National Park Service
U.S. Department of the Interior

Northeast Region
Philadelphia, Pennsylvania

Vegetation Classification and Mapping at Upper Delaware Scenic and Recreational River

Technical Report NPS/NER/NRTR—2008/133



ON THE COVER
Riverside Rock Outcrop at Skinner's Falls in the Upper Delaware Scenic and Recreational River.
Photograph by: Stephanie Perles.

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Technical Report NPS/NER/NRTR—2008/133

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U.S. Department of the Interior
National Park Service
Northeast Region
Philadelphia, Pennsylvania

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Executive Summary

Vegetation classification and mapping was conducted at Upper Delaware Scenic and Recreational River, creating a current digital geospatial vegetation database for the park. Fifty vegetation associations and 14 Anderson Level II land use categories that occur within the park were identified and described in detail. Two communities found within the park, Sparsely Vegetated Cliff and Southern New England Bog, could not be mapped but are included in the descriptions. Many of the vegetation types are strongly influenced by the varied environmental settings and land use history of the park. A map showing the locations of 48 vegetation associations in the park was created following the USGS/NPS Vegetation Mapping Program protocols (TNC and ESRI 1994a, b, and c). All 50 vegetation associations were crosswalked to the National Vegetation Classification System in order to provide a regional and global context for the park's vegetation. A dichotomous field key was also developed for the 50 vegetation associations to assist with field recognition and classification. This project documents the vegetation associations and Anderson Level II land classifications of the Upper Delaware Scenic and Recreational River based on 2004 aerial photography and 2005–2007 field sampling, and completes one of 12 basic inventory data sets for the park.

The most abundant association in Upper Delaware Scenic and Recreational River is Hemlock - Beech - Oak Forest, covering approximately one-fifth (19.70%, 4,385.2 ha [10,836 ac]) of the park area. Several oak-dominated types a0.re in high abundance, such as Northeastern Dry Oak - Hickory Forest (12.5%), Lower New England Slope Chestnut Oak Forest (12.2%), and Dry, Rich Oak - Hickory Forest (4.6%), which collectively cover nearly a third of the park (29.2%, 6,507.7 ha [16,080.8 ac]). Another major class of forested vegetation types in the park contains several associations dominated by northern hardwoods, in whole or in part, including Central Appalachian Northern Hardwood Forest (5.1%), Hemlock - Northern Hardwood Forest (5.1%), and Semi-rich Northern Hardwood Forest (4.2%), which collectively cover about 14.4% (3,200.3 ha [7,908.1 ac]) of the park.

Several successional forest types also occur in the park, including Northeastern Modified Successional Forest, Northeastern Oak - Red Maple Successional Forest, and Red Maple - Sweet Birch Hardwood Forest, which collectively account for about 6.0 % (1,330.4 ha [3287.5 ac]) of the mapped park area. In addition, two conifer plantation associations, Larch Plantation and Mixed Pine Conifer Plantation, occur within the park, accounting for 0.4% (83.4 ha [206.1 ac]) of the park area.

The vegetation mapping includes another seven terrestrial forest and woodland types that have few occurrences and/or limited total area, including Hickory - Eastern Redcedar Rocky Woodland, Inland Pitch Pine - Oak Forest, Pitch Pine Rocky Summit, Red Oak - Heath Woodland / Rocky Summit, Ridgetop Scrub Oak Barrens, Sugar Maple - Ash - Basswood Northern Rich Mesic Forest, and White Pine - Oak Forest. These seven associations collectively account for 2.9% (639.3 ha [1579.7 ac]) of the park. An additional community found within the park, Sparsely Vegetated Cliff, could not be mapped because it is located on vertical cliff faces and therefore is not distinguishable on aerial photography.

The park contains three successional non-forested associations. Northeastern Old Field and Northeastern Successional Shrubland account for 0.8% (168.8 ha [417.1 ac]) of the area mapped within the park, and are associated with former agricultural land and represent relatively recent abandonment. The third successional type, Little Bluestem Old Field, occurrs in areas with evidence of past disturbance (non-agricultural).

The park also includes two non-forested vegetation types, Central Appalachian Blueberry Shrubland and Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening, associated with dry ridgetops and outcrops. These two associations tend to occur in patches less than 1 ha (2.47 ac) in size.

The vegetation mapping includes nine non-riparian wetland associations, three forested, three shrubland, and three herbaceous, with a collective area of only 80.5 ha (198.9 ac [0.4% of park]) within the park boundary. One forested wetland type (Swamp Forest - Bog Complex (Spruce Type)) and one herbaceous wetland type (Eastern Reed Marsh) each have a single occurrence within the mapped project area, but outside of the park boundary. The two forested wetland types within the park boundary are Hemlock - Hardwood Swamp and Southern New England Red Maple Seepage Swamp. The three non-riparian shrubland wetland types include Highbush Blueberry Bog Thicket, Speckled Alder Swamp, and Steeplebush / Reed Canarygrass Successional Wet Meadow. The two non-riparian herbaceous wetland types within the park boundary are Eastern Cattail Marsh and Mixed Forb Marsh. Another non-riparian wetland type found within the park is Southern New England Bog. This association is found as inclusions smaller than the minimum mapping unit within Highbush Blueberry Bog Thickets, and could not be mapped.

There are 14 riparian vegetation associations, five forested, two shrubland, and seven herbaceous, in the Upper Delaware Scenic and Recreational River collectively covering approximately 2.9% (642.05 ha [1,586.5 ac]) of the park. The five forested riparian associations include: Sugar Maple Floodplain Forest, Bitternut Hickory Lowland Forest, Silver Maple Floodplain Forest, Sycamore - Mixed Hardwood Floodplain Forest, and River Birch Low Floodplain Forest.

The two shrubland riparian vegetation types are Birch - Willow Riverbank Shrubland and Willow River-Bar Shrubland. The seven herbaceous riparian vegetation associations include Water-willow Rocky Bar and Shore, Northeastern Temperate Cobble Scour Rivershore, Hairy-fruit Sedge Wetland, Reed Canarygrass Eastern Marsh, Riverside Prairie Grassland, Northern Riverside Rock Outcrop, and Japanese Knotweed Gravelbar. The remaining riparian herbaceous vegetation type is Japanese Knotweed Gravelbar, which was mapped on 61.3 ha (151.5 ac [0.3%]) within the park.

Fourteen Anderson Level II categories were assigned to polygons that represented non-vegetation associations within the park, such as roads and agricultural areas. In total, Anderson Level II categories account for 5,026.92 ha (12,421.7 ac) mapped within the park.

Keywords: vegetation association, vegetation classification, vegetation mapping, Upper Delaware Scenic and Recreational River.

Introduction

General Background

One of the goals of the National Park Service's Inventory and Monitoring Program is to provide the information and expertise needed by park managers for effective, long-term management of the natural resources held in trust (NPS 2003). The program recommends that 12 basic natural resource inventories be developed for each park that contains significant natural resources. These inventories provide crucial baseline information needed for proper park natural and cultural resource stewardship. A map of each park's vegetation based on aerial photography less than five years old is one of the 12 inventories recommended by the program (NPS 2003). To ensure that vegetation mapping is standardized across the National Park Service (NPS), The Nature Conservancy (TNC), in conjunction with NatureServe, the Federal Geographic Data Committee (FGDC), and the Ecological Society of America Vegetation Subcommittee, developed a protocol for creating vegetation maps in national parks. This protocol was adopted by the United States Geological Survey (USGS)/NPS Vegetation Mapping Program as the standard (TNC and ESRI 1994a,b, and c) and has been implemented at Upper Delaware Scenic and Recreational River by the Pennsylvania Natural Heritage Program.

The goal of the mapping effort at Upper Delaware Scenic and Recreational River was to produce an up-to-date digital geospatial vegetation database for the park and to provide a plant species list, a dichotomous key for vegetation associations, and descriptions of the vegetation associations in the park. Baseline information on plant community composition and rarity is critical to developing desired conditions and park management goals relating to native plant communities, nonnative plant and insect species, and effects of deer browse and other disturbances. The identification and description of plant communities also provide habitat information important to understanding associated organisms, including animals, protozoans, bacteria, and fungi. A map of vegetation communities may allow inferences about the location and abundance of species that are characteristic of each community.

This report also describes the park's vegetation in the context of a national and regional vegetation classification. The Nature Conservancy (TNC), in conjunction with NatureServe, the Federal Geographic Data Committee, and the Ecological Society of America Vegetation Subcommittee, developed the United States National Vegetation Classification system (USNVC) in order to standardize vegetation classification and facilitate the comparison of vegetation types throughout the United States and internationally. The USNVC is a systematic approach to classifying existing natural vegetation using physiognomics and floristics. This classification system has a hierarchical structure (Grossman et al. 1998).

The basic unit of vegetation classification in the USNVC is the association. An association is defined as a plant community type that is relatively homogeneous in composition and structure and occurs in a uniform habitat. For example, Central Appalachian Hemlock - Northern Hardwood Forest is a common forest type on slopes and ravines in the northeastern United States. Associations are also assigned global rarity ranks that indicate their conservation status and relative risk of extirpation (Grossman et al. 1998). Associations from the USNVC are often equivalent to communities in state-specific vegetation classifications such as the Terrestrial and

Palustrine Plant Communities of Pennsylvania (Fike 1999). Therefore, USNVC associations can be crosswalked with communities in these state classifications.

Several associations that share one or more dominant or characteristic species can be grouped to form an alliance. Alliances are generally more wide-ranging geographically than associations, covering multiple habitats and broader species composition. For example, the Central Appalachian Hemlock - Northern Hardwood Forest association mentioned previously is grouped with other similar hemlock-dominated forest associations into the Eastern Hemlock - Yellow Birch Forest alliance. An association with unique species composition or environmental niche can be assigned to its own alliance, such that the alliance only contains one association instead of multiple associations.

One level above alliance is the formation, representing vegetation types that share a common physiognomy within broadly defined environmental factors (Grossman et al. 1998). For example, Mixed Needle-leaved Evergreen - Cold-deciduous Forest is a common formation that encompasses numerous mixed forest types in the northeastern and midwestern United States, including the Eastern Hemlock - Yellow Birch Forest alliance mentioned above.

Park-specific Information

The Upper Delaware Scenic and Recreational River was designated as part of the National Wild and Scenic Rivers System on November 10, 1978 to acknowledge the outstanding natural and cultural resources of the valley. The Delaware River is the longest free-flowing river in the eastern United States, and whose watershed provides water for over 17 million people. The park stretches along 118 km (73.4 mi) of the river and encompasses the watershed lands immediately adjacent to the river, up to the first ridgetops. Of the approximately 22,250 ha (55,000 ac) of land within the designated park boundary, only 12 ha (30 ac) are in federal ownership. Thus, the Upper Delaware Scenic and Recreational River is a partnership of individuals, private landowners, and local, state, and federal governments working to protect the river, its environment, and the communities in the valley (NPS 2006).

Of the nearly 500,000 people who visit the Delaware River Valley each year, the majority are visitors to the river, participating in canoeing, kayaking, rafting, tubing, fishing, and eagle watching. The Upper Delaware Scenic and Recreational River also includes portions of the historic Delaware and Hudson Canal and the Delaware Aqueduct, both designated as a National Civil Engineering Landmark in 1968. The Delaware and Hudson Canal was constructed from 1825 to 1829 to transport anthracite coal to the Hudson River. The first canal built as a private enterprise, it operated until 1898, when the Erie Railroad provided a cheaper and more reliable means of transport. The Delaware Aqueduct is the nation's oldest existing wire suspension bridge, designed by John A. Roebling, future engineer of the Brooklyn Bridge. The Zane Grey Museum, one-time home of the prolific western author, is also located in the park (NPS 2006).

The most current digital version of the park's boundary was obtained from the park's GIS specialist in April 2005. All maps in this report used this shapefile to depict the park's boundary.

Project Area

Location and Regional Setting

The Upper Delaware Scenic and Recreational River is located on the Pennsylvania - New York border, and includes the river segment stretching from the confluence of the east and west river branches in Hancock, NY to Railroad Bridge No.2 near Mill Rift, PA. Portions of the park fall within Pike and Wayne counties in Pennsylvania, and Orange, Sullivan, and Delaware counties in New York (Figure 1). The park spans twelve 1:24,000 USGS topographic quad maps, including Hancock, Fishs Eddy, Lake Como, Long Eddy, Callicoon, Damascus, Narrowsburg, Eldred (NY), Rowland, Shohola, Pond Eddy, and Port Jervis North (Figure 2).

The Upper Delaware River lies entirely within the Glaciated Low Plateau Section of the Appalachian Plateau Province. The Glaciated Low Plateau Section drains to the Susquehanna River Basin to the west and the Delaware River Basin in the east (Schultz 1999).

The predominant natural vegetation in the environs of Upper Delaware Scenic and Recreational River is Appalachian Oak Forest in Pike County, PA, and Northern Hardwood Forest in Wayne County, PA. The Appalachian Oak Forest is typically dominated by white oak (*Quercus alba*) and northern red oak (*Quercus rubra*), with sugar maple (*Acer saccharum*), sweet birch (*Betula lenta*), bitternut hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), and tuliptree (*Liriodendron tulipifera*) as associates. The Northern Hardwood Forest is typically dominated by sugar maple, American beech, sweet birch, yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), and black cherry (*Prunus serotina*) (Cuff et al. 1989). Braun (1950) classified this region as the Allegheny Section of the Northern Appalachian Highland Division of the Hemlock - White Pine - Northern Hardwoods Region.

Park Environmental Attributes

Many environmental factors, such as geology, topography, soils, and hydrology, influence the types and distribution of vegetation within the Upper Delaware Scenic and Recreational River.

The geology of the Upper Delaware Scenic and Recreational River is characterized by bedrock of Upper Devonian Age (360–376 million years old [Schultz 1999]). The geology of this region has been understudied and detailed geological maps are lacking for the much of the Pennsylvania portion of the study area (available paper and digital maps show the study area as Devonian age rock, undifferentiated) (Figure 3). Although nomenclature varies between Pennsylvania and New York, bedrock formations are continuous across the Delaware River and apparent discrepancies in geologic mapping are an artifact of differing mapping approaches between the Pennsylvania and New York geologic surveys. The entire park, from Hancock, New York to Millrift, Pennsylvania, is underlain by non-marine sandstone, siltstone, shale, and mudstone of the Catskill deltaic system (Pennsylvania: Long Run, Walcksville, and Towamensing members of the Catskill Formation, and the Trimmers Rock Formation; New York: various members of the West Falls, Sonyea, and Genesee formations). Bedrock in this region is more or less horizontally bedded with a gentle dip to the north-northwest. There are a number of small (mostly abandoned) quarries in the park that may have provided stone for the construction of canals along the Delaware River in the 1800s, remnants of which are still visible in places.

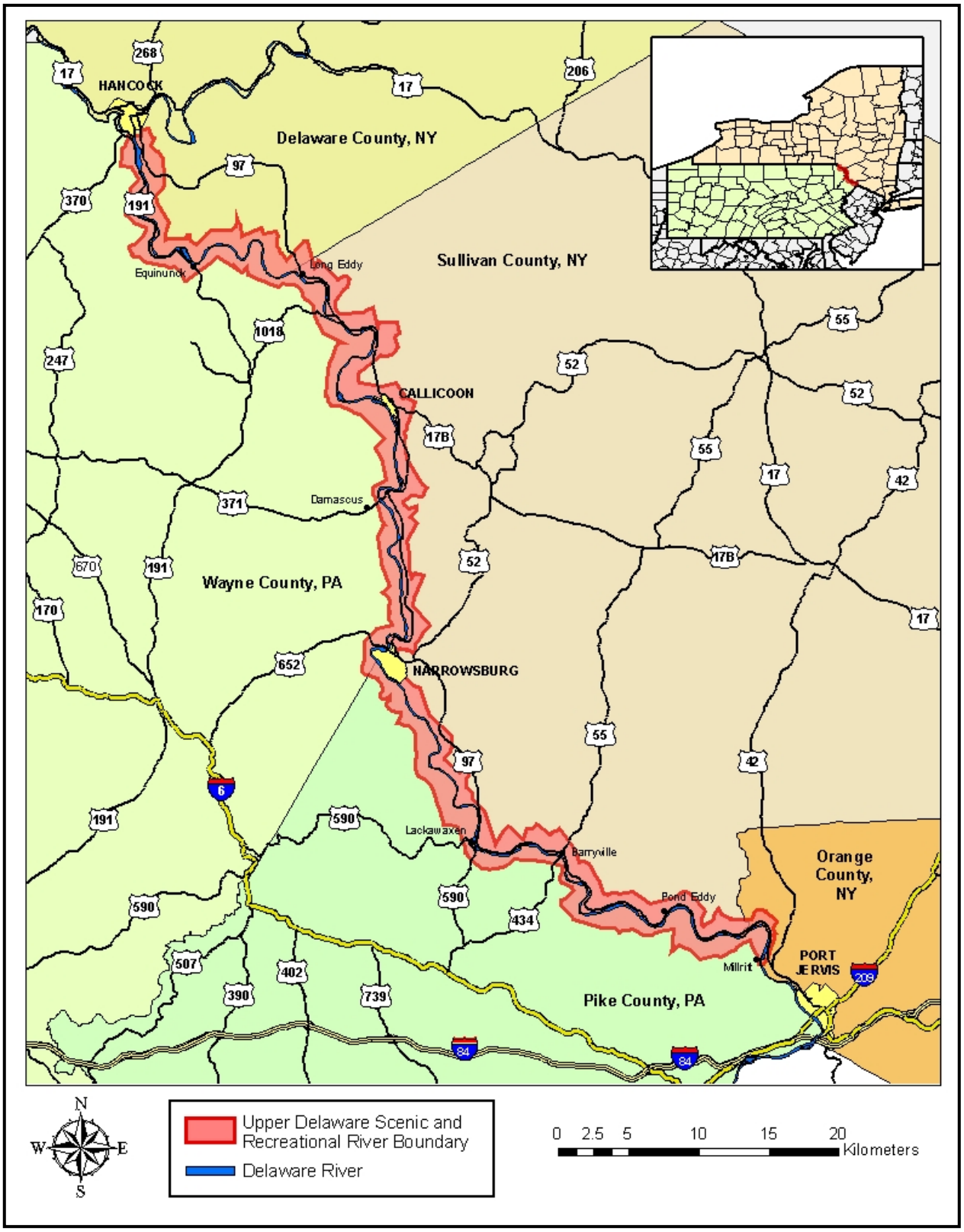


Figure 1. Location of Upper Delaware Scenic and Recreational River in Wayne and Pike counties in Pennsylvania, and Delaware, Sullivan, and Orange counties in New York.

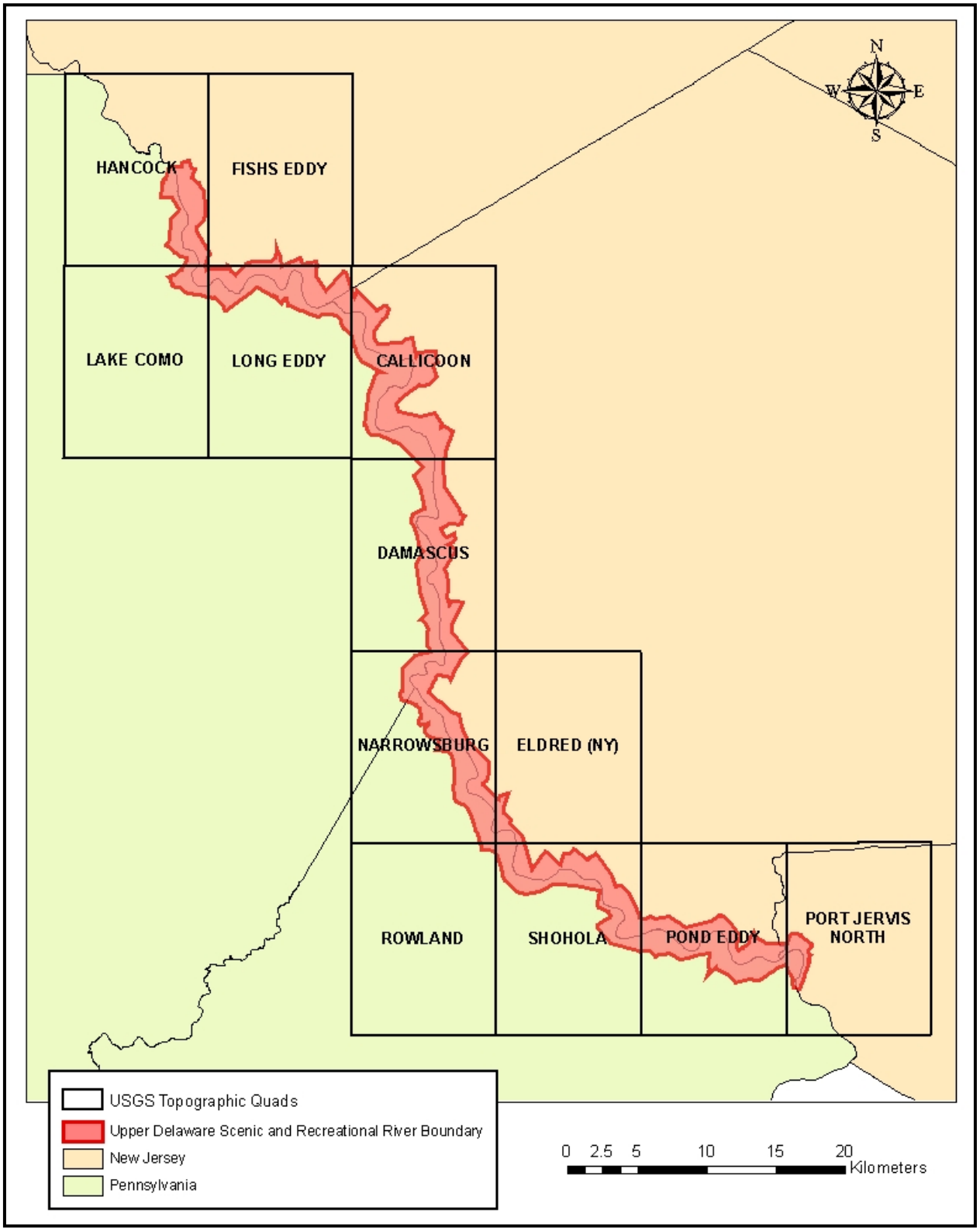


Figure 2. Location of Upper Delaware Scenic and Recreational River on twelve 1:24,000 USGS topographic quad maps.

