)	CEGL006304
FBOB	Black Oak - White Oak / Blueberry Forest	CEGL005030
FDMO	Dry-mesic Oak Forest	CEGL002068, CEGL002076
FCOS	Sugar Maple - Chinkapin Oak Forest	CEGL005010
FBMG	Beech - Maple Glaciated Forest	CEGL005013
FHBM	East-central Hemlock - Hardwood Forest	CEGL005043
FSCP	Successional Conifer Plantation Forest	CEGL007167, CEGL006408, CEGL007177, CEGL007178, CEGL006686, CEGL004730, CEGL005208
FSBL	Successional Black Locust Forest	CEGL007279
FSMH	Successional Mixed hardwood Forest	CEPS006687, CEPS006693
FSEC	Successional Cottonwood Forest	CEPS006689
FOSW	Northern (Great Lakes) Flatwoods	CEGL005037
FBAS	Red Maple - Black Ash Swamp	CEGL007441
FFSM	Silver Maple - Elm Forest	CEGL002586
FFCS	Cottonwood - Sycamore Floodplain Forest	CEPS006688, CEGL002018
FSFH	Successional Floodplain Hardwood Forest	CEPS006684, CEGL002014
SSDM	Successional Autumn Olive - Hawthorn - Multiflora Rose Shrubland	CEGL005207
SWSM	Mixed Wet Shrubland	CEGL005078, CEGL002381, CEGL002190, CEGL005206
HSFD	Successional Central Dry-Mesic Herbaceous Field	CEPS006692
HSFW	Successional Central Wet-Mesic Herbaceous Field	CEPS006690
HSGD	Successional Grassland Meadow	CEGL005249, CEPS006691
HCTM	Midwest Cattail Deep Marsh	CEGL002233
HWSM	Lake Sedge Wet Meadow	CEGL002256
HRCG	Reed Canarygrass Eastern Marsh	CEGL006044
HCRM	Eastern Reed Marsh	CEGL004141
HSJK	Japanese Knotweed Gravelbar	CEGL008472
HWLY	Water-lily Aquatic Wetland	CEGL002386
HPWD	Midwest Pondweed Submerged Aquatic Wetland	CEGL002282
HMPM	Mixed Herbaceous Pond Mosaic	CEGL002233, CEGL002026, CEGL002256, CEGL006461, CEGL006044, CEGL004141, CEGL002386, CEGL002282
VRSV	Riverine Gravel Wash	CEGL002408

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