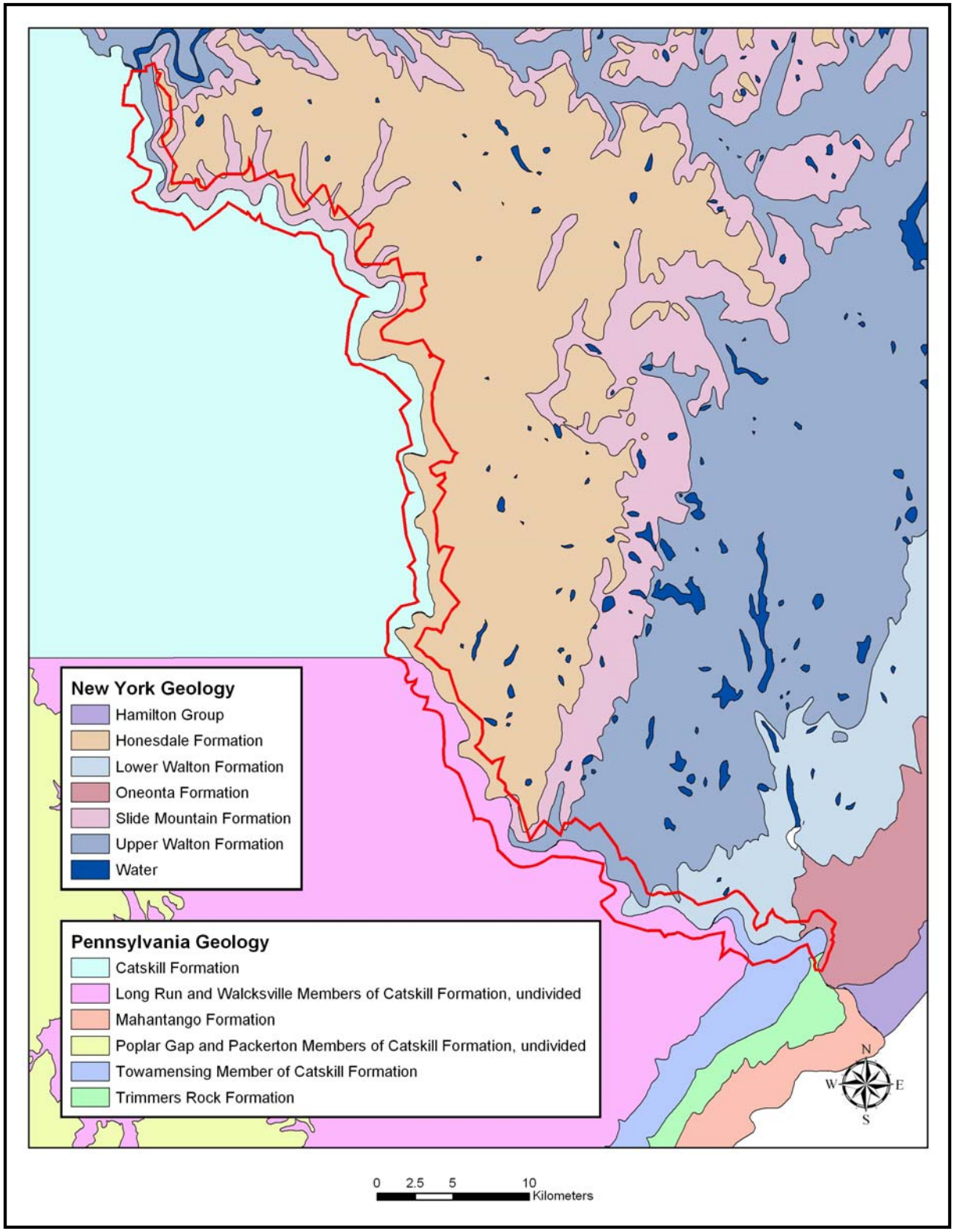


Figure 3. Geologic formations of the Upper Delaware Scenic and Recreational River. The map is based on available geologic data for the park. As a result, the Pennsylvania portion of the park is generalized while the New York portion is differentiated.

The topography of the park is characterized by steep mountain sides surrounding the Delaware River as it winds through the narrow valley. The river descends 140 m (460 ft) during its journey through the park, from an elevation of 270 m (880 ft) at Hancock to 130 m (420 ft) near Millrift. The ridgetops in the park's northern section generally rise to 430–490 m (1,400–1,600 ft), with the highest peaks reaching above 530 m (1,740 ft). Towards the park's southern end, the ridgetops generally occur at 335–365 m (1,100–1,200 ft) with isolated peaks above 415 m (1,370 ft). The gaps and ravines occur in the curving ridgelines where tributaries drain to the river.

Soils in the park vary by topographic position. Typical floodplain and stream-side soils are fine sandy loams, including Barbour, Basher, Delaware, Fluvaquents, Linden, Pope, and Wenonah soil series. Lower slopes and valleys tend to contain silt loams and sandy loams, typically Erie, Craigsville, Wellsboro, Wyoming, Unadilla, and Valois soil series. The soils of the ridgetops and steep upper slopes tend to be complexes of rock outcrops, rocky loams, silt loams, and sandy loams. Arnot, Cadosia, Cheshire, Edgemere, Hoosic, Lackawanna, Lordstown, Mardin, Morris, Oquaga, Shohola, Swartswood, and Wurtsboro are typical soil series on the steep upper slopes and ridgetops. Four of the most common soils in the park are Arnot, Wellsboro, Lackawanna, and Oquaga.

The Delaware River, the longest free-flowing river in the eastern United States, is the major hydrologic feature around which the park is centered. Approximately 118 km (73 mi) of the 530-km (330-mi) Delaware River occurs within the park. Numerous small tributaries drain into the Delaware River from the surrounding ridgetops. The largest tributaries on the Pennsylvania side of the river are (from north to south): Equinunk Creek, Little Equinunk Creek, Calkins Creek, Lackawaxen River, and Shohola Creek. The significant tributaries within the park in New York are (from north to south): Basket Creek, Hankins Creek, Callicoon Creek, and Mongaup River.

Materials and Methods

Planning and Scoping

Several steps were taken to prepare for the mapping and classification of vegetation at Upper Delaware Scenic and Recreational River. A planning and review meeting was held on February 13, 2003 with scientists and staff from the Pennsylvania Natural Heritage Program, New York Natural Heritage Program, National Park Service, and NatureServe. The project timeline, access issues, park boundary status, resource management priorities, current vegetation management, and applicable previous research conducted at the park were discussed.

Preliminary Data Collection and Review of Existing Information

Previous studies conducted at Upper Delaware Scenic and Recreational River pertinent to the vegetation mapping effort were limited (Kunsman 1994). National Park Service staff provided shapefiles containing digital information on bedrock geology, soils, streams, park boundary, land ownership, and roads for review.

Aerial Photography Acquisition and Processing

Kucera International, Inc., acquired color infrared, stereo pair 1:12,000 scale aerial photographs for a digital orthophoto mosaic of Upper Delaware Scenic and Recreational River on March 28 and 29, 2004, during leaf-off conditions. A total of 648 aerial photographs that cover the park, as well as a relatively large buffer area outside the park, were delivered to the National Park Service (NPS), quality checked, accepted as provided, and sent to North Carolina State University (NCSU). Upon receipt at NCSU, the aerial photographs were counted to make sure that none were missing, and the photographs to be included in the mosaic were identified, scanned, and saved in .tif format. All of the aerial photographs are stored in the archive that NCSU maintains for the NPS Northeast Region Inventory & Monitoring Program. Associated data and information provided by Kucera International that are also stored in the archive include the airborne global positioning system (GPS) and inertial mapping unit (IMU) data, the camera calibration certificate, and a hardcopy flight index map.

The mosaic was produced from the 232 color infrared aerial photographs that cover the area within the park boundary, scanned at 600 dpi. The scanned images of the aerial photographs were imported into ERDAS IMAGINE .img format where a photo block was created using the airborne GPS and IMU data that Kucera International supplied with the aerial photographs. The photo block was manipulated until it could be triangulated with a root mean square error of less than 1. Single frame orthophotos (one for each aerial photograph) were then generated within IMAGINE and exported to IMAGINE .lan format. The .lan files were imported into ER Mapper's native (.ers) format and ER Mapper was used to define cutlines, color balance and mosaic the images, generate band interleaved by line (.bil) image and header files for the mosaic, and convert the .bil image to IMAGINE .img format. The .img image was compressed using MrSID software with a 20:1 compression ratio. The final mosaic, in both .img and MrSID formats, is stored in the NCSU data archive.

Metadata

A metadata record for the mosaic was prepared in accordance with the current Federal Geographic Data Committee standards (FGDC 1998a). Metadata were produced in notepad and parsed using the USGS metadata compiler (USGS 2004). After all errors and omissions identified by the parser were corrected, the metadata compiler was used to generate final TXT, HTML, and XML versions of the metadata record which are stored in the NCSU archive. Key information for the mosaic is summarized in Table 1.

Photointerpretation

After receiving the digital orthophoto mosaic from North Carolina State University, ecologists at the Pennsylvania Natural Heritage Program developed a vegetation cover type map that identified broad vegetation types and land use categories. The vegetation cover types were differentiated based on vegetation structure, leaf phenology, and hydrologic regime because these characteristics can be easily identified through aerial photograph interpretation. This map was developed as a guide over which the vegetation sampling efforts would be distributed.

The vegetation cover type map was created through aerial photograph interpretation. Aerial photograph interpretation is the act of examining aerial photographs in order to identify objects—in this case, vegetation types (Avery 1978). The diapositive photographs (color infrared, stereo pair, hard copy photographs) were examined through a stereoscope, which provides the viewer with a three-dimensional view of the photographs. The digital orthophoto mosaic was also examined onscreen in ArcView 3.2 (ESRI 1992–2000). In addition, digital topographic quad maps were examined in ArcView 3.2. Using information gathered from the diapositives, the mosaic, and the topographic maps, polygons representing different vegetation types and land uses were identified. These polygons were digitized onscreen using ArcView 3.2.

In order to provide information about the vegetation and land use surrounding the park boundary, a 200 m buffer was created around the park boundary. The shapefile of the park boundary was obtained from the park's GIS specialist in April 2005 and was used in the buffer calculation. This 200 m buffer was used as the maximum extent of aerial photograph interpretation and polygon delineation. Polygons near or bordering the park boundary were delineated beyond the park boundary, but did not exceed the buffer. Only polygons originating from inside or on the park boundary were delineated into the buffer.

Polygons that represented vegetation were attributed with vegetation cover types and polygons that represented other land uses, such as buildings and roads, were attributed with Anderson Level II categories (Anderson et al. 1976 [Table 2]). Formation-level categories from the USNVC were used as references when assigning vegetation cover types to the polygons (Grossman et al. 1998). To determine which vegetation cover types or Anderson Level II categories should be assigned to each polygon, an aerial photography interpretation key (Appendix A) was used.

Table 1. Summary of key information for the Upper Delaware Scenic and Recreational River mosaic.

Title of metadata record:	Upper Delaware Scenic and Recreational River Color Infrared Orthorectified Photomosaic - Leaf-off (ERDAS IMAGINE .img and MrSID formats)
Publication date of mosaic (from metadata):	November 9, 2004
Date aerial photography was acquired:	March 28 and 29, 2004
Vendor that provided aerial photography:	Kucera International, Inc.
Scale of photography:	1:12,000
Type of photography:	Color infrared, stereo pairs
Number of aerial photographs delivered:	648 (232 included in mosaic)
Archive location of aerial photographs, airborne GPS and IMU data, camera calibration certificate, and hard copy flight index map:	North Carolina State University, Center for Earth Observation
Scanning specifications:	600 dpi
Horizontal positional accuracy of mosaic:	1.490 meters, meets Class 1 National Map Accuracy Standard
Number of ground control points upon which estimated accuracy is based:	102
Method of calculating positional accuracy:	Root mean square error
Archive location of mosaic and metadata:	North Carolina State University, Center for Earth Observation
Formats of archived mosaic:	.img (uncompressed) and MrSID (20:1 compression)

Table 2. Number of polygons, total mapped hectares, mapped hectares within the park boundary, and number of plots sampled for vegetation cover types and Anderson Level II categories in the Upper Delaware Scenic and Recreational River.

Vegetation Cover Type	Number of Polygons	Total Mapped Hectares	Mapped Hectares within Park Boundary	Number of Plots Sampled
Deciduous Forest	959	10,478.68	8,566.53	90
Deciduous Shrubland	51	74.50	65.50	3
Deciduous Woodland	49	111.89	81.84	1
Evergreen Forest	166	1,464.76	1,163.04	10 (11)*
Evergreen Plantation	20	18.61	11.81	0
Evergreen Shrubland	4	3.42	1.43	0
Evergreen Woodland	39	57.13	51.29	3
Grassland	232	895.24	768.08	8
Mixed Evergreen - Deciduous Forest	894	7,654.54	6,316.71	68
Mixed Evergreen - Deciduous Shrubland	2	2.24	2.24	0
Mixed Evergreen - Deciduous Woodland	48	146.83	113.94	1
Saturated Deciduous Shrubland	9	8.27	1.50	0
Saturated Herbaceous Vegetation	27	21.72	19.88	0
Seasonally Flooded Deciduous Forest	20	30.08	16.16	0
Seasonally Flooded Evergreen Forest	4	14.83	5.62	0
Seasonally Flooded Mixed Evergreen - Deciduous Forest	7	6.41	4.81	0
Seasonally Flooded Mixed Evergreen - Deciduous Woodland	1	3.60	3.60	0
Semipermanently Flooded Herbaceous Vegetation	16	9.48	7.86	0
Temporarily Flooded Deciduous Forest	87	261.30	256.67	5
Temporarily Flooded Deciduous Shrubland	14	24.11	24.11	0
Temporarily Flooded Deciduous Woodland	55	94.73	89.01	1
Temporarily Flooded Evergreen Forest	2	5.46	0.90	0
Temporarily Flooded Herbaceous Vegetation	197	329.53	329.20	12
Temporarily Flooded Mixed Evergreen - Deciduous Forest	18	71.74	71.74	1
Temporarily Flooded Mixed Evergreen - Deciduous Woodland	4	19.56	19.56	0
Anderson Level II Category				
Bare Exposed Rock	9	12.79	12.11	0
Beaches	16	5.72	5.41	4
Commercial and Services	179	446.26	409.21	0
Cropland and Pasture	37	177.69	158.54	0
Industrial	3	10.90	9.10	0
Lakes	104	44.67	29.42	0
Orchards, Nurseries, and Horticultural Areas	1	4.36	4.36	0
Reservoirs	5	13.25	6.04	0
Residential	268	865.91	799.86	0
Residential / Deciduous Forest	26	715.09	560.80	0
Residential / Evergreen Forest	2	27.55	26.17	0
Residential / Mixed Evergreen - Deciduous Forest	42	294.34	265.99	0
Streams and Canals	38	1,562.17	1,546.10	20
Strip Mines, Quarries, and Gravel Pits	25	51.46	41.64	0
Transitional Areas	5	32.31	32.16	0
Transportation, Communications, and Utilities	44	368.97	350.74	0
Total	3,729	26,442.09	22,250.68	227 (228)*

* One plot was sampled in Evergreen Forest just outside the park boundary in a polygon that extended into the park.

Once the vegetation cover type map was completed, it was discovered that the original park boundary shapefile used to create the buffer and the map was labeled with the wrong projection information. The datum shift from UTM NAD 1927 to UTM NAD 1983 moved the park boundary to its correct location, 200 m to the north and 32 m to the east of the original file's location. This shift essentially eliminated the buffer on the north side of the park and doubled the width of the buffer on the south side of the park. In several places along the corrected park boundary, additional polygons were delineated to fill in gaps where the polygons in the old buffer did not reach the corrected park boundary.

The resulting vegetation cover type map (Figure 4 [due to physical size of this image it has been placed back-to-back with Figure 5]) identified 3,729 map polygons each labeled with a vegetation cover type or Anderson Level II category (Table 2). The number of total mapped hectares listed in Table 2 is larger than the size of the park because the mapped polygons extend beyond the park boundary. This vegetation cover type map was used to guide vegetation plot sampling in the park.

Field Data Collection and Classification

All vegetation plot sampling followed the USGS/NPS Vegetation Mapping Program protocols (TNC and ESRI 1994b). The Upper Delaware Scenic and Recreational River is considered a large park (222 km^2 [86 mi^2]) for which the gradient directed transect sampling (gradsect) approach should be used. The gradsect approach is a variant of a stratified random sampling strategy that intends to efficiently describe the full range of vegetation by sampling along the full range of environmental variability (Gillison and Brewer 1985; Austin and Adomeit 1991). Gradsects are areas of the park selected for sampling that contain the strongest environmental gradients and that are reasonably accessible. This strategy optimizes the amount of data collected relative to the time and effort spent during vegetation sampling. The total area of the gradsects should include at least 15% of the park area (TNC and ESRI 1994b).

In order to select gradsect areas, the environmental gradients and factors of elevation, slope, aspect, and geology were examined. Due to the orientation of the Upper Delaware Scenic and Recreational River around the river itself, these factors form strong environmental gradients from the river to the ridgetops in both Pennsylvania and New York. However, the vast majority of the land in the Upper Delaware Scenic and Recreational River is held in private ownership. Hence, the sampling strategy was also driven by the accessibility of the land within the gradsects.

Thirty-seven potential gradsects stretching from rivershore to the park boundary were identified. Twenty of these gradsects were located within parcels that are owned by public entities (e.g. Pennsylvania Game Commission and New York Department of Environmental Conservation), private conservation organizations, or landowners of large parcels who were likely to provide access to their lands. The remaining 17 gradsects were located along the length of the park and on both sides of the river in order to capture environmental gradients between the southern and northern ends of the park, as well as the eastern and western sides of the river. These gradsects captured variation in vegetation cover type, aerial photograph signature, elevation, topography, aspect, and geology. Because the large number of gradsects provided redundancy, certain

gradsects, which encompassed 8,052 ha (19,888 ac) in total and covered 36% of the park area, were eliminated due to access constraints.

With the vegetation cover type map and the gradsects as guides, ecologists from the New York Natural Heritage Program worked with park staff at the Upper Delaware Scenic and Recreational River to gain access to lands within the park for vegetation sampling. National Park Service personnel issued a press release to inform the public of the vegetation mapping and classification study. They then contacted landowners with lands located in the gradsects by mail and phone to ask permission to access their lands. By the end of the field season, access had been granted for sampling in 17 of the gradsects, with a total area of 3,018 ha (7,454 ac) (Figure 5 [due to physical size of this image it has been placed back-to-back with Figure 4]).

In addition to the gradsect sampling, vegetation cover types not adequately sampled by the gradsect method were targeted. Temporarily flooded and semipermanently flooded vegetation cover types on Delaware River islands and shoreline were accessed by canoe and sampled on two days in September 2005 at sites where access was granted.

Field Survey

Within each polygon selected for sampling, a plot was established in an area that was most representative of the existing vegetation cover type (Mueller-Dombois and Ellenberg 1974). All vegetation data were collected following NatureServe's accepted natural heritage sampling protocols (TNC and ESRI 1994b; Edinger et al. 2002), with 20×20 m plots in forests and woodlands, 10×10 m plots in shrublands, and 5×5 m plots in herbaceous vegetation. The vegetation was visually divided into eight strata: emergent trees (variable height), tree canopy (variable height), tree subcanopy (>5 m in height), tall shrub (2–5 m), short shrub (<2 m), herbaceous, non-vascular, and vines. The percent cover was estimated for each species in each stratum. Specimens of species that were not identifiable in the field were collected for later identification and destroyed after identification. The diameter at breast height (1.3 m) was measured with a Biltmore stick for all trees larger than 10 cm in diameter that were rooted in the plot. The diameters were recorded by species and strata.

In addition to floristic information, the following environmental variables were recorded for each plot either directly in the field or from GIS data layers after field sampling was completed: slope, aspect, topographic position, hydrologic regime, soil stoniness, average soil texture, and soil drainage. In order to expedite plot sampling, soil core samples were not collected. Any unvegetated area of the plot was characterized by the exposed substrate. Notes were taken on the plot representativeness of the surrounding vegetation and any other significant environmental information, such as landscape context, herbivory, stand health, recent disturbance, or evidence of historic disturbance. Plot data and reference observation point data were initially collected on paper forms, but starting in summer 2005, data were collected digitally in the field using an iPAQ hand-held computer with the Hand-Held Database (HHDB) software and imported into the Field Form Database (FFDB) developed by the NY Natural Heritage Program. A sample plot form and screen shots from the HHDB used for this project are included in Appendix B.

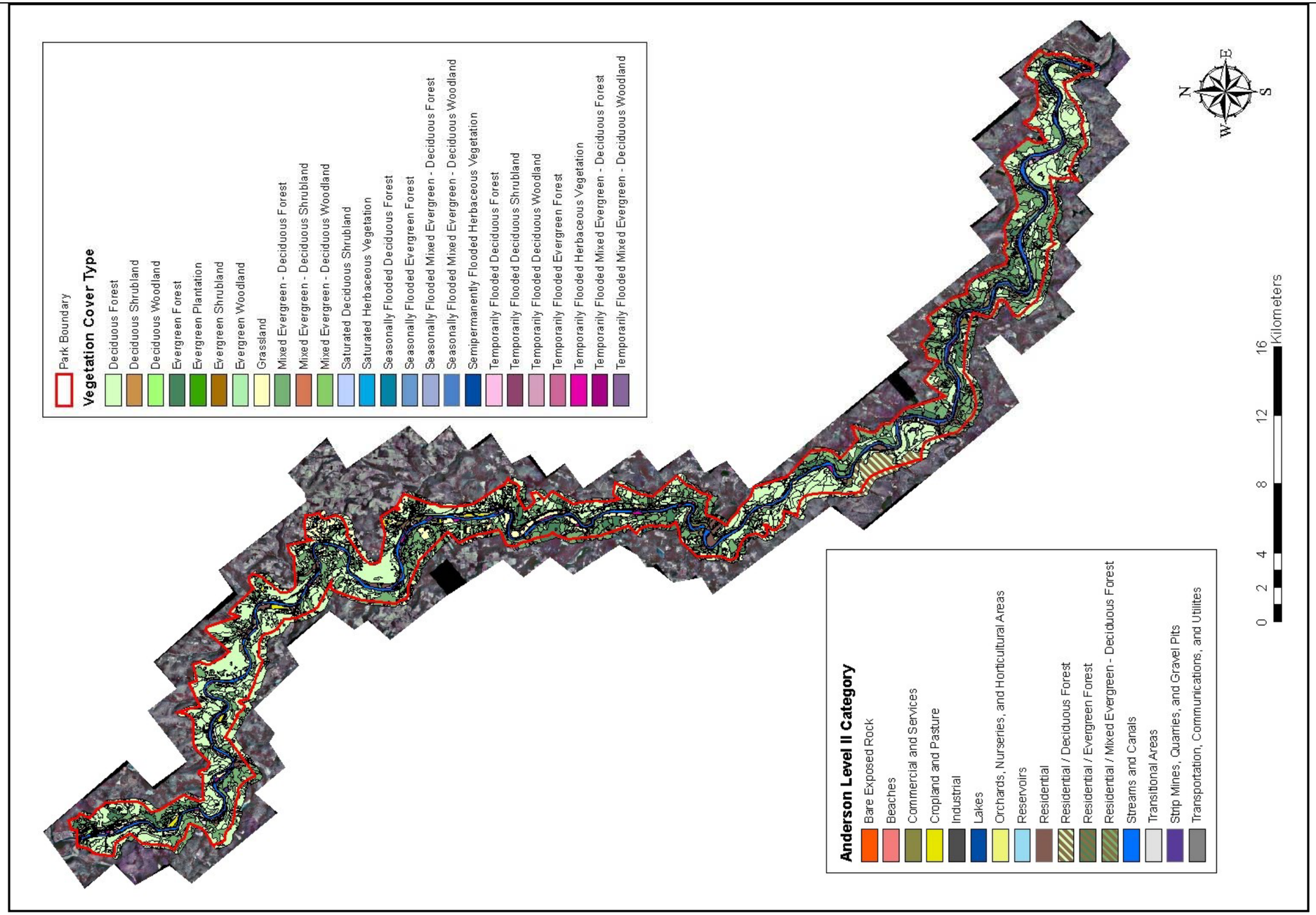


Figure 4. Vegetation cover types and Anderson Level II categories delineated in the Upper Delaware Scenic and Recreational River in order to guide vegetation plot sampling.

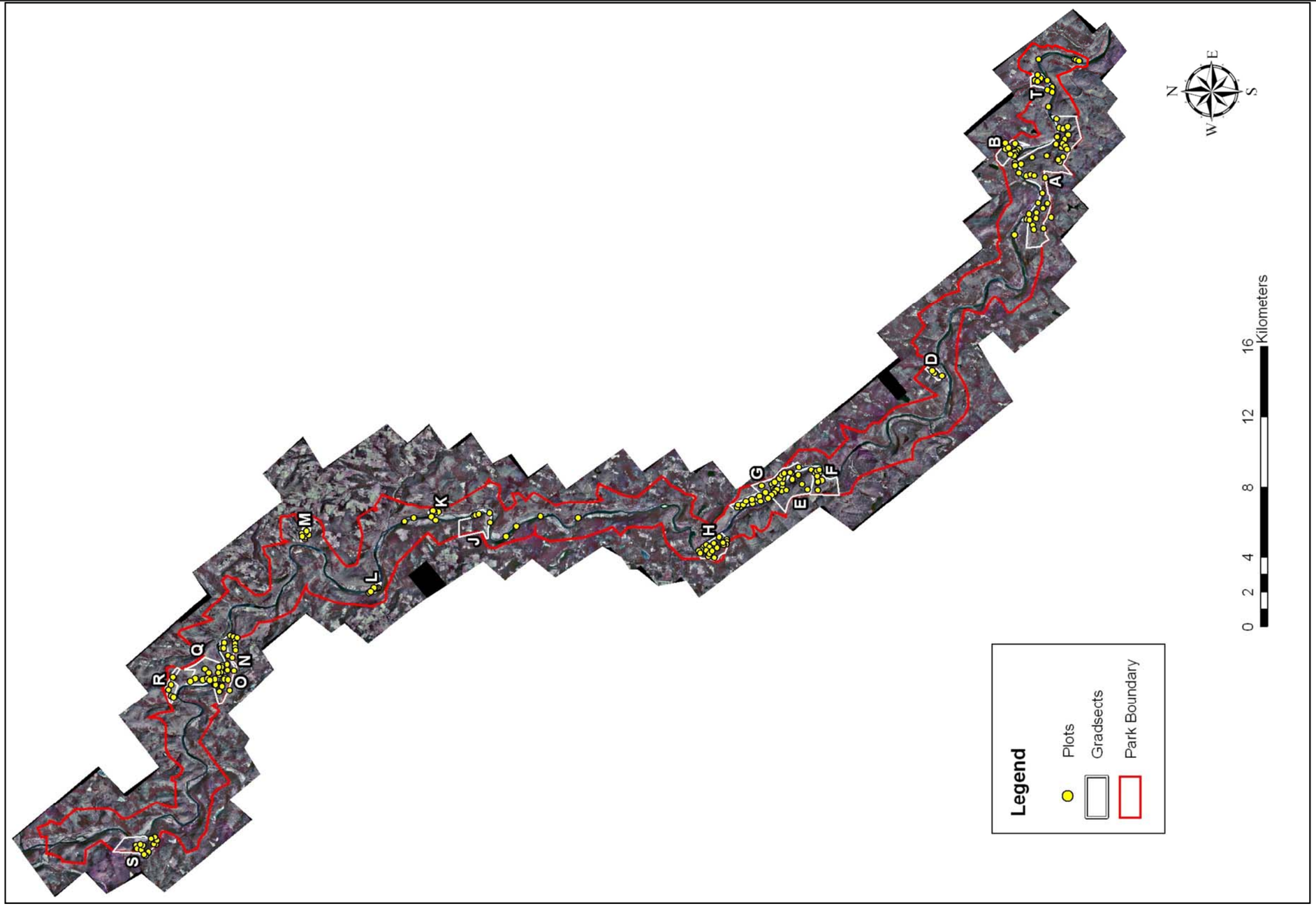


Figure 5. Locations of gradsects and vegetation plots sampled in the Upper Delaware Scenic and Recreational River for vegetation classification and mapping.

A digital photograph was taken at most of the plot sampling locations. The location of each plot within the southern gradsects and in the river channel (A, B, D-H, T, and U) was recorded with a Magellan SporTrak GPS unit. The location of each plot within the northern gradsects (K–O and Q–S) was recorded with a Garmin 12 Map GPS unit. The datum on the GPS units was set to North American 1983 (Conus) and the coordinate system was set to Universal Trans-Mercator (UTM) zone 18. Plot locations are shown in Figure 5.

Vegetation Classification and Characterization

Data from vegetation plots were entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform. In the PLOTS 2.0 database, species were assigned standardized codes and nomenclature based on the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA, NRCS 2004). For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region.

Vegetation plot data were analyzed using several multivariate statistical techniques available in the PC-ORD version 4.0 Multivariate Analysis package (McCune and Mefford 1999). Plot data from the PLOTS 2.0 database along with data from the NY Natural Heritage Field Form Database (FFDB) were exported into a Microsoft Excel spreadsheet for data preparation prior to PC-ORD analyses. In general, the analyses were designed to progressively fragment the dataset into more workable subsets, using cluster analysis, two-way indicator species analysis, and non-metric multidimensional ordination analysis. Different techniques were employed to provide multiple lines of evidence from which to interpret the results. For a detailed discussion of the statistical techniques used in this study, please refer to McCune and Grace (2002). The data analysis and interpretation process was iterative in order to identify and analyze increasingly finer groups until vegetation associations were characterized.

Cluster analyses were performed using the percent cover of species data. This agglomerative analysis produces a hierarchical classification of the plots based on the similarity in their species composition. Euclidean distance measure and Ward's group linkage method were used in this analysis. Two-way indicator species analyses (TWINSPAN) were also performed using the percent cover of species data. This divisive analysis successively divides the plots into groups that are similar in species composition (Hill and Gauch 1979). Non-metric multidimensional ordination analyses (NMS) were performed using the percent cover of species from the plots. NMS is an ordination technique well suited to non-normal data sets (Kruskgal and Wish 1978). In this analysis, Sorensen distance measure, a random starting configuration, and a stability criterion of 0.005 were employed. Forty runs were performed with the real data, with a maximum of 400 iterations.

The results of the classification analyses were then evaluated and compared to the Ecological Communities of New York State (Edinger et al. 2002) and Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999), and the United States National Vegetation Classification system (USNVC). Based on this evaluation, preliminary vegetation associations were identified and assigned a common name based on Edinger et al. (2002) and Fike (1999). Detailed local descriptions for the preliminary vegetation associations were then written based on plot data, photographs of each plot, and the ecologists' field observations.

After these local, park-specific descriptions were developed, the associations were crosswalked to the United States National Vegetation Classification system (USNVC), which contains range-wide global descriptions for each type. The USNVC was developed by ecologists of the Natural Heritage Program network and The Nature Conservancy after many years of literature review, data collection, and data analysis. This collaborative effort culminated in the publication of International Classification of Ecological Communities: Terrestrial Vegetation of the United States (Grossman et al. 1998). The International Classification of Ecological Communities, now known as the International Vegetation Classification, of which the USNVC is a subset, has been revised and refined since 1998, and is now managed by NatureServe in continued collaboration with the network of Natural Heritage Programs. The classification is housed in the Biotics database and is updated regularly. The upper levels of the USNVC were adopted as a standard by the Federal Geographic Data Committee to support the production of uniform statistics on vegetation at the national level (FGDC 1996). The USGS/NPS Vegetation Mapping Program adopted the alliance level, and, where possible, the association level, as the mapping unit for national parks.

Preliminary park-specific local vegetation associations were qualitatively compared to existing associations in the National Vegetation Classification System by searching for alliances sharing similar dominant species, physiognomy, and environmental setting. Total floristic composition was used to determine the appropriate association within the alliance. Global information on the associations from the USNVC was then appended to the local descriptions to provide resource managers with a broader context for the vegetation in the park.

A park-specific dichotomous key was created for the preliminary vegetation associations to guide accuracy assessment and for use by park natural resource managers and others. A dichotomous key is a tool for identifying unknown entities, in this case, vegetation associations. It is structured by a series of couplets, two statements that describe different, mutually exclusive characteristics of the associations. Choosing the statement that best fits the association in question leads the user to the correct association. The dichotomous key should be used in conjunction with the detailed vegetation association descriptions to confirm that the association selected with the key is appropriate.

Vegetation Map Preparation

Following the vegetation data analysis, the vegetation cover type map was edited and refined to develop a preliminary association-level vegetation map. Using ArcGIS 8.x and 9.x (ESRI 1999–2006), polygon boundaries were revised onscreen based on the plot data, field observations, classification analyses, aerial photography signatures, and topographic maps. Each polygon was assigned a USNVC Community Element Global (CEGL) code based on the information sources listed above. Following accuracy assessment, the vegetation cover type map was revised to correct misclassifications between mapped communities and the accuracy assessment points. This revision increases the overall accuracy of the final product; however, the original error rates from the accuracy assessment are reported within this document.

Accuracy Assessment

Two sources of potential error in the vegetation map include: 1) horizontal positional accuracy, in which a location on the mosaic does not accurately align with the same location on the ground due to errors in orthorectification or triangulation; and 2) thematic accuracy, in which the vegetation type assigned to a particular location on the map does not correctly represent the vegetation at the same location in the park due to mapping error. The USGS/NPS Vegetation Mapping Program protocols (TNC and ESRI 1994c) were followed to assess the positional and thematic accuracy of the Upper Delaware Scenic and Recreational River vegetation map.

Positional Accuracy Assessment

The horizontal positional accuracy of the mosaic was assessed using the guidelines of the USGS/NPS Vegetation Mapping Program (ESRI, NCGIA, and TNC 1994). Well-defined positional accuracy ground control points were placed throughout all quadrants of the mosaic in ArcMap. Ground control points and zoomed-in screenshots of each point were plotted on hard copy maps with the mosaic as a background. These maps and plots were used to locate the ground control points in the field. Field staff recorded the ground control point coordinates with a Trimble GeoXT. Mapped ground control points that were physically inaccessible were also noted. The field crew collected accuracy assessment data at 109 ground control points. The coordinate data were collected with real time GPS and post-processed with differential correction using Pathfinder Office software. Prior to calculating accuracy, seven ground control points were identified as outliers with SAS JMP program and removed. The field-collected GPS coordinates for the remaining 102 points were compared to the coordinates obtained from the mosaic viewed in ArcMap. Both pairs of coordinates for each point were entered into a spreadsheet in order to calculate horizontal accuracy (in meters). The accuracy calculation formula is based on root mean square error (FGDC 1998b; Minnesota Governor's Council on Geographic Information and Minnesota Land Management Information Center 1999). Figure 6 shows the distribution of the ground control points within the park and surrounding area.

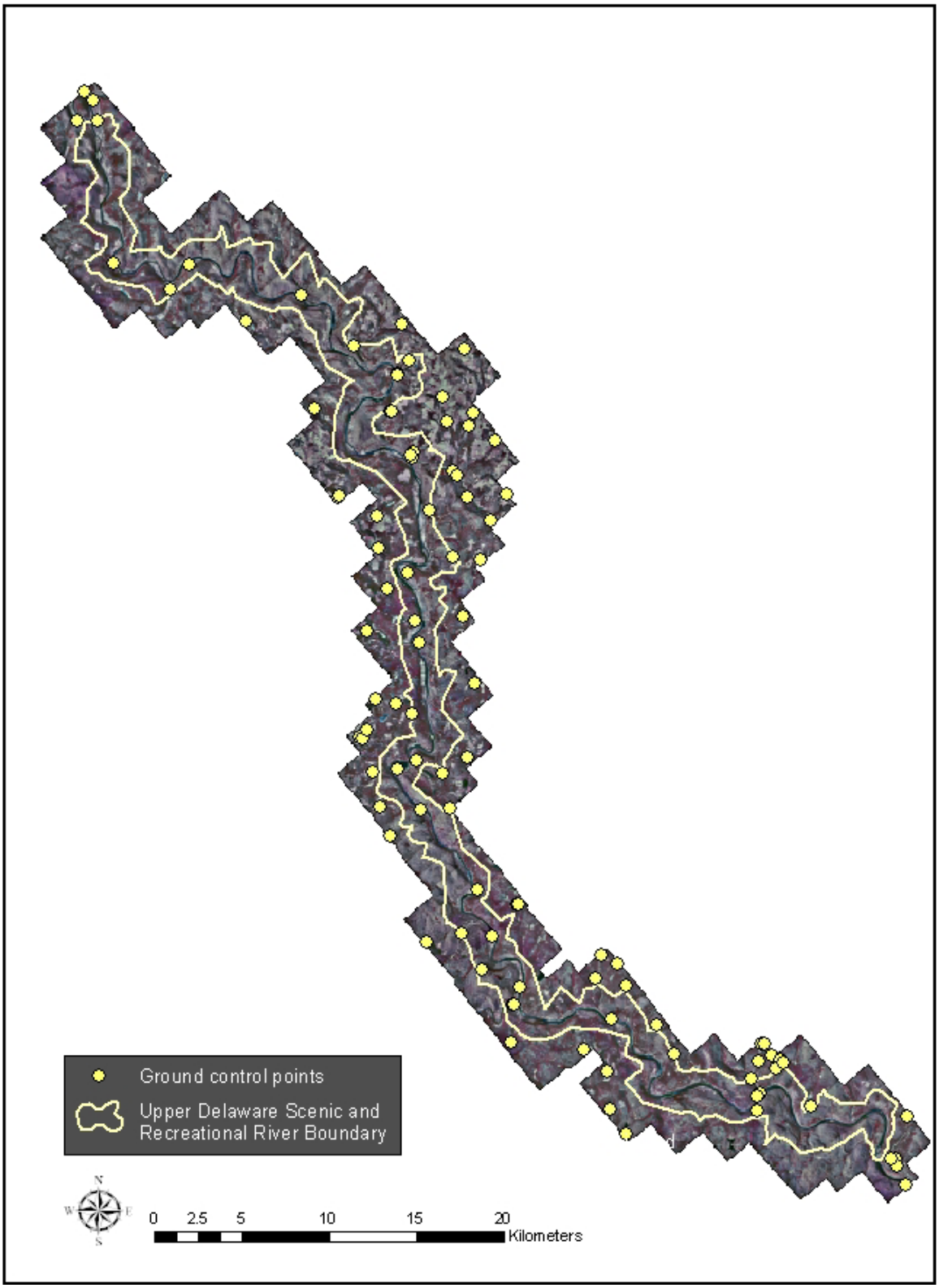


Figure 6. Ground control points used to calculate horizontal positional accuracy of the Upper Delaware Scenic and Recreational River (UPDE) mosaic.

Thematic Accuracy Assessment

The thematic accuracy of the preliminary vegetation map was assessed by the Pennsylvania Natural Heritage Program. A stratified random sampling approach was used, distributing the sampling effort across the preliminary vegetation associations (Table 3 [due to the amount of data in this table, it has been placed back-to-back with Figure 7]). Polygons labeled with Anderson Level II categories were not included in the thematic accuracy assessment sampling. However, due to the vast private landownership within the park, the thematic accuracy assessment sampling was constrained to areas of the park in which landowners granted access. Ecologists from the Pennsylvania and New York Natural Heritage Programs met with park resource managers in April 2006 to identify areas of the park that should be targeted for thematic accuracy assessment. National Park Service personnel issued a second press release to inform the public of the upcoming thematic accuracy assessment portion of the work on the vegetation mapping and classification project. They then contacted landowners with lands in the targeted areas by mail and phone to ask permission to access their lands. Due to a greater positive public response to permission requests for accuracy assessment land access compared to those received for the original vegetation plot sampling, more areas were available for sampling, including some river-only access areas. Twenty-seven accessible areas totaling 7,550 ha (18,648 ac) were identified in which thematic accuracy assessment sampling could be conducted (Figure 7 [due to physical size of this image it has been placed back-to-back with Table 3]).

According to the USGS/NPS vegetation mapping protocol, the number of thematic accuracy assessment sampling points per preliminary vegetation association is determined according to the rarity of the vegetation type, both in terms of number of polygons and polygon size. The following rules are typically used to determine the number of points assigned to each association (TNC and ESRI 1994c):

Scenario A: The association is abundant. It covers more than 50 ha of the total park area and consists of at least 30 polygons. In this case, it is recommended that 30 polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the 30 selected polygons.

Scenario B: The association is relatively abundant. It covers more than 50 ha of the total park area but consists of fewer than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons, and that one sampling point be assigned to each of the 20 selected polygons. If the association contains less than 20 polygons, some polygons will contain multiple sampling points. The number of sampling points assigned to each polygon is determined by the relative area of that polygon compared with the other polygon in that association.

Scenario C: The association is relatively rare. It covers less than 50 ha of the total park area but consists of more than 30 polygons. In this case, it is recommended that 20 polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the 20 selected polygons.

Scenario D: The association is rare. It has 5–30 polygons and covers less than 50 ha of the total park area. In this case, it is recommended that five polygons be selected at random from the set of the association's polygons. One sampling point will be assigned to each of the five selected polygons.

Scenario E: The association is very rare. It has fewer than five polygons and occupies less than 50 ha of the total park area. In this case, it is recommended that one sampling point be assigned to each polygon.

If the entire park was accessible for sampling, the number of sampling points that would have been recommended by the protocol for each association is shown in Table 3. However, sampling was restricted to the 27 accessible areas, and other polygons that bordered the Delaware River and could be accessed. Thus, the number of sampling points feasible within the accessible areas and by river access was determined for each association (Table 3). Every effort was made to attain the number of sampling points recommended by the protocol, but this was not possible for every association. Sixteen associations received fewer sampling points than recommended by the protocol. Four of these associations received no sampling points because the polygons were not in any of the accessible areas. For these four associations, special efforts were made to contact the landowners to obtain permission to access their property. Unfortunately, these efforts were unsuccessful and the thematic accuracy assessment of these associations could not be assessed. A total of 547 thematic accuracy assessment points would be sampled across the other associations.

The location of the accuracy assessment points within the vegetation map was determined in ArcGIS (ESRI 1999). The locations of the accuracy assessment points were constrained to polygons within the accessible areas and polygons immediately adjacent to the river. All accuracy assessment points fell within the vegetation association map; however, some points fell outside the park boundary but within the mapped buffer area. The locations of the sampling points within the polygons were created with Hawth's Analysis Tools (Beyer 2004). In order to randomly select the polygons in sampling Scenarios A, C, and D, the Create Random Selection tool in Hawth's Analysis Tools was used in ArcGIS. For all of the sampling scenarios, the Generate Random Points tool in Hawth's Analysis Tools was used to randomly determine the location of the sampling points in the polygon. The locations of the 547 thematic accuracy assessment sampling points are shown in Figure 7.

In July through September 2006, each accuracy assessment point was located in the field using a Garmin III+ or Garmin 76C global positioning system (GPS) unit, with the datum set to North American 1983 (Conus) and the coordinate system set to Universal Trans-Mercator (UTM) zone 18. The vegetation association at that location was then determined using the dichotomous key and the detailed vegetation descriptions. The minimum area of observation around the sampling point was a circle with a radius of 50 m. The accuracy assessment data form used in this study is shown in Appendix C. Data from the 547 accuracy assessment points were then entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform from October through December 2006. In the PLOTS database, species were assigned standardized codes based on the PLANTS 3.5 Database (USDA, NRCS 2006). For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during

Table 3. Thematic accuracy assessment (AA) sampling strategy for the preliminary vegetation map of the Upper Delaware Scenic and Recreational River.

Association Name	Total Number of Mapped Polygons	Total Mapped Hectares	Number of Sampling Points Recommended by Protocol[1]	Number of Polygons within Accessible Areas	Total Hectares within Accessible Areas	Number of Sampling Points within Accessible Areas	Additional Number of Points Accessed by River	Total Number of Sampling Points
Birch - Willow Riverbank Shrubland	19	28.92	5	4	6.20	4	1	5
Bitternut Hickory Lowland Forest	3	16.91	3	2	5.59	1	2	3
Central Appalachian Blueberry Shrubland	1	0.82	1	1	0.82	1	0	1
Central Appalachian Northern Hardwood Forest	120	1,561.29	30	25	283.29	30	0	30
Dry, Rich Oak - Hickory Forest	111	1,613.63	30	24	341.81	30	0	30
Eastern Cattail Marsh	4	3.30	4	1	1.42	1	0	1
Eastern Reed Marsh	4	3.36	4	0	0.00	0	0	0
Hairy-fruit Sedge Wetland	7	24.94	5	2	9.32	4	1	5
Hemlock - Beech - Oak Forest	447	5,281.03	32	106	603.06	32	0	32
Hemlock - Hardwood Swamp	16	38.36	5	5	8.28	5	0	5
Hemlock - Northern Hardwood Forest	145	1,399.25	30	43	286.79	30	0	30
Hickory - Eastern Redcedar Rocky Woodland	1	3.47	1	1	0.01	1	0	1
High Allegheny Rich Red Oak - Sugar Maple Forest	12	178.16	20	8	42.24	16	0	16
Inland Pitch Pine - Oak Forest	2	9.08	2			0	0	0
Japanese Knotweed Gravelbar	59	115.05	30	3	3.98	3	17	20
Larch Plantation	2	2.62	2			0	0	0
Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening	16	18.08	5	6	6.67	5	0	5
Little Bluestem Old Field	3	7.53	3	1	2.14	1	0	1
Lower New England Slope Chestnut Oak Forest	208	3,608.43	30	51	879.19	30	0	30
Mixed Forb Marsh	14	18.77	5			0	0	0
Mixed Pine Conifer Plantation	63	93.02	30	7	10.82	7	0	7
Northeastern Dry Oak-Hickory Forest	126	2,583.58	30	29	708.85	30	0	30
Northeastern Modified Successional Forest	32	65.00	30	10	11.40	10	0	10
Northeastern Oak - Red Maple Successional Forest	185	750.74	30	16	36.22	30	0	30
Northeastern Old Field	63	91.57	30	2	2.65	2	0	2
Northeastern Successional Shrubland	20	49.13	5	2	4.36	4	0	4
Northeastern Temperate Cobble Scour Rivershore	30	12.88	5	2	0.32	2	3	5
Northern Riverside Rock Outcrop	11	5.37	5	1	0.16	1	4	5
Pitch Pine Rocky Summit	7	19.11	5	4	2.65	4	0	4
Red Maple - Sweet Birch Hardwood Forest	197	861.34	30	29	199.14	30	0	30
Red Oak - Heath Woodland / Rocky Summit	49	264.82	30	18	55.56	30	0	30
Reed Canarygrass Eastern Marsh	134	194.87	30	18	20.54	18	12	30
Ridgetop Scrub Oak Barrens	1	0.33	1	1	0.33	1	0	1
River Birch Low Floodplain Forest	75	163.67	30	4	1.76	4	26	30
Riverside Prairie Grassland	24	49.90	5	9	6.11	5	0	5
Semi-rich Northern Hardwood Forest	87	819.48	30	22	109.92	30	0	30
Southern New England Red Maple Seepage Swamp	13	12.56	5	4	3.73	4	0	4
Speckled Alder Swamp	7	3.76	5	1	1.04	1	0	1
Steeplebush / Reed Canarygrass Successional Wet Meadow	18	30.59	5	15	14.47	5	0	5
Sugar Maple - Ash - Basswood Northern Rich Mesic Forest	17	250.88	20	12	120.39	20	0	20
Sycamore - Mixed Hardwood Floodplain Forest	76	217.15	30	12	9.27	12	18	30
Water-willow Rocky Bar and Shore	3	1.51	3	0	0.00	0	3	3
White Pine - Oak Forest	15	188.22	20	8	40.30	16	0	16
Total	2,447	20,662.47	661	509	3,840.76	460	87	547

[1] The Nature Conservancy and Environmental Systems Research Institute. 1994 (c). NBS/NPS Vegetation Mapping Program: Accuracy Assessment Procedures. 71 pp. Report to the National Biological Survey and the National Park Service. Arlington, VA and Redlands, CA. http://biology.usgs.gov/npsveg/standards.html. Last accessed 17 March 2005.

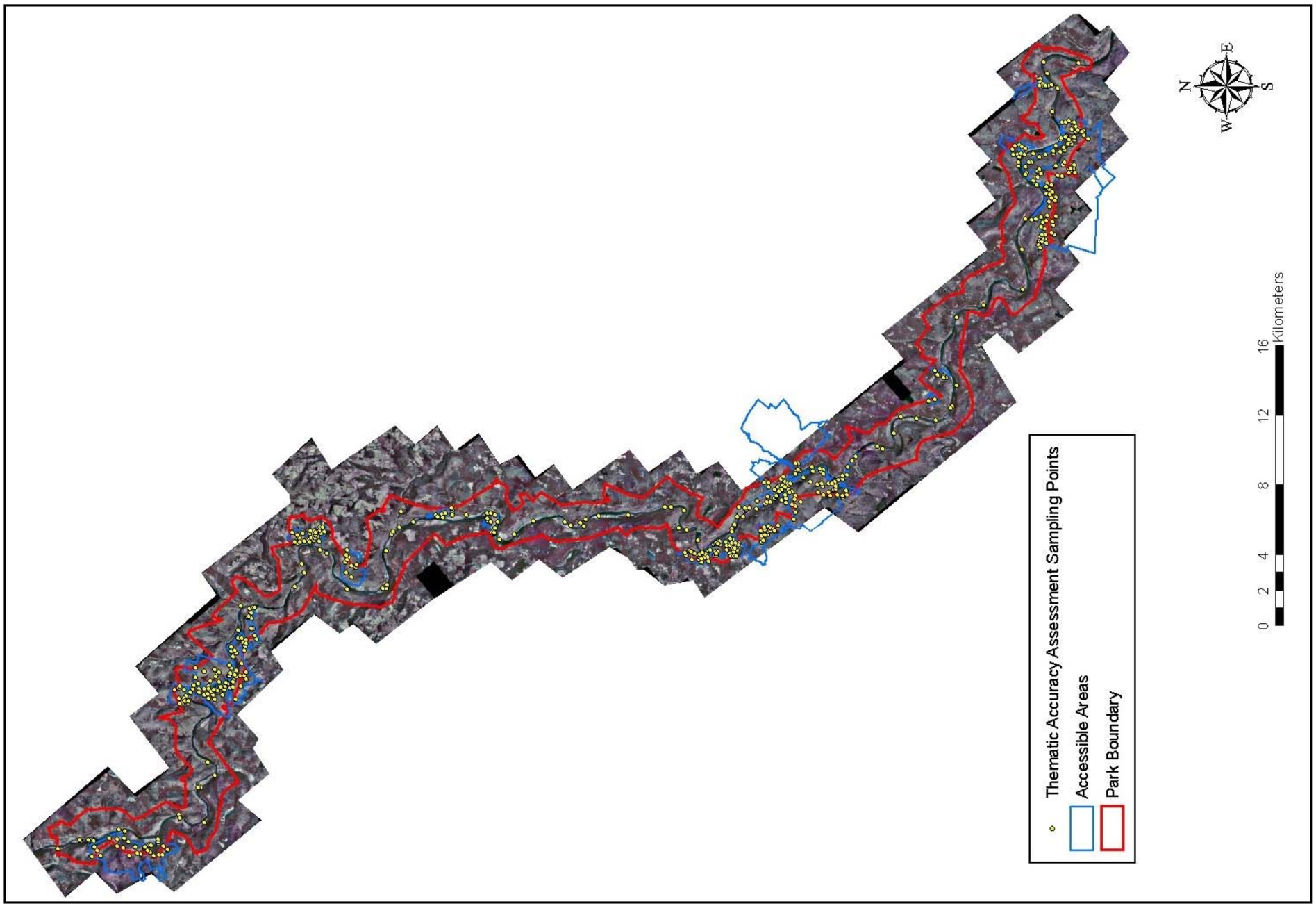


Figure 7. Locations of accessible areas and thematic accuracy assessment sampling points in the Upper Delaware Scenic and Recreational River.

thematic accuracy assessment sampling are listed in Appendix D. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in the appendix as such.

The thematic accuracy was then tabulated using a contingency matrix that compared the mapped vegetation associations with the actual vegetation associations observed in the field. Overall percent accuracy and the Kappa index were calculated (TNC and ESRI 1994c). Overall percent accuracy was calculated by dividing the number of correctly classified accuracy assessment points by the total number of accuracy assessment points. The Kappa index is the preferred method of reporting overall thematic accuracy because it takes into account that a certain number of correct classifications will occur by chance (Foody 1992). The USGS/NPS vegetation mapping protocol requires that the Kappa index of vegetation association maps exceed 80% (TNC and ESRI 1994c).

Producer's accuracy and user's accuracy were also calculated in the contingency matrix. The producer's and user's accuracies for the vegetation association map should exceed 80%, according to the USGS/NPS Vegetation Mapping Protocol (TNC and ESRI 1994c). These statistics are not independent, such that one incorrect observation point influences both the producer's and the user's accuracy.

Producer's accuracy represents the percentage of a given association that is correctly identified on the map. In other words, from the perspective of the map, what are the chances that this mapped association correctly matches the vegetation on the ground? Producer's accuracy is calculated by dividing the number of correct observation points in one mapped association class by the total number of observation points in that mapped association class. Error of omission is calculated as 1 - producer's accuracy. This error indicates the percentage of observation points that should have been mapped a given association, but were omitted.

User's accuracy represents the probability that a given location on the ground is classified correctly on the map. In other words, from the perspective of the real world vegetation, what are the chances this association on the ground correctly matches the mapped association? User's accuracy is calculated by dividing the number of correct observation points in one observed association by the total number of points at which that association was observed. Error of commission is calculated as 1 - user's accuracy. This error indicates the percentage of the observation points for a given association that were shown on the map as other associations.

Results

Vegetation Classification and Characterization

Plot sampling was conducted from June 7 to September 22, 2005 by Gregory Edinger (NY Natural Heritage) for plots within gradsects A, B, D–H, T, and U and Aissa Feldmann (NY Natural Heritage Program) for plots within gradsects K–O and Q–S with assistance from Jennifer Garrett (NY Natural Heritage Program). In total, 228 plots were sampled throughout the park (Figure 5). Table 2 provides a summary of the number of plots per each vegetation cover type and Anderson Level II category that were sampled during the course of this project.

Data from the 228 vegetation plots were entered into the NatureServe PLOTS 2.0 Database System on a Microsoft Access platform during winter 2005–2006. In the PLOTS 2.0 database, species were assigned standardized codes based on the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA, NRCS 2004). For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region. The common and scientific names of plants observed during the vegetation plot sampling are listed in Appendix D. Some tree and shrub seedlings and immature herbaceous plants could only be identified to the genus level and are therefore listed in the appendix as such.

The vegetation associations of the Upper Delaware Scenic and Recreational River were classified using PC-ORD version 4.0 Multivariate Analysis package (McCune and Mefford 1999). Plot data were exported from the NY Natural Heritage Field Form Database (FFDB) and transferred into a Microsoft Excel spreadsheet for data preparation prior to PC-ORD analyses. A dataset containing all plots with species separated by strata, excluding non-vasculars, was converted into a 228 (plots) × 621 (species by strata) matrix that was used in the following procedures:

1. CA: Hierarchical Cluster Analysis, Euclidian distance measure, and Ward's group linkage method.
2. NMS: Non-metric Multidimensional Scaling (Kruskal and Wish 1978; Clarke 1993), Sorensen (Bray-Curtis) distance measure, a random starting configuration, and a stability criterion of 0.005 were employed. Forty runs were performed with the real data, with a maximum of 400 iterations.
3. TWINSPAN: Two-Way Indicator Species Analysis (Hill and Gauch 1979) with default settings.

Due to the large size of the dataset, it is impractical to include graphical representations of these analyses in this report. The results of these classification analyses were evaluated against each other and compared to Ecological Communities of New York State (Edinger et al. 2002), Terrestrial and Palustrine Plant Communities of Pennsylvania (Fike 1999), and the National Vegetation Classification System (USNVC). For a detailed discussion of the statistical techniques used in this study, please refer to McCune and Grace (2002). Based on this evaluation, 43 preliminary vegetation associations were identified. These preliminary vegetation associations are listed in Table 3.

Vegetation Map Production

Based on the plot sampling data and the classification of 43 vegetation associations, the vegetation cover type map was revised to correct errors and create more accurate vegetation polygon boundaries at the USNVC association level. In this iteration, plot data, field observations, classification analyses, aerial photography signatures, and topographic maps were used to revise polygon boundaries and attributes.

Thematic accuracy of this preliminary vegetation association map was then assessed. Based on accuracy assessment sampling data, the association map was revised again to correct errors and create the final vegetation association polygon boundaries. In this final revision, accuracy assessment data were used in addition to the resources noted above to revise polygon boundaries and attributes. As a result, five additional vegetation associations that were not a part of the initial sampling stategy were observed during the accuracy assessment process. Combined with the original 43 vegetation associations, there is a total of 48 mapped vegetation associations represented within the park (Table 4 [due to the physical size of and amount of data in this table, it has been placed at the end of the Results section]). Two additional communities found within the park, Sparsely Vegetated Cliff and Southern New England Bog, could not be mapped but are included in the descriptions. Sparsely Vegetated Cliff is not distinguishable on aerial photography since it is located on vertical cliff faces and aerial photography provides only a bird's eye view. Southern New England Bog is found as inclusions in Highbush Blueberry Bog Thickets and is smaller than the minimum mapping unit.

A field was included in the map attribute table to indicate which United States Fish and Wildlife Service (USFWS) wetland system (*sensu* Cowardin et al. 1979) a vegetation association represents. Polygons representing wetland formations (those with temporarily flooded, seasonally flooded, saturated, semipermanently flooded, or tidal hydrologic modifiers) were tagged to the appropriate system in the USFWS wetland classification. Polygons representing vegetation that is not classed as a wetland have the value of "upland" in this field.

The resulting final vegetation association map is shown in Figure 8 and a summary table of the vegetation association distribution and abundance is provided in Table 4. The total number of hectares mapped listed in Table 4 is larger than the number of hectares in the park because the mapped polygons extend beyond the park boundary.

Accuracy Assessment

Positional Accuracy

The horizontal positional accuracy of the mosaic is 1.490 meters, which meets the Class 1 National Map Accuracy Standard (FGDC 1998b). A copy of the spreadsheet containing the x and y coordinates for each ground control point and the accuracy calculation formula is stored in the NCSU archive.

Thematic Accuracy

Based on the contingency matrix (Table 5 [due to the physical size of and amount of data in this table, it has been placed at the end of the Results section) the Kappa index for the vegetation association map was 37.4% ± 3.4%, with overall percent accuracy calculated as 42.0%. This does not meet the USGS/NPS vegetation mapping protocol requirement of 80%. The errors of commission for five of the 48 vegetation associations exceeded the USGS/NPS protocol requirement of 80%. Nineteen of the 48 associations reported errors of commission above 50%. Errors of omission for 10 of the 48 vegetation associations exceeded the USGS/NPS vegetation mapping protocol requirement of 80%. Twenty-one of the 48 vegetation associations reported errors of omission above 50%. The low errors of commission and omission indicate that many classes, particularly hardwood forest types, were not consistently distinguished by aerial photography interpretation. Three oak-dominated types were poorly distinguished from each other: Dry, Rich Oak - Hickory Forest, Northeastern Dry Oak - Hickory Forest, and Lower New England Slope Chestnut Oak Forest, with error of omission rates of 42.11%, 72.97%, and 63.64%, respectively. If treated as a single map class, error of omission for these three forest types combined would 82.02%. Hemlock - Beech - Oak Forest and Hemlock - Northern Hardwood Forest were also not consistently distinguished in the aerial interpretation, with errors of omission of 34.48 and 51.61, respectively. If treated as a single class, the error of omission for the combined forest type improves to 68.33%.

Two successional forest types, Northeastern Oak - Red Maple Successional Forest and Red Maple - Sweet Birch Hardwood Forest, with errors of omission results of 7.41% and 24.00%, respectively, were poorly predicted by the aerial photography interpretation. During accuracy assessment, Northeastern Oak - Red Maple Successional Forest was distributed across 14 other vegetation associations, and Red Maple - Sweet Birch Hardwood Forest was distributed across nine other vegetation associations, the majority of mis-assignments to Northeastern Dry Oak - Hickory Forest and Semi-rich Northern Hardwood Forest.

Vegetation Association Descriptions

Detailed local descriptions for the vegetation associations were written based on plot data, compositional statistics, photographs of each plot, thematic accuracy assessment data, the ecologists' field observations at the Upper Delaware Scenic and Recreational River and other national parks, and the other research cited in the local descriptions. These vegetation associations were then crosswalked to the United States National Vegetation Classification system (USNVC) which contains range-wide global descriptions for each association. Since the local expression of an association can differ in various locations throughout its range, the local description provides information on the park-specific expression of the type. The global description provides the broader concept of the association and may include plant species that do not occur in the park but are typical of the association elsewhere in its range.

A list of the plants found during the vegetation plot sampling and thematic accuracy assessment sampling is located in Appendix C. Detailed local and global descriptions of the vegetation associations are included in Appendix E. An index of the representative photographs of associations in the Upper Delaware Scenic and Recreational River provided after the descriptions is located in Appendix F. Each association is also crosswalked to the state classifications for

Pennsylvania and New York (Fike 1999; Edinger et al. 2002). The state conservation rank (S Rank), global conservation rank (G Rank), and classification confidence for state and global classifications are included in the descriptions. Classification confidence refers to the certainty that the association is accurately described and that the association is distinct from other similar associations. Definitions of the conservation ranks and classification confidence codes are shown in Appendix G. A bibliography for the sources cited in the global vegetation descriptions from the USNVC is provided in Appendix H.

A dichotomous key was also developed for these vegetation associations (Appendix I). The dichotomous key should be used in conjunction with the detailed vegetation community descriptions to confirm that the community selected with the key is appropriate. This key and the detailed vegetation community descriptions were used in the thematic accuracy assessment and may be used by park resource managers and others to identify vegetation communities in the park.

Project Deliverables

Final products of the vegetation mapping project are shown in Table 6. All products have been delivered to the National Park Service by the Western Pennsylvania Conservancy and the New York Natural Heritage Program.

Table 6. Summary of products resulting from the Upper Delaware Scenic and Recreational River vegetation classification and mapping project.

Product	FGCD-complaint spatial metadata
Aerial photos, including flight line map and photoindex	Yes
Photomosaic as paper copy and in digital format	Yes
Annotated field forms with vegetation plot sampling data	Not applicable
Vegetation plot sampling data in the PLOTS 2.0 database	Not applicable
Differentially corrected GPS locations of vegetation plots	Yes
Annotated field forms with thematic accuracy assessment Data	Not applicable
Thematic accuracy assessment data in the PLOTS 2.0 database	Not applicable
Differentially corrected GPS locations of thematic accuracy assessment sampling points	Yes
Digital photos representative of all vegetation types	Not applicable
Final map of vegetation associations as paper copy and in digital format	Yes
Final report as paper copy and in digital format	Not applicable

Table 4. Number of polygons, total mapped hectares, and mapped hectares within the park boundary for vegetation associations and Anderson Level II categories of the Upper Delaware Scenic and Recreational River.

Vegetation Association	Number of Polygons	Total Mapped Hectares	Mapped Hectares within Park Boundary
Birch - Willow Riverbank Shrubland	45	40.46	39.76
Bitternut Hickory Lowland Forest	14	28.55	28.55
Central Appalachian Blueberry Shrubland	11	11.39	8.78
Central Appalachian Northern Hardwood Forest	125	1,433.76	1,129.31
Dry, Rich Oak - Hickory Forest	106	1,290.40	1,019.38
Eastern Cattail Marsh	6	2.29	1.62
Eastern Reed Marsh	1	0.38	0.00
Hairy-fruit Sedge Wetland	19	16.60	16.60
Hemlock - Beech - Oak Forest	429	5,185.68	4,385.22
Hemlock - Hardwood Swamp	20	33.03	13.33
Hemlock - Northern Hardwood Forest	160	1,393.69	1,125.58
Hickory - Eastern Redcedar Rocky Woodland	2	3.94	3.94
High Allegheny Rich Red Oak - Sugar Maple Forest	22	189.97	177.65
Highbush Blueberry Bog Thicket	3	1.38	1.02
Inland Pitch Pine - Oak Forest	5	59.96	59.96
Japanese Knotweed Gravelbar	61	61.30	61.30
Larch Plantation	1	0.80	0.80
Little Bluestem - Poverty Grass Low- to Mid- Elevation Outcrop Opening	22	12.65	12.65
Little Bluestem Old Field	7	11.85	11.57
Lower New England Slope Chestnut Oak Forest	211	3,579.58	2,709.86
Mixed Forb Marsh	18	17.28	15.66
Mixed Pine Conifer Plantation	69	92.03	82.56
Northeastern Dry Oak - Hickory Forest	174	3,169.09	2,779.69
Northeastern Modified Successional Forest	61	142.44	136.53
Northeastern Oak - Red Maple Successional Forest	166	672.25	593.15
Northeastern Old Field	76	111.54	107.68
Northeastern Successional Shrubland	38	66.15	61.12
Northeastern Temperate Cobble Scour Rivershore	24	7.62	7.62
Northern Riverside Rock Outcrop	24	6.35	6.35
Pitch Pine Rocky Summit	7	19.90	16.26
Red Maple - Sweet Birch Hardwood Forest	193	724.01	600.73
Red Oak - Heath Woodland / Rocky Summit	33	137.98	106.15
Reed Canarygrass Eastern Marsh	170	223.41	223.42
Ridgetop Scrub Oak Barrens	1	0.33	0.33
River Birch Low Floodplain Forest	33	32.72	31.39
Riverside Prairie Grassland	29	36.75	36.75
Semi-rich Northern Hardwood Forest	94	1,088.15	945.45
Silver Maple Floodplain Forest	30	49.58	49.58
Southern New England Red Maple Seepage Swamp	19	22.04	12.48
Speckled Alder Swamp	9	4.69	2.14
Steeplebush / Reed Canarygrass Successional Wet Meadow	12	9.76	8.86
Sugar Maple - Ash - Basswood Northern Rich Mesic Forest	17	141.62	138.09
Sugar Maple Floodplain Forest	3	5.17	5.17
Swamp Forest - Bog Complex (Spruce Type)	1	4.68	0.00
Sycamore - Mixed Hardwood Floodplain Forest	76	139.96	131.96
Water-willow Rocky Bar and Shore	1	3.36	3.36
White Pine - Oak Forest	36	360.18	314.59
Willow River - Bar Shrubland	1	0.24	0.24
Anderson Level II Category			
Bare Exposed Rock	2	2.17	1.49
Beaches	2	0.67	0.35
Commercial and Services	191	464.36	431.48
Cropland and Pasture	148	907.59	800.05
Industrial	1	2.87	2.87
Orchards, Nurseries, and Horticultural Areas	1	4.36	4.36
Other Agricultural Land	4	2.10	2.10
Pond	93	42.95	28.60
Reservoirs	2	4.79	4.79
Residential	375	1,855.34	1,628.62
Streams and Canals	39	1,553.60	1,538.52
Strip Mines, Quarries, and Gravel Pits	30	84.18	64.74
Transitional Area	22	147.66	145.99
Transportation, Communications, and Utilities	51	392.87	372.96
Total	3,646	26,112.45	22,251.06

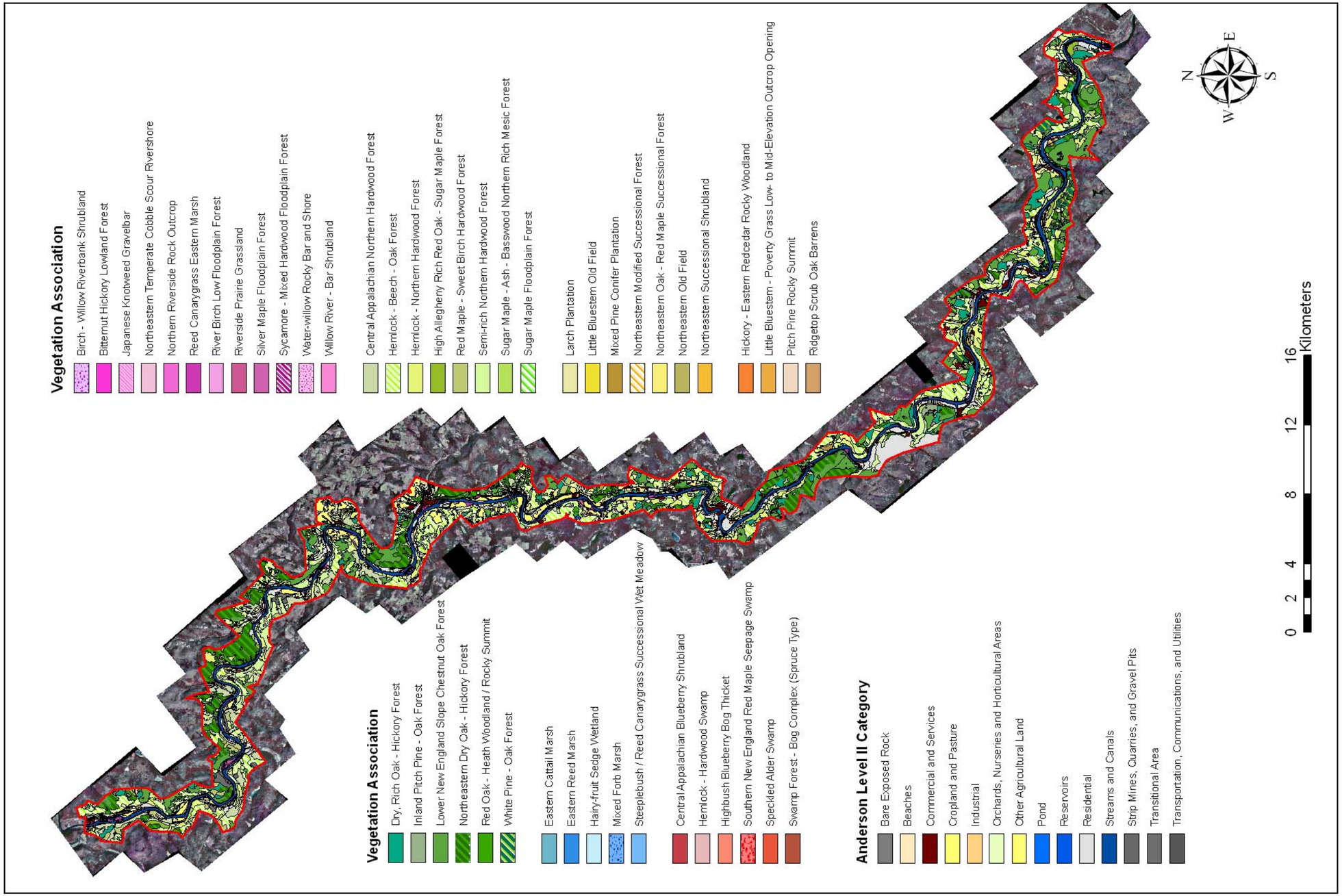


Figure 8. Vegetation associations and Anderson Level II categories of the Upper Delaware Scenic and Recreational River.

Table 5. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation association map for the Upper Delaware Scenic and Recreational River.

	Mapped Associations																								
Accuracy Assessment Observation	Birch - Willow Riverbank Shrubland	Bitternut Hickory Lowland Forest	Central Appalachian Blueberry Shrubland	Central Appalachian Northern Hardwood Forest	Dry, Rich Oak - Hickory Forest	Eastern Cattail Marsh	Eastern Reed Marsh	Hairyfruit Sedge Wetland	Hemlock - Beech - Oak Forest	Hemlock - Hardwood Swamp	Hemlock - Northern Hardwood Forest	Hickory - Eastern Redcedar Rocky Woodland	High Allegheny Rich Red Oak - Sugar Maple Forest	Highbush Blueberry Bog Thicket	Inland Pitch Pine - Oak Forest	Japanese Knotweed Gravelbar	Larch Plantation	Little Bluestem Old Field	Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening	Lower New England Slope Chestnut Oak Forest	Mixed Forb Marsh	Mixed Pine Conifer Plantation	Northeastern Dry Oak - Hickory Forest	Northeastern Modified Successional Forest	Northeastern Oak - Red Maple Successional Forest	Northeastern Old Field
Birch - Willow Riverbank Shrubland																2										
Bitternut Hickory Lowland Forest		3																							1	
Central Appalachian Blueberry Shrubland			2					1											1							
Central Appalachian Northern Hardwood Forest	1			18					1		1		1										1	1	2	
Dry, Rich Oak - Hickory Forest					5				1				1							2			1			
Eastern Cattail Marsh																										
Eastern Reed Marsh							1																			
Hairy-fruit Sedge Wetland																2										
Hemlock - Beech - Oak Forest					1				10		8		1							1		1			2	
Hemlock - Hardwood Swamp									1	2															1	
Hemlock - Northern Hardwood Forest				3					7		16														2	
Hickory - Eastern Redcedar Rocky Woodland												1														
High Allegheny Rich Red Oak - Sugar Maple Forest					1								8										1			
Highbush Blueberry Bog Thicket																										
Inland Pitch Pine - Oak Forest																										
Japanese Knotweed Gravelbar																7										
Larch Plantation																										
Little Bluestem Old Field																										
Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening																			3							
Lower New England Slope Chestnut Oak Forest					8				2		1		1		1					21			4			
Mixed Forb Marsh																					1				1	
Mixed Pine Conifer Plantation																						4			1	
Northeastern Dry Oak - Hickory Forest				3	5				2				4		1					5			27			
Northeastern Modified Successional Forest																								5	1	
Northeastern Oak - Red Maple Successional Forest																		1							2	
Northeastern Old Field																			1							1
Northeastern Successional Shrubland																								1		1
Northeastern Temperate Cobble Scour Rivershore																1										
Northern Riverside Rock Outcrop																										
Pitch Pine Rocky Summit									1																	
Red Maple - Sweet Birch Hardwood Forest				3	1				1											2			2		2	
Red Oak - Heath Woodland / Rocky Summit																										
Reed Canarygrass Eastern Marsh								1								5										
Ridgetop Scrub Oak Barrens																										
River Birch Low Floodplain Forest																										
Riverside Prairie Grassland																1										
Semi-rich Northern Hardwood Forest					3				2		1		1											1	5	
Silver Maple Floodplain Forest																										
Southern New England Red Maple Seepage Swamp										1															1	
Speckled Alder Swamp	1																								1	
Steeplebush / Reed Canarygrass Successional Wet Meadow	1							1			1													1		
Sugar Maple - Ash - Basswood Northern Rich Mesic Forest					1				1				2											1		
Sugar Maple Floodplain Forest								2																		
Swamp Forest - Bog Complex (Spruce Type)										1																
Sycamore - Mixed Hardwood Floodplain Forest	1																									
Water-willow Rocky Bar and Shore																										
White Pine - Oak Forest											3									2		1	1		3	
Willow River-Bar Shrubland																										
Total	4	3	2	27	25	0	0	5	29	4	31	1	19	0	2	18	0	1	5	33	1	6	37	11	27	2
Error of Omission (Percent correct)	0.00%	100.00%	100.00%	66.67%	20.00%	0.00%	0.00%	0.00%	34.48%	50.00%	51.61%	100.00%	42.11%	0.00%	100.00%	38.89%	0.00%	0.00%	60.00%	63.64%	100.00%	66.67%	72.97%	45.45%	7.41%	50.00%

Table 5. Contingency matrix and calculated errors for the thematic accuracy assessment of the vegetation association map for the Upper Delaware Scenic and Recreational River (continued).

	Mapped Associations																							
Accuracy Assessment Observation	Northeastern Successional Shrubland	Northeastern Temperate Cobble Scour	Northern Riverside Outcrop	Pitch Pine Rocky Summit	Red Maple - Sweet Birch Hardwood Forest	Red Oak - Heath Woodland / Rocky Summit	Reed Canarygrass Eastern Marsh	Ridgetop Scrub Oak Barrens	River Birch Low Floodplain Forest	Riverside Prairie Grassland	Semi-Rich Northern Hardwood Forest	Silver Maple Floodplain Forest	Southern New England Red Maple Seepage Swamp	Speckled Alder Swamp	Steeplebush / Reed Canarygrass Successional Wet Meadow	Sugar Maple - Ash - Basswood Northern Rich Mesic Forest	Sugar Maple Floodplain Forest	Swamp Forest - Bog Complex (Spruce Type)	Sycamore - Mixed Hardwood Floodplain Forest	Water-willow Rocky Bar and Shore	White Pine - Oak Forest	Willow River-Bar Shrubland	Grand Total	Error of Commission (Percent Correct)
Birch - Willow Riverbank Shrubland							1			1									3	1			8	0.00%
Bitternut Hickory Lowland Forest			1				4		3										1				13	23.08%
Central Appalachian Blueberry Shrubland				1	1	2																	8	25.00%
Central Appalachian Northern Hardwood Forest						1					1								1				29	62.07%
Dry, Rich Oak - Hickory Forest					1						2												13	38.46%
Eastern Cattail Marsh							1																1	0.00%
Eastern Reed Marsh																							1	100.0%
Hairy-fruit Sedge Wetland			1						1														4	0.00%
Hemlock - Beech - Oak Forest						3					2					2							31	32.26%
Hemlock - Hardwood Swamp																							4	50.00%
Hemlock - Northern Hardwood Forest																3			1				32	50.00%
Hickory - Eastern Redcedar Rocky Woodland																							1	100.00%
High Allegheny Rich Red Oak - Sugar Maple Forest			1		1						1								3				16	50.00%
Highbush Blueberry Bog Thicket													1										1	0.00%
Inland Pitch Pine - Oak Forest						1																	1	0.00%
Japanese Knotweed Gravelbar							4																11	63.64%
Larch Plantation					1																		1	0.00%
Little Bluestem Old Field																							0	0.00%
Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening																							3	100.00%
Lower New England Slope Chestnut Oak Forest						8					3										1		50	42.00%
Mixed Forb Marsh																							2	50.00%
Mixed Pine Conifer Plantation					2																		7	57.14%
Northeastern Dry Oak - Hickory Forest					6	7			1		10		1			5			2		2		81	33.33%
Northeastern Modified Successional Forest							1		1		1												9	55.56%
Northeastern Oak - Red Maple Successional Forest																							3	66.67%
Northeastern Old Field							1		1	1													5	20.00%
Northeastern Successional Shrubland	3						3		1														9	33.33%
Northeastern Temperate Cobble Scour Rivershore																							1	0.00%
Northern Riverside Rock Outcrop			1																				1	100.00%
Pitch Pine Rocky Summit				3																			4	75.00%
Red Maple - Sweet Birch Hardwood Forest					6						1				1	1			2				22	27.27%
Red Oak - Heath Woodland / Rocky Summit																							0	0.00%
Reed Canarygrass Eastern Marsh		3					11		3										1				24	45.83%
Ridgetop Scrub Oak Barrens								1															1	100.00%
River Birch Low Floodplain Forest							1		2										1				4	50.00%
Riverside Prairie Grassland			1				2			2													6	33.33%
Semi-rich Northern Hardwood Forest					5	1					23								1				43	53.49%
Silver Maple Floodplain Forest							1		4	1									5				11	0.00%
Southern New England Red Maple Seepage Swamp					1								3		1				1				8	37.50%
Speckled Alder Swamp														1									3	33.33%
Steeplebush / Reed Canarygrass Successional Wet Meadow							1								1								6	16.67%
Sugar Maple - Ash - Basswood Northern Rich Mesic Forest						1										5							11	45.45%
Sugar Maple Floodplain Forest																			1				3	0.00%
Swamp Forest - Bog Complex (Spruce Type)																							1	0.00%
Sycamore - Mixed Hardwood Floodplain Forest							1												19	1			25	76.00%
Water-willow Rocky Bar and Shore																				2			2	100.00%
White Pine - Oak Forest					1	3															14		28	50.00%
Willow River-Bar Shrubland																							0	0.00%
Total	3	3	5	4	25	27	32	1	17	5	44	0	5	1	3	16	0	0	42	4	17	0	547	
Error of Omission (Percent correct)	100.00%	0.00%	20.00%	75.00%	24.00%	0.00%	34.38%	100.00%	11.76%	40.00%	52.27%	0.00%	60.00%	100.00%	33.33%	31.25%	0.00%	0.00%	45.24%	50.00%	82.35%	0.00%		

Total Points Correct	230
Overall Accuracy	42.0%
Kappa Index	37.4%
90% Confidence Interval	3.4%

Discussion

Vegetation Characterization and Classification

This study at Upper Delaware Scenic and Recreational River identified 50 vegetation associations, 48 of which could be mapped (Table 4). Forested vegetation associations dominated the park landscape, accounting for 81.6% (16,469 ha [40,696 ac]) of the park area. The most abundant association in Upper Delaware Scenic and Recreational River is Hemlock - Beech - Oak Forest, covering approximately one-fifth (19.70% [4,385.2 ha {10,836 ac}]) of the park area. This type is typically associated with acidic bedrock on moderate slopes with a northerly aspect. This community often appears in a degraded form due to timber harvesting, characterized by a greatly decreased eastern hemlock (*Tsuga canadensis*) component and increased American beech component in shrub and subcanopy layers from stump and root sprouting. Several oak-dominated types were in high abundance, such as Northeastern Dry Oak - Hickory Forest (12.5%), Lower New England Slope Chestnut Oak Forest (12.2%), and Dry, Rich Oak - Hickory Forest (4.6%), which collectively covered nearly a third of the park (29.2% [6,507.7 ha{16,080.8 ac}]). All three of these types are typically associated with mid to upper slopes with thin rocky, acidic soils. Lower New England Slope Chestnut Oak Forest tends to be more common along knobs and ridge tops above the other two oak-dominated types and is strongly dominated by chestnut oak (*Quercus prinus*). Northeastern Dry Oak - Hickory Forest may contain chestnut oak, but usually as a co-dominant with several other oak species (*Quercus* spp.) and occasionally hickory species (*Carya* spp.). Dry, Rich Oak - Hickory Forest appears to be slightly more mesic with somewhat richer soils than the other two oak types and is characterized by a greater cover of hickory species (shagbark hickory [*Carya ovata*] and pignut hickory [*C. glabra*]).

Another major class of forested vegetation types in the park contains several associations dominated by northern hardwoods, in whole or in part, including Central Appalachian Northern Hardwood Forest (5.1%), Hemlock - Northern Hardwood Forest (5.1%), and Semi-rich Northern Hardwood Forest (4.2%), which collectively cover about 14.4% (3,200.3 ha [7,908.1 ac]) of the park. The northern hardwood-dominated forests are associated with mesic soils on gentle to steep slopes, often with a northern aspect. These forest types are typically found on lower to mid-slopes and generally downslope from the dry oak forest associations noted above. Central Appalachian Northern Hardwood Forest is characterized by a canopy dominated by sugar maple, red maple, American beech, and sweet birch, and generally lacks indicators of rich soils in the herb layer. Hemlock - Northern Hardwood Forest is similar but also contains a significant cover (>25%) of eastern hemlock with a somewhat depauperate herb layer where hemlock cover is high. Semi-rich Northern Hardwood Forest is similar to the above two associations, but has a greater cover of rich site indicators including sugar maple, basswood (*Tilia americana*), and hop hornbeam (*Ostrya virginiana*) and a more diverse herb layer. A fourth forest type, High Allegheny Rich Red Oak - Sugar Maple Forest, is somewhat intermediate between the oak-dominated forests and the northern hardwood dominated forests. The canopy in this type is dominated by tulip poplar, northern red oak, white oak, and sugar maple. The shrub and herb layers can be diverse and may contain enrichment indicators.

Several successional forest types also occur in the park, including Northeastern Modified Successional Forest, Northeastern Oak - Red Maple Successional Forest, and Red Maple - Sweet Birch Hardwood Forest, which collectively accounted for about 6.0 % (1,330.4 ha [3,287.5 ac]) of the mapped park area. Northeastern Modified Successional Forest is associated with abandoned agricultural land, which in the park is often limited to level floodplain terraces. The community is often very weedy and dominated by early successional native and nonnative invasive species (e.g., black locust [*Robinia pseudoacacia*], bitternut hickory, black cherry, red maple, tree of heaven [*Ailanthus altissima*], white ash [*Fraxinus americana*], Japanese barberry [*Berberis thunbergii*], and multiflora rose [*Rosa multiflora*]). Northeastern Oak - Red Maple Successional Forest is also associated with former pasture and agricultural land, but is less weedy and often has a significant component of young eastern white pine (*Pinus strobus*), northern red oak, and American beech, in addition to early successional canopy species typical of Northeastern Modified Successional Forest. Red Maple - Sweet Birch Hardwood Forest is widespread in the park, typically in small patches on abandoned agricultural land as well as stands subject to recent timber harvesting. These stands are often strongly dominated by red maple and/or sweet birch. In silvicultural stands, other canopy species may be occasional to abundant, reflecting the composition of the pre-harvest stands (i.e., significant oak cover in former oak-dominated forests, and northern hardwood cover in former northern hardwood stands).

Two conifer plantation associations occur within the park, Larch Plantation and Mixed Pine Conifer Plantation, accounting for 0.4% (83.4 ha [206.1 ac]) of the park area. These associations occur on a variety of soils, slopes, and aspects; often on former agricultural land. Stand structure and composition is variable, reflecting the initial stand plantings and the degree of silvicultural management. Some stands remain fairly monotypic with low diversity, while other, often unmanaged, stands are slowly reverting to successional hardwood forests.

The vegetation mapping includes another seven terrestrial forest and woodland types that have few occurrences and/or limited total area, including Hickory - Eastern Redcedar Rocky Woodland, Inland Pitch Pine - Oak Forest, Pitch Pine Rocky Summit, Red Oak - Heath Woodland / Rocky Summit, Ridgetop Scrub Oak Barrens, Sugar Maple - Ash - Basswood Northern Rich Mesic Forest, and White Pine - Oak Forest. These seven associations collectively accounted for 2.9% (639.3 ha [1,579.7 ac]) of the park. Hickory - Eastern Redcedar Rocky Woodland, Inland Pitch Pine - Oak Forest, Pitch Pine Rocky Summit, Red Oak - Heath Woodland / Rocky Summit, and Ridgetop Scrub Oak Barrens associations were associated with xeric ridgetops and upper slopes and, in some instances, steep rock outcrops and cliffs. Hickory - Eastern Redcedar Rocky Woodland, Pitch Pine Rocky Summit, and Ridgetop Scrub Oak Barrens associations are rare or uncommon in Pennsylvania and/or New York. The individual occurrences were typically a few hectares in size, with many more small occurrences possibly present as inclusions in other vegetation types (especially dry oak forest associations). Sugar Maple - Ash - Basswood Northern Rich Mesic Forest tends to be restricted to mesic toeslopes with rich soils and may also occur as inclusions in the various northern hardwood types. White Pine - Oak Forest occurs on flat to gently sloping landscapes and resembles dry oak forests in composition, but with a significant eastern white pine component. An additional community found within the park, Sparsely Vegetated Cliff, could not be mapped because it is located on vertical cliff faces and therefore is not distinguishable on aerial photography.

The park contains three successional non-forested associations. Northeastern Old Field and Northeastern Successional Shrubland accounted for 0.8% (168.8 ha [417.1 ac]) of the area mapped within the park, and are associated with former agricultural land and represent relatively recent abandonment. These associations are susceptible to invasion by nonnative species. The third successional type, Little Bluestem Old Field, occurred as small patches on dry to dry-mesic, often stony soils in areas with evidence of past disturbance (non-agricultural). These stands resembled old field vegetation but with a significant cover of little bluestem (*Schizachyrium scoparium*).

The park also includes two non-forested vegetation types associated with dry ridgetops and outcrops, the Central Appalachian Blueberry Shrubland and the Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening. Central Appalachian Blueberry Shrubland is a fire-dependent association limited to small patches on ridgetop flats and gently rolling summits. Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening occurs in a similar setting, but often with a higher cover of bare rock and a lower cover of ericads (i.e., *Vaccinium* spp.). Both vegetation types have relatively low cover of tall shrubs and trees, reflecting thin, droughty, poor soils and frequent fires. These two associations tend to occur in patches less than one hectare in size.

The vegetation mapping includes nine non-riparian wetland associations, three forested, three shrubland, and three herbaceous, with a collective area of only 80.5 ha (198.9 ac [0.4% of park]) within the park boundary. The relative paucity of non-riparian wetlands is an artifact of the topography within the park boundary, characterized by moderate to steep slopes from the edge of the floodplain to the park boundary, usually at ridge lines and summits. The lack of level, poorly drained terrain does not favor any significant wetland formation. One forested wetland type (Swamp Forest - Bog Complex (Spruce Type)) and one herbaceous wetland type (Eastern Reed Marsh) each have a single occurrence within the mapped project area but outside of the park boundary. The two forested wetland types within the park boundary are Hemlock - Hardwood Swamp and Southern New England Red Maple Seepage Swamp. Occurrences of both types are generally less than two hectares in size. Hemlock - Hardwood Swamp association tends to occur on peat soils and is often associated with headwater seep areas. Southern New England Red Maple Seepage Swamp occurs in a variety of settings, usually on mineral soils where drainage is poor and the soil is seasonally saturated or shallowly inundated.

The three non-riparian shrubland wetland types include Highbush Blueberry Bog Thicket, Speckled Alder Swamp, and Steeplebush / Reed Canarygrass Successional Wet Meadow. Highbush Blueberry Bog Thicket is relatively rare in the park, with only 1.02 ha (2.52 ac) mapped within the park boundary. This association occurs in small depressions with thin to moderate peat deposits over acidic sandstone bedrock. The vegetation is characterized by moderate to dense shrub growth, typically dominated by highbush blueberry (*Vaccinium corybosum*) with a sphagnum mat below. Speckled Alder Swamp association is also limited in the park, with only 2.14 ha (5.29 ac) within the park boundary. This vegetation type was associated with small seasonally flooded depressions and stream headwater areas. Steeplebush / Reed Canarygrass Successional Wet Meadow is the wetland equivalent of a successional old field, and is associated with somewhat poorly drained to poorly drained areas of abandoned cropland and pastures. As with the other non-riparian wetland types, this association was uncommon (only 8.86 ha [21.89 ac]) in the park. Another non-riparian wetland type found

within the park is Southern New England Bog. This association is found as inclusions smaller than the minimum mapping unit within Highbush Blueberry Bog Thickets and could not be mapped.

There are two non-riparian herbaceous wetland types within the park boundary, Eastern Cattail Marsh and Mixed Forb Marsh. Eastern Cattail Marsh is uncommon, with a total area within the park of 1.62 ha (4.0 ac). This association occurs in depressions and basins with permanently flooded and/or saturated soils. The most abundant non-riparian wetland type in the park was Mixed Forb Marsh (15.66 ha [38.7 ac {0.1% of park area}]). This association occurs in depressions, drainages, and basins that contain ponded water throughout the year. In general, water flow out of the sites is restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites.

There are 14 riparian vegetation associations, five forested, two shrubland, and seven herbaceous, in the Upper Delaware Scenic and Recreational River, collectively covering approximately 2.9% (642.05 ha [1,586.5 ac]) of the park. The cover of some riparian associations, especially shrubland and herbaceous types, are likely greatly underestimated because the aerial photography used was taken at a time of relatively high water when the vegetation was dormant. As a result, the extent of types of riparian associations exposed only at low water later in any given year was underestimated. The five forested riparian associations reflect a range of hydrologic and geomorphic settings. Sugar Maple Floodplain Forest tends to occur on higher, less frequently flooded terraces. These terraces often appear to have been former agricultural lands, suggesting sugar maple dominance may be an artifact of sugar maple colonization shortly following abandonment. Bitternut Hickory Lowland Forest tends to occur at the transition between the higher and lower floodplain terraces, and may routinely experience some flooding during average flood events, albeit for a relatively short duration. This vegetation type typically occurs as long, narrow stands at or below the edge of high terraces and occasionally on island terraces (e.g., Butternut Island near Callicoon). While this association is common on the Upper Delaware River, it is uncommon elsewhere in the state. Silver Maple Floodplain Forest is uncommon in the Upper Delaware River and is associated with lower gradient reaches, typically pool sections, where finer sediments can accumulate along the shore and on islands. These stands are characterized by large silver maples (*Acer saccharinum*), and sparse shrub and sub-canopy layers on intermediate height terraces that are inundated for some period of time during average flood events. Sycamore - Mixed Hardwood Floodplain Forest occurs on lower shoreline terraces and islands and tolerates increased flood event duration, frequency, and flow velocity. A majority of vegetation in this community tolerates scouring from water, corrosion (scouring by transported streambed materials such sand, gravel cobbles, and boulders), and ice scouring. The most frequently flooded riparian forest type is River Birch Low Floodplain Forest, which occurs along the lowest shoreline reaches and low island terraces and island heads. Frequent exposure to high flow velocity and ice scouring tends to give this forest type a stunted appearance, with most stems appearing battered and bent downstream. The substrate in this association is usually coarse cobbles and boulders, reflecting high stream velocities. All of the floodplain forest types are susceptible to heavy infestations of nonnative invasive plant species. Sugar Maple Floodplain Forest is resistant to Japanese knotweed (*Polygonum cuspidatum*) due to shading, but may have significant cover of shade-tolerant species such as Japanese barberry. Bitternut Hickory Lowland Forest, Silver Maple Floodplain

Forest, and Sycamore - Mixed Hardwood Floodplain Forest often have moderate to dense stands of Japanese knotweed in the understory, likely resulting in a significant reduction in biodiversity in the herbaceous layer. River Birch Low Floodplain Forest seems to have a lower incidence of nonnative invasive plant species, perhaps due to the frequent, intense flood disturbances.

The two shrubland riparian vegetation types, Birch - Willow Riverbank Shrubland and Willow River-Bar Shrubland, occur on very low bars and the heads of river islands. Willow River-Bar Shrubland is characterized by stunted willows (*Salix* spp.) growing in coarse gravel and cobble substrate. This vegetation type is frequently flooded and is routinely scoured by stream sediment and ice, preventing succession beyond an open dwarfed willow shrubland. Birch - Willow Riverbank Shrubland experiences slightly less intense flood flows and scouring and may attain tall shrub stature. Should instream conditions change, such that this community experiences less direct flood flow and scouring, it may quickly succeed into Sycamore - Mixed Hardwood Floodplain Forest or perhaps River Birch Low Floodplain Forest.

The seven riparian herbaceous vegetation associations include: Water-willow Rocky Bar and Shore, Northeastern Temperate Cobble Scour Rivershore, Hairy-fruit Sedge Wetland, Reed Canarygrass Eastern Marsh, Riverside Prairie Grassland, Northern Riverside Rock Outcrop, and Japanese Knotweed Gravelbar. Water-willow Rocky Bar and Shore is an emergent vegetation type characterized by a single species, American water-willow (*Justicia americana*), and occurs in gravelly substrates near island heads and shorelines that rarely, if ever, dry out. While never common on the Delaware River within the park, its extent is likely underestimated due to seasonal dormancy during the period aerial photography was obtained. Northeastern Temperate Cobble Scour Rivershore occurs at a slightly higher relative elevation than Water-willow Rocky Bar and Shore and is usually exposed by mid-summer. This association is characterized by a high relative cover of weedy nonnative invasive annuals. These species appear to take advantage of substrate that experiences severe stream velocities and scouring during flood events that prevent the establishment and persistence of perennial vegetation. Hairy-fruit Sedge Wetland and Reed Canarygrass Eastern Marsh associations tend to co-occur, particularly along some long reaches where the river channel is somewhat confined. In general, Hairy-fruit Sedge Wetland occurs lower on the shoreline and appears to tolerate longer periods of flooding and/or scouring, while Reed Canarygrass Eastern Marsh often dominates the upper portion of the shoreline. These vegetation types mix considerably at intermediate shoreline positions. Reed Canarygrass Eastern Marsh is the single most abundant riparian vegetation type (223.41 ha [552.06 ac]) in the park and should be a point of concern due to the uncertain status of reed canarygrass (*Phalaris arundinacea*) as a native or nonnative invasive species. If the genome present in the park is a nonnative invasive strain, then its aggressive ability to colonize and form near monotypic stands may reduce biodiversity within the riparian zone.

Riverside Prairie Grassland is a rare riparian herbaceous association along the Delaware River and contains several populations of one rare plant, eastern sand cherry (*Prunus pumila* var. *depressa*). This vegetation type is associated with coarse sandy-gravel to small cobble substrates and is frequently flooded but often droughty by late summer. The geomorphic setting required by this association appears to be very specific as it typically occurs in small patches with the same substrate and approximate stage height. In a few instances, on point bars and low islands, these conditions are met over a larger area, resulting in significantly larger occurrences.

Northern Riverside Rock Outcrop riparian herbaceous association occurs where the river has exposed bedrock outcrops, with Skinner's Falls being the most dramatic example. These areas are characterized by sparse vegetation, restricted to crevices where sediment may accumulate and plants can anchor themselves. Vegetation is a variable mix of riparian shrubs and perennial herbs.

The remaining riparian herbaceous association is Japanese Knotweed Gravelbar, which was mapped on 61.3 ha (151.5 ac [0.3% of the park area]) within the park. This is an underestimate of the total extent of Japanese knotweed as it does not reflect its invasion into many of the other riparian forest associations. The actual impact of this nonnative invasive species is likely much greater. Japanese knotweed is a serious concern in the riparian zone of the Upper Delaware Scenic and Recreational River as it tends to form stable, monotypic stands that exclude native species and reduce biodiversity. It appears that it may also interfere with woody plant regeneration and may threaten the cycle of riparian forest destruction and regeneration characteristic of large river systems.

Fourteen Anderson Level II categories were assigned to polygons that represented non-vegetation associations within the park such as roads and agricultural areas. In total, Anderson Level II categories accounted for 5,026.92 ha (12,421.74 ac) mapped within the park.

Vegetation Map Production

The final vegetation map for Upper Delaware Scenic and Recreational River depicts 48 vegetation associations and 14 Anderson Level II categories based on aerial photography that was flown in March 2004. Since that time, the vegetation in the park continues to change. Continued natural succession in successional herbaceous, shrubland, and forest associations will influence vegetation composition. Despite these continual changes, the vegetation map produced by this project provides critical baseline data for park resource managers.

The majority of the park (approximately 85% of the area) contains deciduous hardwood and mixed deciduous hardwood-conifer forest, which can be very difficult to differentiate into associations through aerial photography interpretation. The park is also characterized by steep slopes, which increases the difficulty of accurately identifying transitions between forest types. Additionally, the varied landuse and disturbance history has significantly altered the vegetational composition of portions of the park thus creating further challenges for the classification and mapping of the vegetation. Considering these influences, a Kappa index of well below 80% as reported for this park's vegetation map is expected. Because the map errors that were identified during accuracy assessment have been corrected in the final vegetation association map, this final map is more accurate than reported in the accuracy assessment results section. Re-assessing the thematic accuracy of the final vegetation association map would require another round of intensive field sampling. The costs of a second round of sampling do seem justified simply to quantify the level of increased accuracy of the final map.

One challenge in developing the vegetation map for Upper Delaware Scenic and Recreational River is the fact that the majority of the Upper Delaware Scenic and Recreational River is in private ownership and vegetation classification and accuracy assessment sampling was limited to gradsect blocks on public and private property where access could be obtained. Permission for

private land access was granted for only 17 gradsect blocks for the collection of vegetation plot data used to develop the preliminary vegetation map (approximately 15% of the park area). Permission for the original 17 gradsect blocks plus an additional 10 gradsect blocks (for a total of 27 blocks) was gained for the thematic accuracy assessment portion of the project that contributed to the development of the final vegetation map.

Recommendations for Future Projects

Nonnative invasive species are a major threat to the native vegetation at the Upper Delaware Scenic and Recreational River, particularly in disturbed areas and in the riparian zone of the Delaware River. Of greatest concern is Japanese knotweed, which is widespread throughout the riparian zone of the park. This species can form dense monotypic stands that can reduce biodiversity through the exclusion of native riparian herbs and interfere with the recruitment of riparian shrub and tree species. A second nonnative invasive species of concern is the potentially exotic strain of reed canarygrass. Repeated introductions of exotic agronomically important genotypes to North America have resulted in the invasion of many natural habitats throughout North America by a highly aggressive strain of reed canarygrass (Lavergne and Molofsky 2004). Similar to Japanese knotweed, reed canarygrass forms extensive colonies throughout the riparian zone of the park, which are also characterized by low plant diversity and appear to be displacing the Hairy-fruit Sedge Wetland. Although little work has been done to examine differences between native and exotic populations of reed canarygrass, the use of specific genetic markers may enable one to distinguish native populations from exotic ones. Effective means to control both of these species at the landscape-scale required for the park have yet to be developed but should be considered in future management efforts.

Another challenge for this park is the management of vegetation (native and nonnative invasives) in a park where the majority of land is in private ownership. The park will need to continue to educate private landowners on the need to responsibly manage their lands, promote native biodiversity, and control the spread and impact of nonnative invasive species.

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Appendix A. Aerial photograph interpretation key to vegetation cover types and Anderson Level II categories for the Upper Delaware Scenic and Recreational River for March 2004 color infrared aerial photography.

1. Individual tree crowns visible as gray, black, or pink signatures of varying architecture. Trees cover greater than 25% of area. (If buildings, structures, parking lots, and roads are present see couplet 18 below).

    2. Signatures of at least 25% of the trees are pink and conical, indicating evergreen trees.

        3. Signatures of at least 75% of the trees are pink and conical, creating a near continuous pink canopy or an open canopy of conical pink crowns.

            4. Tree crowns occur in visible rows or organized patterns. Stand usually has distinct, linear edges. ..... **Evergreen Plantation**

            4. Tree crowns do not occur in visible rows or organized patterns. Stand does not usually have distinct, linear edges.

                5. Tree crowns cover 25-60% of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present. ..... **Evergreen Woodland**

                5. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.

                    6. Signature under canopy is black, indicating standing water. Forest occurs in a swale, depression, or low topographic position. ..... **Seasonally Flooded Evergreen Forest**

                    6. Signature under canopy is white, light gray, or pink, indicating leaf litter or vegetation. Forest occurs in terrestrial setting or adjacent to a river or stream.

                        7. Forest occurs in a terrestrial setting, not adjacent to a dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Evergreen Forest**

                        7. Forest occurs immediately adjacent to the dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Temporarily Flooded Evergreen Forest**

        3. Signatures of 25–75% of the trees are pink and conical. The canopy contains light to dark gray deciduous tree crowns interspersed with pink, conical evergreen tree crowns.

8. Tree crowns cover 25–60% of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.

    9. Signature under canopy is black or speckled black, indicating standing water. Woodland occurs in a swale, depression, or low topographic position. ..... **Seasonally Flooded Mixed Evergreen - Deciduous Woodland**

    9. Signature under canopy is white, light gray, or pink, indicating leaf litter or vegetation. Woodland occurs in terrestrial setting or adjacent to a river or stream.

        10. Forest occurs in a terrestrial setting, not adjacent to a dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Mixed Evergreen - Deciduous Woodland**

        10. Forest occurs in a low, flat area, adjacent to the dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Temporarily Flooded Mixed Evergreen - Deciduous Woodland**

8. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.

    11. Signature under canopy is black, indicating standing water. Forest occurs in a swale, depression, or low topographic position. ..... **Seasonally Flooded Mixed Evergreen - Deciduous Forest**

    11. Signature under canopy is white, light gray, or pink, indicating leaf litter or vegetation. Forest occurs in terrestrial setting or adjacent to a river or stream.

        12. Forest occurs in a terrestrial setting, not adjacent to a dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Mixed Evergreen - Deciduous Forest**

        12. Forest occurs in a low, flat area, adjacent to the dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Temporarily Flooded Mixed Evergreen - Deciduous Forest**

2. Signatures of trees are light to dark gray or black, indicating cold-deciduous trees. Less than 25% of the trees are pink and conical.

    13. Tree crowns cover 60% or less of the area, such that individual trees or clumps of trees are visible in a matrix of white to light gray herbaceous vegetation. Gray shrubs may also be present.

14. Trees are organized into rows, columns, or other geometric patterns. Generally, each species are clearly grouped in rows or blocks. ..... **Orchards, Nurseries, and Horticultural Areas**

14. Trees are scattered or clumped, but are not organized into rows, columns, or other geometric patterns.

15. Individual gray or black tree crowns form an open canopy over bright white to light pink herbaceous vegetation. Woodland occurs on island or shoreline adjacent to dark blue-gray curvilinear feature of the Delaware River or its major tributaries. ..... **Temporarily Flooded Deciduous Woodland**

15. Individual gray or black tree crowns form an open canopy over light pink, gray, or white herbaceous vegetation. Rounded gray clumps of shrubs may also be present. Dark curvilinear drainage features are not present. ..... **Deciduous Woodland**

13. Tree crowns cover greater than 60% of the area, creating a near continuous canopy.

16. Signature under canopy is black, indicating standing water. Forest occurs in a swale, depression, or low topographic position. ..... **Seasonally Flooded Deciduous Forest**

16. Signature under canopy is white, light gray, or pink, indicating leaf litter or vegetation. Forest occurs in terrestrial setting or adjacent to a river or stream.

17. Forest occurs in a low flat area, adjacent to the dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Temporarily Flooded Deciduous Forest**

17. Forest does not occur immediately adjacent to the dark blue gray curvilinear signature of a creek, tributary, or the Delaware River. ..... **Deciduous Forest**

1. Individual tree crowns cover less than 25% of the area.

18. Signature is primarily white, gray, or pink ranging from uniform to mottled, representing shrub or herbaceous vegetation. Buildings, structures, parking lots, and roads are absent. Signature is not uniform dark blue gray with occasional white speckles, indicating open water. Signature is not extremely steeply sloping or isolated outcrops of white to blue gray, representing bare rock.

19. Shrubs cover greater than 25% of the area, appearing as round gray circles, or short, thin, pink cones. Shrubs are scattered or in clumps within a matrix of white, light gray, or pink herbaceous vegetation. Areas of dense deciduous shrub cover will have a bumpy gray signature.

    20. At least 25% of the shrubs occur as short, thin, pink cones, with the remaining shrubs appearing as round gray circles.

        21. Signatures of at least 75% of the shrubs are pink and conical, with very few rounded gray circles. ..... **Evergreen Shrubland**

        21. Signatures of 25–75% of the shrubs are pink and conical. Pink conical shrubs are interspersed with rounded gray shrubs. ..... **Mixed Evergreen - Deciduous Shrubland**

    20. Less than 25% of the shrubs occur as short, thin, pink cones. The vast majority of the shrubs appear as round gray circles.

        22. Shrubland occurs in a basin, depression, or topographically low area. Signature shows uniformly bumpy blue gray shrubs over dark blue gray or black standing water. Dark blue gray curvilinear features of the Delaware River or its tributaries are generally absent. ..... **Saturated Deciduous Shrubland**

        22. Dark blue gray or black signature of standing water does not appear interspersed with the rounded gray shrub features. Dark blue gray curvilinear drainage features may be present, though rounded gray shrub features generally appear in a matrix of dappled or mottled white, light pink, or bright pink vegetation or light blue gray cobbles.

            23. Shrubland occurs on islands or shorelines in or adjacent to the dark blue gray curvilinear features of the Delaware River or its major tributaries. ..... **Temporarily Flooded Deciduous Shrubland**

            23. Shrubland does not occur on islands or shorelines in or adjacent to the dark blue gray curvilinear features of the Delaware River or its major tributaries. ..... **Deciduous Shrubland**

19. Shrubs cover 25% or less of the area. Signature is almost entirely white, light gray, and/or light to bright pink herbaceous vegetation, ranging from uniform to mottled.

    24. Signature is bright dappled white of herbaceous vegetation interspersed with black areas of open water. Dark gray linear drainage features can be present.

25. Signature is bright dappled white and dappled, indicating saturated soil and dense hummocky herbaceous vegetation. Black areas of open water may be interspersed with the bright white vegetation. Dark gray linear drainage features are present. ..... **Saturated Herbaceous Vegetation**

25. Signature is primarily black open water with scattered white dapples of emergent vegetation. Or signature is light gray, indicating continuous, but not dense, herbaceous vegetation over standing water. Signature occurs adjacent to lakes, ponds, and Delaware River islands. ..... **Semipermanently Flooded Herbaceous Vegetation**

24. Signature is primarily white, pink, or gray. Black areas of open water are absent. Dark blue gray curvilinear features of the Delaware River or its major tributaries may or may not be present. Polygons may or may not have linear edges and regular shapes.

    26. Signature tends to be bright to light pink, white, and/or light to dark gray. Polygons tend to have linear edges and regular shapes. One of the following is typically visible: parallel mow or till lines, grazing paths, recently cut tree stumps or boles, evidence of land clearing.

        27. Parallel mow lines, till lines, or grazing paths are often prominent. ..... **Cropland and Pasture**

        27. Recently cut tree stumps or boles, or evidence of land clearing are often prominent. ..... **Transitional Areas**

    26. Signature tends to be white, light pink, and/or blue gray, and does not occur in wide linear bands of color. Parallel mow or till lines are absent. Polygons may or may not have linear edges and regular shapes.

        28. Occurs on edges of islands or shorelines adjacent to the dark blue gray curvilinear features of the Delaware River or its major tributaries. ..... **Temporarily Flooded Herbaceous Vegetation**

        28. Does not occur adjacent to the dark blue gray curvilinear features of the Delaware River or its major tributaries. Round gray circles or bright pink cones of deciduous or evergreen shrubs may be widely scattered in the matrix of white or pink herbaceous vegetation. Polygons may have linear edges and regular shapes. ..... **Grassland**

18. Signature is not uniform to mottled white, gray, or pink, representing shrub or herbaceous vegetation. Buildings, structures, parking lots, and roads are present; OR signature is uniform dark blue gray with occasional white speckles, indicating open water; OR signature is extremely steeply sloping or isolated outcrops of white to blue gray, representing bare rock.

    29. Buildings, structures, parking lots and roads are present, often surrounded by frequently mowed turf grass that has a light to bright pink signature.

        30. Polygon is long, thin, straight or curvilinear feature with hard edges. Either a) Evenly spaced metal structures connected by occasionally visible wires may be present. Color and texture of signature is variable. Polygon continues its linear path despite changes in topography or vegetation, or b) Roads and highways have a linear uniform light gray to blue-gray signature often with visible lane lines and automobiles. ..... **Transportation, Communications, and Utilities**

        30. Polygon is typically square or rectangular-like. Buildings, structures, and parking lots are visible, often surrounded by frequently mowed turf grass that has a light, bright pink signature.

            31. Buildings are very large with smoke stacks or pipes emerging from the buildings. Buildings are typically surrounded by equipment, trucks, or parking lots. ..... **Industrial**

            31. Buildings are medium-sized to small, generally without smoke stacks or pipes.

                32. Buildings are typically medium-sized, and often surrounded by parking lots, cars, and trucks. ..... **Commercial and Services**

                32. Buildings are typically small and surrounded by bright pink lawn with trees and occasionally a swimming pool. ..... **Residential**

    29. Signature is uniform dark blue gray with occasional white speckles, indicating open water; OR signature is gently to steeply sloping or isolated outcrops of white to blue gray, representing bare rock. Buildings, structures, parking lots and roads surrounded by bright pink mowed turf grass are absent.

        33. Signature is uniform black to dark blue gray with occasional white speckles, indicating open water.

            34. Feature is curvilinear dark blue gray with occasional white speckles. ..... **Streams and Canals**

            34. Feature is not curvilinear, but more rounded and ovular, often with a black or dark blue gray signature.

35. Feature is small and somewhat circular or ovular with a black signature. ..... **Lakes**

35. Feature is large, may have a convoluted (though rounded) perimeter and a dark blue gray signature. One end of the feature is typically flat. ..... **Reservoirs**

33. Signature is gently to steeply sloping or isolated outcrops of white to blue gray, representing bare rock.

36. When viewed through a stereoscope, feature contains vertical or near vertical slopes.

37. Feature is blue gray, usually observed as a large pit or several stair steps to a lower flat area. ... **Strip Mines, Quarries, and Gravel Pits**

37. Feature may be gray or white, usually observed as a linear vertical feature surrounded by vegetation. .....**Bare Exposed Rock**

36. Feature occurs along the shoreline of the Delaware River, a stream, lake or reservoir. In general, feature is flat or gently sloping.

38. Signature is mottled white or gray and of variable size and shape. ..... **Beaches**

38. Signature is a thin uniform white band immediately above the water line along the shore of the Delaware River. ..... **Bare Exposed Rock**

Appendix B. Vegetation plot sampling form and screen shots of the NY Heritage Hand-Held Database (HHDB).

COMMUNITY FORM 3: QUANTITATIVE COMMUNITY CHARACTERIZATION revised May 10, 2001

NY Natural Heritage Program

Reviewed by NY Natural Heritage Program: Date:____ Initials: _____

A. IDENTIFIERS / LOCATION (GENERAL EOR INFORMATION)

1. Survey site name:_____
2. Quad code(s):_____
3. Quad name(s): _____
4. County name(s):_____ 5. Town:_____
6. Directions to this transect:_____
_____
_____
7. Sourcecode:_____ 8. Survey date:_____ 9. State:
10. Surveyors:_____

B. ENVIRONMENTAL DESCRIPTION

11. **Community name** _____
12. National Association_____

13. Transect/observation point #

14. Image annotation #

15. Elevation:

16. Topographic position:
___Interfluve ___Toeslope
___High slope ___Low level
___High level ___Channel wall
___Midslope ___Channel bed
___Backslope ___Basin floor
___Step in slope ___Other:
___Lowslope

17. Topographic sketch (show where plot is located within surrounding topography):

18. Slope degrees:_____

19. Slope aspect:_____

20. Parent material/bedrock:

21. Soil profile description: note depth, texture, and color of each horizon. Note significant changes such as depth to mottling, depth to water table, root penetration depth
22. Organic horizon depth:_____
23. Organic horizon type: Mor:__ Mull:___
24. Average pH of mineral soil:_____

25. Soil moisture regime:
___Extremely dry ___Very dry
___Dry ___Well drained
___Somewhat moist ___Moist
___Somewhat wet ___Wet
___Permanently inundated ___Very wet
___Periodically inundated
Soil pore salinity_____ppt. (optional)

26.Soil drainage:
___Rapidly drained
___Well drained
___Moderately well drained
___Somewhat poorly drained
___Poorly drained
___Very poorly drained

27. Hydrologic Regime of plot (adapted from Cowardin 1979):
___Semipermanently flooded ___Intermittently flooded
___Seasonally flooded ___Permanently flooded
___Saturated ___Tidally flooded
___Temporarily flooded ___Unknown
___Never Inundated

Optional fields below
pH of water_____
Flood depth_____
Tidal range_____

28. Stoniness:
_Stone free <0.1%
_Moderately stony 0.1-1%
_Stony 3-15%
_Very stony 15-50%
_Exceedingly stony 50-90%
_Stone piles >90%

29. Average mineral soil texture (Brewer 1982):
___ sand ___ loamy sand
___ loam ___ sandy loam
___ silt loam ___ sandy clay loam
___ clay loam ___ silty clay loam
___ silt ___ sandy clay
___ clay ___ silty clay

30. Average organic soil texture:
___muck
___peat

Von Post scale of peat decomposition:_____
pH of peat:_____

31.Unvegetated surface (total):_____%
___% Bedrock ___% Litter, duff
___% Large rocks (>10cm) ___% Wood >1cm
___% Small rocks (0.2-10cm) ___% Water
___% Sand (0.1-2mm) ___% Other:
___% Bare soil

32. Environmental Comments: Note homogeneity of vegetation, evidence of erosion/sedimentation, further observations of inundation, etc._____
_____
_____
_____
_____
33. Plot representativeness:_____
_____
_____
_____
_____

C. VEGETATION

Community name:_____

34. System:___Terrestrial ___Palustrine ___Estuarine 35. Plot number:_____ 36. Plot dimensions:_____

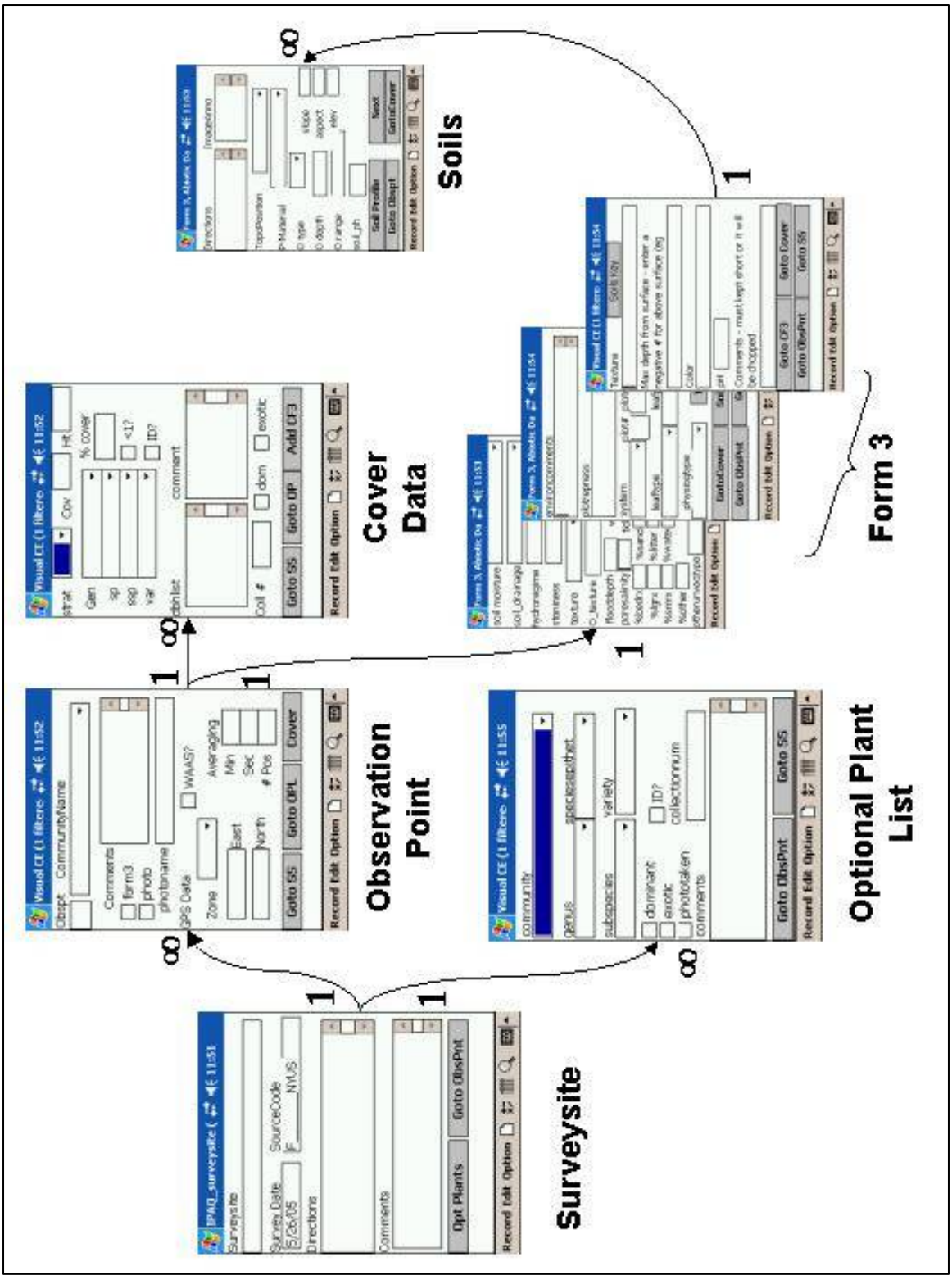
37. Leaf type:
(of dominant stratum)
___Broad-leaf
___Semi-broad-leaf
___Mixed broad-needle leaf
___Semi-needle-leaf
___Needle-leaf
___Graminoid
___Broad-leaf herbaceous
___Pteridophyte
___Non-vascular

38. Leaf phenology:
(of dominant stratum)
___Forest
___Semi-deciduous
___Mixed deciduous-evergreen
___Semi-evergreen
___Evergreen
___Perennial
___Annual

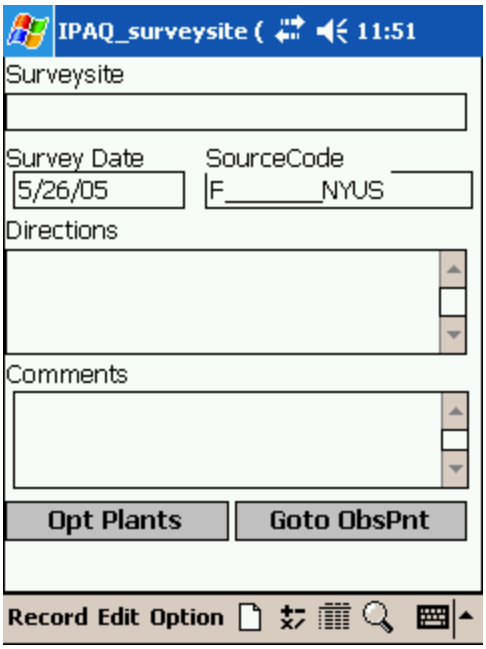
39. Physiognomic type:
___Woodland
___Sparse woodland
___Shrubland
___Sparse shrubland
___Dwarf shrubland
___Sparse dwarf shrubland
___Herbaceous
___Sparsely vegetated
___Non-vegetated

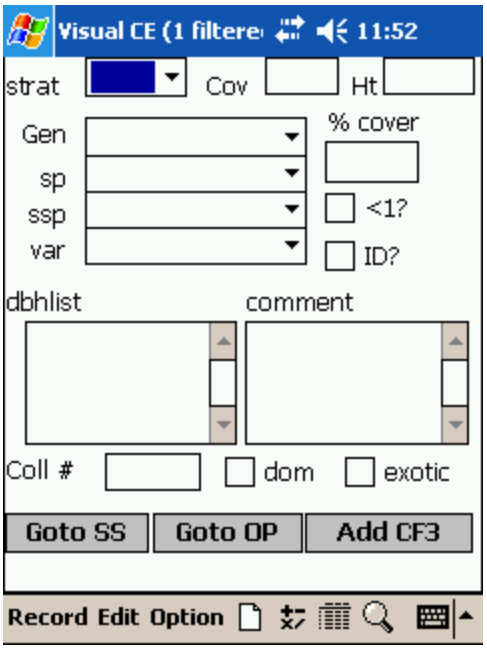
40. Strata/life forms	%cover	height
T1 Emergent tree (>5m)		
T2 Tree canopy (>5m)		
T3 Tree sub-canopy (>5m)		
S1 Tall shrub (2m - 5m)		
S2 Short shrub (< 2m)		
V Vine/liana		
H Herbaceous		
N Non-vascular		
E Epiphyte		
A1 Emergent aquatic		
A2 Floating-leaved aquatic		
A3 Submerged aquatic		

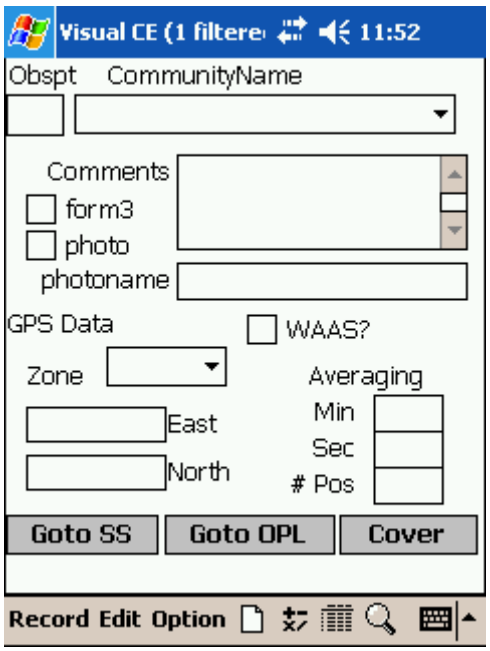
41. Species/percent cover: starting with the uppermost stratum, list all species and % cover for each in the stratum. For forests and woodlands, list the DBH of all trees over 10 cm diameter on a separate line below each tree species. Separate the measurements with a comma and note whether in cm or inches. Estimate number of fauna.



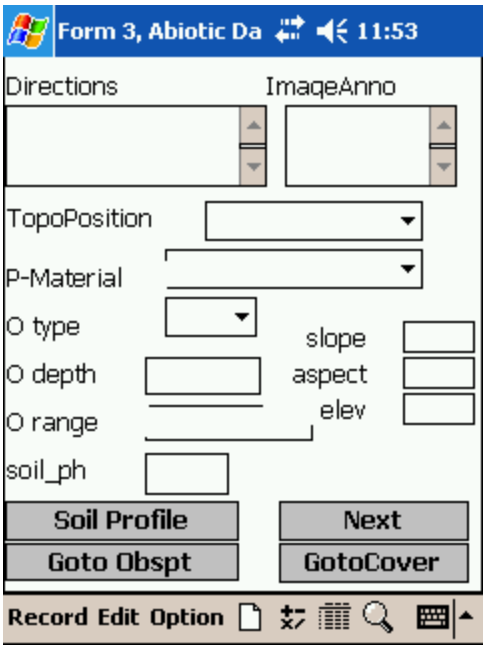
Screen shots of the NY Natural Heritage Hand-Held Database (HHDB). Vegetation plot data and accuracy assessment point data were digitally collected in the field using this software.

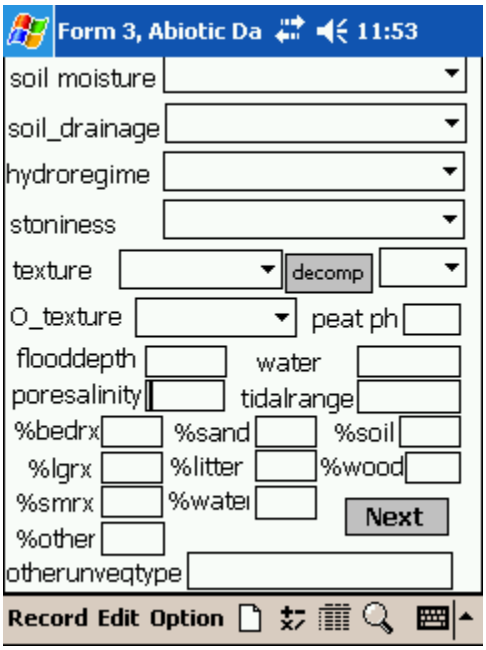


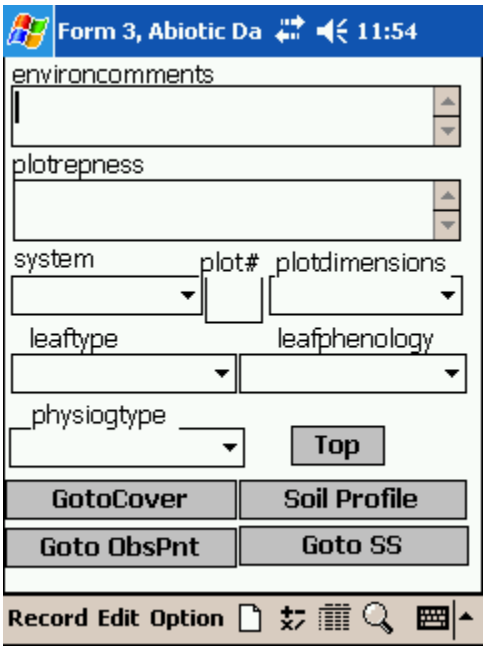




Screen shots of the NY Natural Heritage Hand-Held Database (HHDB). Survey site information, plot and point spatial data, and vegetation cover data were digitally collected in the field using this software.









Screen shots of the NY Natural Heritage Hand-Held Database (HHDB). Data on the physical characteristics and soils for plots were digitally collected in the field using this software.

Appendix C. Accuracy assessment data form.

Accuracy Assessment Form for USGS-NPS Vegetation Mapping Program

AA Point: _____ Park: UPDE Date: _____ Observers: _____

GPS Unit: _____ Projection: UTM Map datum: NAD83 Zone: 18

Easting: __ __ __ __ __ __ E Northing: __ __ __ __ __ __ __ N PDOP: _____ EPE: _____ m / ft: _____

Offset: YES / NO Easting Offset: + / - m Northing Offset: + / - m

Topographic Description: _____ Elevation: m Aspect: _____

Vegetation Association at Point: _____

Veg Assoc 2 w/in 50 m of point: _____

Veg Assoc 3 w/in 50 m of point: _____

Major Species by Strata:

T1: _____

T2: _____

T3: _____

S1: _____

S2: _____

H: _____

V: _____

Rationale for Classification: _____

Confidence in Classification: (very low) 1 2 3 4 5 (very high)

Comments: _____

Phone Numbers: _____

Appendix D. Plants observed in Upper Delaware Scenic and Recreational River during vegetation plot and thematic accuracy assessment sampling.

Nomenclature follows the PLANTS 3.5 Database developed by the Natural Resource Conservation Service in cooperation with the Biota of North America Program (USDA, NRCS 2006). For this report, some common names listed in the PLANTS database were changed to reflect the common names typically used by ecologists and resource managers in this region.

Family	Scientific Name	Common Name
Acanthaceae	*Justicia americana*	American water-willow
Aceraceae	*Acer negundo*	boxelder
	Acer pensylvanicum	striped maple
	Acer platanoides[#]	Norway maple
	Acer rubrum	red maple
	Acer saccharinum	silver maple
	Acer saccharum	sugar maple
	Acer spicatum	mountain maple
Alismataceae	*Alisma* sp.	water plantain
	Sagittaria graminea	grassy arrowhead
	Sagittaria lancifolia ssp. *lancifolia*	bulltongue arrowhead
Amblystegiaceae	*Drepanocladus* sp.	drepanocladus moss
Anacardiaceae	*Rhus copallinum*	flameleaf sumac
	*Rhus glabra**	smooth sumac
	Rhus hirta	staghorn sumac
	Toxicodendron radicans	eastern poison ivy
Anomodontaceae	*Anomodon attenuatus*	anomodon moss
Apiaceae	*Daucus carota*[#]	Queen Anne's lace
	Hydrocotyle americana	American marshpennywort
	Sium suave	hemlock waterparsnip
	Zizia aurea	golden zizia
Apocynaceae	*Apocynum androsaemifolium*	spreading dogbane
	Apocynum cannabinum	Indianhemp
	Vinca minor[#]	common periwinkle
Aquifoliaceae	*Ilex montana*	mountain holly
	Ilex verticillata	common winterberry
Araceae	*Arisaema triphyllum*	Jack in the pulpit
Araliaceae	*Aralia nudicaulis*	wild sarsaparilla
	Panax quinquefolius	American ginseng
Aristolochiaceae	*Asarum canadense*	Canadian wildginger
Asclepiadaceae	*Asclepias incarnata*	swamp milkweed
	Asclepias syriaca	common milkweed
	Asclepias tuberosa	butterfly milkweed
Aspleniaceae	*Asplenium montanum*	mountain spleenwort
	Asplenium platyneuron	ebony spleenwort
	Asplenium trichomanes	maidenhair spleenwort
Asteraceae	*Achillea millefolium*[#]	common yarrow
	Ageratina altissima var. *altissima*	white snakeroot
	Ambrosia artemisiifolia	annual ragweed
	Anaphalis margaritacea	western pearly everlasting
	Antennaria plantaginifolia	woman's tobacco
	Artemisia vulgaris[#]	common wormwood
	Bidens cernua	nodding beggartick
	Bidens connata	purplestem beggarticks

Family	Scientific Name	Common Name
Asteraceae (cont.)	*Bidens frondosa*	devil's beggartick
	Bidens tripartita	threelobe beggarticks
	Centaurea biebersteinii[#]	spotted knapweed
	Cirsium sp.	thistle
	Doellingeria umbellata var. *umbellata*	parasol whitetop
	Erechtites hieraciifolia var. *hieraciifolia*	American burnweed
	Erigeron sp.	fleabane
	Eupatorium maculatum	spotted joepyeweed
	Eupatorium perfoliatum	common boneset
	Eurybia divaricata	white wood aster
	Euthamia graminifolia	flat-top goldentop
	Galinsoga parviflora[#]	gallant-soldier
	Galinsoga quadriradiata[#]	shaggy-soldier
	Gnaphalium sp.	cudweed
	Helenium autumnale	common sneezeweed
	Helianthus tuberosus[#]	Jerusalem artichoke
	Hieracium caespitosum[#]	meadow hawkweed
	Hieracium paniculatum	Allegheny hawkweed
	Hieracium venosum	rattlesnakeweed
	Ionactis linariifolius	flaxleaf whitetop aster
	Lactuca sp.	lettuce
	Oclemena acuminata	whorled wood aster
	Oligoneuron rigidum var. *rigidum*	stiff goldenrod
	Prenanthes alba	white rattlesnakeroot
	Prenanthes trifoliolata	gall of the earth
	Pseudognaphalium macounii	Macoun's cudweed
	Pseudognaphalium obtusifolium ssp. *obtusifolium*	rabbittobacco
	Solidago bicolor	white goldenrod
	Solidago caesia	wreath goldenrod
	Solidago canadensis	Canada goldenrod
	Solidago canadensis var. *scabra*	Canada goldenrod
	Solidago flexicaulis	zigzag goldenrod
	Solidago gigantea	giant goldenrod
	Solidago juncea	early goldenrod
	Solidago nemoralis	gray goldenrod
	Solidago odora	anisescented goldenrod
	Solidago puberula	downy goldenrod
	Solidago rugosa	wrinkleleaf goldenrod
	Solidago speciosa	showy goldenrod
	Symphyotrichum cordifolium	common blue wood aster
	Symphyotrichum lanceolatum ssp. *lanceolatum*	white panicle aster
	Symphyotrichum lateriflorum	calico aster
	Symphyotrichum novae-angliae	New England aster
	Symphyotrichum prenanthoides	crookedstem aster
	Symphyotrichum puniceum	purplestem aster
	Symphyotrichum racemosum	smooth white oldfield aster
	Taraxacum officinale[#]	common dandelion
	Tussilago farfara[#]	coltsfoot
	Verbesina alternifolia	wingstem
Balsaminaceae	*Impatiens capensis*	jewelweed
	Impatiens pallida	pale touch-me-not
Berberidaceae	*Berberis thunbergii*[#]	Japanese barberry
	Caulophyllum thalictroides	blue cohosh
	Podophyllum peltatum	mayapple

Family	Scientific Name	Common Name
Betulaceae	*Alnus incana* ssp. *rugosa*	speckled alder
	Alnus serrulata	hazel alder
	Betula alleghaniensis	yellow birch
	Betula lenta	sweet birch
	Betula minor	dwarf white birch
	Betula nigra	river birch
	Betula papyrifera	paper birch
	Betula populifolia	gray birch
	Carpinus caroliniana	American hornbeam
	Corylus americana	American hazelnut
	Corylus cornuta	beaked hazelnut
	Ostrya virginiana	hophornbeam
Blechnaceae	*Woodwardia virginica**	Virginia chainfern
Boraginaceae	*Hackelia virginiana*	beggarslice
	Myosotis scorpioides[#]	true forget-me-not
Brachytheciaceae	*Brachythecium salebrosum*	brachythecium moss
Brassicaceae	*Alliaria petiolata*[#]	garlic mustard
	Arabis glabra	tower rockcress
	Arabis laevigata	smooth rockcress
	Arabis lyrata	lyrate rockcress
	Brassica sp.[#]	mustard
	Cardamine bulbosa	bulbous bittercress
	Cardamine parviflora	sand bittercress
	Cardamine pensylvanica	Pennsylvania bittercress
	Cardamine pratensis[#]	cuckoo flower
	Erysimum cheiranthoides[#]	wormseed wallflower
	Hesperis matronalis[#]	dames rocket
	Rorippa palustris	bog yellowcress
	Sisymbrium altissimum[#]	tall tumblemustard
Callitrichaceae	*Callitriche* sp.	water-starwort
Campanulaceae	*Lobelia cardinalis*	cardinalflower
	Lobelia inflata	Indian-tobacco
	Lobelia spicata	palespike lobelia
Cannabaceae	*Humulus japonicus*[#]	Japanese hop
	Humulus lupulus	common hop
Caprifoliaceae	*Diervilla lonicera*	northern bush honeysuckle
	Lonicera morrowii[#]	Morrow's honeysuckle
	Sambucus nigra ssp. *canadensis*	common elderberry
	Sambucus racemosa	red elderberry
	Triosteum aurantiacum	orangefruit horse-gentian
	Viburnum acerifolium	mapleleaf viburnum
	Viburnum dentatum	southern arrowwood
	Viburnum lantanoides	hobblebush
	Viburnum lentago	nannyberry
	*Viburnum rafinesquianum**	downy arrowwood
Caryophyllaceae	*Dianthus armeria*[#]	Deptford pink
	Saponaria officinalis[#]	bouncingbet
	Silene vulgaris[#]	maidenstears
	Stellaria media[#]	common chickweed
	Stellaria media ssp. *media*[#]	common chickweed
	Stellaria pubera	star chickweed
Catillariaceae	*Halecania viridescens*	halecania lichen
Celastraceae	*Celastrus orbiculatus*[#]	oriental bittersweet
Chenopodiaceae	*Chenopodium* sp.	goosefoot
Cistaceae	*Helianthemum canadense*	longbranch frostweed

Family	Scientific Name	Common Name
Cladoniaceae	*Cladina arbuscula*	reindeer lichen
	Cladina rangiferina	greygreen reindeer lichen
	Cladina stellaris	star reindeer lichen
	Cladonia chlorophaea	cup lichen
	Cladonia coniocraea	cup lichen
Climaciaceae	*Climacium dendroides*	tree climacium moss
Clusiaceae	*Hypericum ascyron*	great St. Johnswort
	Hypericum canadense	lesser Canadian St. Johnswort
	Hypericum mutilum	dwarf St. Johnswort
	Hypericum perforatum#	common St. Johnswort
	Hypericum prolificum	shrubby St. Johnswort
	Hypericum punctatum	spotted St. Johnswort
	Triadenum virginicum	Virginia marsh St. Johnswort
Commelinaceae	*Commelina communis*#	Asiatic dayflower
Convolvulaceae	*Calystegia sepium*	hedge false bindweed
	Convolvulus sp.	bindweed
Cornaceae	*Cornus alternifolia*	alternateleaf dogwood
	Cornus amomum	silky dogwood
	Cornus canadensis	bunchberry dogwood
	Cornus florida	flowering dogwood
	Cornus racemosa	gray dogwood
	Cornus rugosa	roundleaf dogwood
	Cornus sericea	redosier dogwood
Cucurbitaceae	*Echinocystis lobata*	wild cucumber
Cupressaceae	*Juniperus virginiana*	eastern redcedar
	Thuja occidentalis	arborvitae
Cuscutaceae	*Cuscuta gronovii*	scaldweed
Cyperaceae	*Carex albicans* var. *albicans*	whitetinge sedge
	Carex albicans var. *emmonsii*	Emmons' sedge
	Carex appalachica	Appalachian sedge
	Carex atlantica ssp. *atlantica**	prickly bog sedge
	Carex blanda	eastern woodland sedge
	Carex bromoides	bromelike sedge
	Carex communis	fibrousroot sedge
	Carex conjuncta	soft fox sedge
	Carex crinita	fringed sedge
	Carex cristatella	crested sedge
	Carex debilis var. *rudgei*	white edge sedge
	Carex digitalis	slender woodland sedge
	*Carex disperma**	softleaf sedge
	Carex echinata	star sedge
	Carex emoryi	Emory's sedge
	Carex folliculata	northern long sedge
	Carex gracilescens	slender looseflower sedge
	Carex gracillima	graceful sedge
	Carex gynandra	nodding sedge
	Carex interior	inland sedge
	Carex intumescens	greater bladder sedge
	Carex laxiculmis	spreading sedge
	Carex laxiflora	broad looseflower sedge
	Carex lurida	shallow sedge
	Carex pensylvanica	Pennsylvania sedge
	Carex plantaginea	plantainleaf sedge
	Carex platyphylla	broadleaf sedge
	Carex radiata	eastern star sedge

Family	Scientific Name	Common Name
Cyperaceae (cont.)	*Carex rosea*	rosy sedge
	Carex scabrata	eastern rough sedge
	Carex scoparia	broom sedge
	Carex stipata	owlfruit sedge
	Carex stricta	upright sedge
	Carex swanii	Swan's sedge
	Carex tribuloides	blunt broom sedge
	Carex trichocarpa	hairyfruit sedge
	Carex trisperma	threeseeded sedge
	Cyperus dentatus	toothed flatsedge
	Cyperus strigosus	strawcolored flatsedge
	Dulichium arundinaceum	threeway sedge
	*Eleocharis acicularis**	needle spikerush
	Eleocharis obtusa	blunt spikerush
	Eleocharis palustris	common spikerush
	Fimbristylis autumnalis	slender fimbry
	*Rhynchospora alba**	white beaksedge
	Rhynchospora capitellata	brownish beaksedge
	*Schoenoplectus pungens**	common threesquare
	Schoenoplectus tabernaemontani	softstem bulrush
	Scirpus atrovirens	green bulrush
	Scirpus cyperinus	woolgrass
Dennstaedtiaceae	*Dennstaedtia punctilobula*	eastern hayscented fern
	Pteridium aquilinum var. *latiusculum*	western brackenfern
Dicranaceae	*Dicranum fulvum*	dicranum moss
	Dicranum scoparium	dicranum moss
Droseraceae	*Drosera rotundifolia**	roundleaf sundew
Dryopteridaceae	*Athyrium filix-femina*	common ladyfern
	Deparia acrostichoides	silver false spleenwort
	Dryopteris carthusiana	spinulose woodfern
	Dryopteris cristata	crested woodfern
	*Dryopteris goldiana**	Goldie’s fern
	Dryopteris intermedia	intermediate woodfern
	Dryopteris marginalis	marginal woodfern
	Gymnocarpium dryopteris	western oakfern
	Matteuccia struthiopteris	ostrich fern
	Onoclea sensibilis	sensitive fern
	Polystichum acrostichoides	Christmas fern
Elaeagnaceae	*Elaeagnus umbellata*[#]	autumn olive
Equisetaceae	*Equisetum arvense*	field horsetail
Ericaceae	*Chamaedaphne calyculata*	leatherleaf
	Epigaea repens	trailing arbutus
	Gaultheria procumbens	eastern teaberry
	Gaylussacia baccata	black huckleberry
	Gaylussacia frondosa	blue huckleberry
	Kalmia angustifolia	sheep laurel
	Kalmia latifolia	mountain laurel
	Kalmia polifolia	bog laurel
	Lyonia ligustrina	maleberry
	Rhododendron maximum	great laurel
	Rhododendron periclymenoides	pink azalea
	*Rhododendron viscosum**	swamp azalea
	Vaccinium angustifolium	lowbush blueberry
	Vaccinium corymbosum	highbush blueberry
	*Vaccinium macrocarpon**	cranberry

Family	Scientific Name	Common Name
Ericaceae (cont.)	*Vaccinium pallidum*	Blue Ridge blueberry
	Vaccinium stamineum	deerberry
Euphorbiaceae	*Acalypha rhomboidea*	Virginia threeseed mercury
	Chamaesyce polygonifolia	seaside sandmat
	Euphorbia cyparissias[#]	cypress spurge
Fabaceae	*Amphicarpaea bracteata*	American hogpeanut
	Apios americana	groundnut
	Baptisia tinctoria	horseflyweed
	Coronilla varia[#]	purple crownvetch
	Desmodium glutinosum	pointedleaf ticktrefoil
	Desmodium nudiflorum	nakedflower ticktrefoil
	Lespedeza capitata	roundhead lespedeza
	Lespedeza frutescens	shrubby lespedeza
	Lespedeza hirta	hairy lespedeza
	Lespedeza virginica	slender lespedeza
	Lotus corniculatus[#]	birdfoot deervetch
	Melilotus officinalis[#]	yellow sweetclover
	Robinia pseudoacacia	black locust
	Strophostyles helvula	trailing fuzzybean
Fagaceae	*Castanea dentata*	American chestnut
	Fagus grandifolia	American beech
	Quercus alba	white oak
	Quercus bicolor	swamp white oak
	Quercus coccinea	scarlet oak
	Quercus ilicifolia	bear oak
	Quercus palustris	pin oak
	Quercus prinus	chestnut oak
	Quercus rubra	northern red oak
	Quercus velutina	black oak
Fumariaceae	*Adlumia fungosa*	allegheny vine
	Corydalis sempervirens	rock harlequin
Geraniaceae	*Geranium maculatum*	spotted geranium
	Geranium robertianum	Robert geranium
Grossulariaceae	*Ribes cynosbati*	eastern prickly gooseberry
Hamamelidaceae	*Hamamelis virginiana*	American witchhazel
Hedwigiaceae	*Hedwigia ciliata*	ciliate hedwigia moss
Hydrangeaceae	*Hydrangea arborescens*	wild hydrangea
Hydrocharitaceae	*Elodea canadensis*	Canadian waterweed
	Vallisneria americana	American eelgrass
Hydrophyllaceae	*Hydrophyllum virginianum*	Shawnee salad
Hylocomiaceae	*Pleurozium schreberi*	Schreber's big red stem moss
Hypnaceae	*Hypnum imponens*	hypnum moss
Iridaceae	*Iris versicolor*	harlequin blueflag
Isoetaceae	*Isoetes riparia*	shore quillwort
Juglandaceae	*Carya alba*	mockernut hickory
	Carya cordiformis	bitternut hickory
	Carya glabra	pignut hickory
	*Carya ovalis**	red hickory
	Carya ovata	shagbark hickory
	Juglans cinerea	butternut
	Juglans nigra	black walnut
Juncaceae	*Juncus canadensis*	Canadian rush
	Juncus debilis	weak rush
	Juncus effusus	common rush
	Juncus marginatus	grassleaf rush

Family	Scientific Name	Common Name
Juncaceae (cont.)	*Juncus tenuis*	poverty rush
	Luzula acuminata	hairy woodrush
	Luzula multiflora ssp. *multiflora*	common woodrush
Lamiaceae	*Blephilia hirsuta*	hairy pagoda-plant
	Clinopodium vulgare[#]	wild basil
	Collinsonia canadensis	richweed
	Galeopsis tetrahit[#]	brittlestem hempnettle
	Glechoma hederacea[#]	ground ivy
	Leonurus cardiaca[#]	common motherwort
	Lycopus americanus	American water horehound
	Lycopus uniflorus	northern bugleweed
	Lycopus virginicus	Virginia water horehound
	Mentha arvensis	wild mint
	Monarda fistulosa	wild bergamot
	Prunella vulgaris	common selfheal
	Pycnanthemum incanum	hoary mountainmint
	Pycnanthemum tenuifolium	narrowleaf mountainmint
	Teucrium canadense var. *canadense*	Canada germander
Lauraceae	*Lindera benzoin*	northern spicebush
	Sassafras albidum	sassafras
Lemnaceae	*Lemna* sp.	duckweed
Lepidoziaceae	*Bazzania trilobata*	a liverwort
Leucobryaceae	*Leucobryum glaucum*	leucobryum moss
Liliaceae	*Allium canadense*	meadow garlic
	Asparagus officinalis[#]	garden asparagus
	Clintonia borealis	bluebead
	*Erythronium americanum**	dogtooth violet
	Lilium philadelphicum	wood lily
	Maianthemum canadense	Canada mayflower
	Maianthemum racemosum ssp. *racemosum*	feathery false lily of the valley
	Maianthemum stellatum	starry false lily of the valley
	Medeola virginiana	Indian cucumber
	Polygonatum biflorum	smooth Solomon's seal
	Polygonatum pubescens	hairy Solomon's seal
	Trillium flexipes	nodding wakerobin
	Trillium undulatum	painted trillium
	Uvularia perfoliata	perfoliate bellwort
	Uvularia sessilifolia	sessileleaf bellwort
	Veratrum viride	green false hellebore
Lycopodiaceae	*Lycopodium complanatum*	groundcedar
	Lycopodium digitatum	fan clubmoss
	Lycopodium obscurum	rare clubmoss
Lythraceae	*Decodon verticillatus**	swamp-loosestrife
	Lythrum salicaria[#]	purple loosestrife
Magnoliaceae	*Liriodendron tulipifera*	tuliptree
Micareaceae	*Psilolechia lucida*	psilolechia lichen
Mniaceae	*Plagiomnium ciliare*	plagiomnium moss
	Plagiomnium cuspidatum	toothed plagiomnium moss
Molluginaceae	*Mollugo verticillata*[#]	green carpetweed
Monotropaceae	*Monotropa uniflora*	Indianpipe
Myricaceae	*Comptonia peregrina*	sweet fern
Nyssaceae	*Nyssa sylvatica*	blackgum
Oleaceae	*Fraxinus americana*	white ash
	Fraxinus nigra	black ash
	Fraxinus pennsylvanica	green ash

Family	Scientific Name	Common Name
Onagraceae	*Circaea alpina*	small enchanter's nightshade
	Circaea lutetiana	broadleaf enchanter's nightshade
	Epilobium ciliatum	fringed willowherb
	Epilobium coloratum	purpleleaf willowherb
	Ludwigia alternifolia	seedbox
	Ludwigia palustris	marsh seedbox
	Oenothera sp.	evening-primrose
Ophioglossaceae	*Botrychium* sp.	grapefern
Orchidaceae	*Corallorrhiza maculata*	summer coralroot
	Cypripedium acaule	moccasin flower
	Epipactis helleborine[#]	broadleaf helleborine
	Goodyera pubescens	downy rattlesnake plantain
	Isotria verticillata	purple fiveleaf orchid
	Spiranthes cernua	nodding ladies'-tresses
Orobanchaceae	*Epifagus virginiana*	beechdrops
Osmundaceae	*Osmunda cinnamomea*	cinnamon fern
	Osmunda claytoniana	interrupted fern
	Osmunda regalis var. *spectabilis*	royal fern
Oxalidaceae	*Oxalis montana*	mountain woodsorrel
	Oxalis stricta	common yellow oxalis
Parmeliaceae	*Parmelia* sp.	shield lichen
Phytolaccaceae	*Phytolacca americana*	American pokeweed
Pinaceae	*Abies balsamea*	balsam fir
	*Larix decidua**[#]	European larch
	Picea abies[#]	Norway spruce
	Picea pungens[#]	blue spruce
	*Picea mariana**	black spruce
	Picea rubens	red spruce
	Pinus resinosa	red pine
	Pinus rigida	pitch pine
	Pinus strobus	eastern white pine
	Pinus sylvestris[#]	Scotch pine
	Pinus thunbergiana[#]	Japanese black pine
	Tsuga canadensis	eastern hemlock
Plagiotheciaceae	*Plagiothecium laetum*	plagiothecium moss
Plantaginaceae	*Plantago lanceolata*[#]	narrowleaf plantain
	Plantago major[#]	common plantain
Platanaceae	*Platanus occidentalis*	American sycamore
Poaceae	*Agrostis hyemalis*	winter bentgrass
	Agrostis perennans	upland bentgrass
	Agrostis stolonifera[#]	creeping bentgrass
	Andropogon gerardii	big bluestem
	Anthoxanthum odoratum[#]	sweet vernalgrass
	Brachyelytrum erectum	bearded shorthusk
	Bromus inermis[#]	smooth brome
	Calamagrostis canadensis	bluejoint
	Cinna arundinacea	sweet woodreed
	Cinna latifolia	drooping woodreed
	Dactylis glomerata[#]	orchardgrass
	Danthonia compressa	flattened oatgrass
	Danthonia spicata	poverty oatgrass
	Deschampsia flexuosa	wavy hairgrass
	Dichanthelium clandestinum	deertongue
	Dichanthelium depauperatum	starved panicgrass
	Dichanthelium latifolium	broadleaf rosette grass

Family	Scientific Name	Common Name
Poaceae (cont.)	*Digitaria ischaemum**#	smooth crabcrass
	Echinochloa crus-galli#	barnyardgrass
	Elymus hystrix	eastern bottlebrush grass
	Elymus riparius	riverbank wildrye
	Elymus virginicus	Virginia wildrye
	Elymus wiegandii	Wiegand's wildrye
	Eragrostis spectabilis	purple lovegrass
	*Eriophorum virginicum**	tawny cottongrass
	Festuca rubra#	red fescue
	Festuca subverticillata	nodding fescue
	Glyceria sp.	mannagrass
	Holcus lanatus#	common velvetgrass
	Leersia oryzoides	rice cutgrass
	Leersia virginica	whitegrass
	Microstegium vimineum#	Nepalese browntop
	Muhlenbergia schreberi	nimblewill
	Muhlenbergia sobolifera	rock muhly
	Muhlenbergia tenuiflora	slender muhly
	Oryzopsis sp.	ricegrass
	Panicum virgatum	switchgrass
	Phalaris arundinacea#	reed canarygrass
	Phleum pratense#	timothy
	*Phragmites australis**#	common reed
	Piptatherum racemosum	blackseed ricegrass
	Poa trivialis#	rough bluegrass
	Schizachyrium scoparium	little bluestem
	Setaria parviflora	marsh bristlegrass
	Sorghastrum nutans	Indiangrass
	Spartina pectinata	prairie cordgrass
	Torreyochloa pallida	pale false mannagrass
Polemoniaceae	*Phlox subulata**	moss phlox
Polygalaceae	*Polygala paucifolia*	gaywings
	Polygala verticillata	whorled milkwort
Polygonaceae	*Polygonum amphibium*	water knotweed
	Polygonum arifolium	halberdleaf tearthumb
	Polygonum caespitosum#	oriental ladysthumb
	Polygonum cilinode	fringed black bindweed
	Polygonum cuspidatum#	Japanese knotweed
	Polygonum hydropiper#	marshpepper knotweed
	Polygonum hydropiperoides	swamp smartweed
	Polygonum lapathifolium#	curlytop knotweed
	Polygonum nepalense#	Nepalese smartweed
	Polygonum pensylvanicum	Pennsylvania smartweed
	Polygonum perfoliatum#	Asiatic tearthumb
	Polygonum persicaria#	spotted ladysthumb
	Polygonum punctatum var. *punctatum*	dotted smartweed
	Polygonum sagittatum	arrowleaf tearthumb
	Polygonum scandens	climbing false buckwheat
	Polygonum virginianum	jumpseed
	Rumex acetosella#	common sheep sorrel
	Rumex obtusifolius#	bitter dock
Polypodiaceae	*Polypodium virginianum*	rock polypody

Family	Scientific Name	Common Name
Polytrichaceae	*Atrichum angustatum*	atrichum moss
	Polytrichum commune	polytrichum moss
	Polytrichum juniperinum	juniper polytrichum moss
	Polytrichum pallidisetum	polytrichum moss
Pontederiaceae	*Pontederia cordata*	pickerelweed
Portulacaceae	*Portulaca oleracea*	little hogweed
Potamogetonaceae	*Potamogeton crispus*[#]	curly pondweed
	Potamogeton epihydrus	ribbonleaf pondweed
Primulaceae	*Lysimachia ciliata*	fringed loosestrife
	Lysimachia nummularia[#]	creeping jenny
	Lysimachia quadrifolia	whorled yellow loosestrife
	Trientalis borealis	starflower
Pteridaceae	*Adiantum pedatum*	northern maidenhair
	Pellaea atropurpurea	purple cliffbrake
Pyrolaceae	*Chimaphila maculata*	striped prince's pine
	Pyrola elliptica	waxflower shinleaf
Ranunculaceae	*Actaea pachypoda*	white baneberry
	Anemone quinquefolia	nightcaps
	Aquilegia canadensis	red columbine
	Clematis virginiana	devil's darning needles
	Coptis trifolia	threeleaf goldthread
	Hepatica nobilis var. *acuta*	sharplobe hepatica
	Hepatica nobilis var. *obtusa*	roundlobe hepatica
	Ranunculus abortivus	littleleaf buttercup
	Thalictrum dioicum	early meadow-rue
	Thalictrum pubescens	king of the meadow
	Thalictrum thalictroides	rue anemone
Rhamnaceae	*Rhamnus* sp.	buckthorn
Rosaceae	*Agrimonia* sp.	agrimony
	Amelanchier arborea	common serviceberry
	Amelanchier laevis	Allegheny serviceberry
	Crataegus sp.	hawthorn
	Fragaria vesca	woodland strawberry
	Fragaria virginiana	Virginia strawberry
	Geum canadense	white avens
	Malus sp.	apple
	Photinia melanocarpa	black chokeberry
	Physocarpus opulifolius	common ninebark
	Potentilla canadensis	dwarf cinquefoil
	Potentilla simplex	common cinquefoil
	Prunus pensylvanica	pin cherry
	Prunus pumila var. *depressa*	eastern sandcherry
	Prunus serotina	black cherry
	Prunus virginiana	chokecherry
	Rosa carolina	Carolina rose
	Rosa multiflora[#]	multiflora rose
	Rubus allegheniensis	Allegheny blackberry
	Rubus flagellaris	northern dewberry
	Rubus hispidus	bristly dewberry
	Rubus idaeus	American red raspberry
	Rubus occidentalis	black raspberry
	Rubus odoratus	purpleflowering raspberry
	Rubus phoenicolasius[#]	wine raspberry
	Rubus pubescens	dwarf red blackberry
	Rubus setosus	setose blackberry

Family	Scientific Name	Common Name
Rosaceae (cont.)	*Sibbaldiopsis tridentata*	shrubby fivefingers
	Spiraea alba	white meadowsweet
	Spiraea alba var. *latifolia*	white meadowsweet
	Spiraea tomentosa	steeplebush
Rubiaceae	*Cephalanthus occidentalis*	common buttonbush
	Galium aparine	stickywilly
	Galium asprellum	rough bedstraw
	Galium circaezans	licorice bedstraw
	Galium lanceolatum	lanceleaf wild licorice
	Galium mollugo#	false baby's breath
	Galium palustre	common marsh bedstraw
	Galium tinctorium	stiff marsh bedstraw
	Galium trifidum	threepetal bedstraw
	Galium triflorum	fragrant bedstraw
	Mitchella repens	partridgeberry
Salicaceae	*Populus deltoides*	eastern cottonwood
	Populus grandidentata	bigtooth aspen
	Populus tremuloides	quaking aspen
	Salix eriocephala	Missouri River willow
	Salix exigua	narrowleaf willow
	Salix fragilis#	crack willow
	Salix nigra	black willow
	*Salix sericea**	silky willow
Santalaceae	*Comandra umbellata*	bastard toadflax
Sarraceniaceae	*Sarracenia purpurea**	purple pitcherplant
Saxifragaceae	*Chrysosplenium americanum*	American golden saxifrage
	Mitella diphylla	twoleaf miterwort
	*Saxafraga virginiensis**	early saxifrage
	Tiarella cordifolia	heartleaf foamflower
Scrophulariaceae	*Agalinis tenuifolia*	slenderleaf false foxglove
	Chelone glabra	white turtlehead
	Gratiola aurea	golden hedgehyssop
	Linaria vulgaris#	butter and eggs
	Lindernia dubia	yellowseed false pimpernel
	Melampyrum lineare	narrowleaf cowwheat
	Mimulus alatus	sharpwing monkeyflower
	Mimulus ringens	Allegheny monkeyflower
	Scrophularia lanceolata	lanceleaf figwort
	Scrophularia marilandica	carpenter's square
	Verbascum thapsus#	common mullein
	Veronica officinalis#	common gypsyweed
Sematophyllaceae	*Brotherella recurvans*	recurved brotherella moss
Simaroubaceae	*Ailanthus altissima**	tree of heaven
Smilacaceae	*Smilax rotundifolia*	roundleaf greenbrier
Solanaceae	*Datura stramonium*#	jimsonweed
	Solanum carolinense	Carolina horsenettle
Sparganiaceae	*Sparganium americanum*	American bur-reed
Sphagnaceae	*Sphagnum torreyanum*	Torrey's sphagnum
Thelypteridaceae	*Phegopteris connectilis*	long beechfern
	Phegopteris hexagonoptera	broad beechfern
	Thelypteris noveboracensis	New York fern
	Thelypteris palustris var. *pubescens*	eastern marsh fern
	Thelypteris simulata	bog fern
Thuidiaceae	*Thuidium delicatulum*	delicate thuidium moss
Tiliaceae	*Tilia americana*	American basswood

Family	Scientific Name	Common Name
Typhaceae	*Typha angustifolia*	narrowleaf cattail
	Typha latifolia	broadleaf cattail
Ulmaceae	*Ulmus americana*	American elm
	Ulmus rubra	slippery elm
Urticaceae	*Boehmeria cylindrica*	smallspike false nettle
	Laportea canadensis	Canadian woodnettle
	Pilea pumila	Canadian clearweed
	Urtica dioica	stinging nettle
Verbenaceae	*Lantana achyranthifolia*	brushland shrubverbena
	Phryma leptostachya	American lopseed
	Verbena hastata	swamp verbena
	Verbena urticifolia	white vervain
Violaceae	*Viola blanda*	sweet white violet
	Viola cucullata	marsh blue violet
	Viola lanceolata	bog white violet
	Viola pubescens	downy yellow violet
	Viola rotundifolia	roundleaf yellow violet
	Viola sagittata	arrowleaf violet
Vitaceae	*Ampelopsis brevipedunculata*[#]	Amur peppervine
	Parthenocissus quinquefolia	Virginia creeper
	Vitis aestivalis	summer grape
	Vitis labrusca	fox grape
	Vitis riparia	riverbank grape
Xyridaceae	*Xyris torta*	slender yelloweyed grass

[#] Species not native to Pennsylvania (Rhoads and Block 2007).

* Species that were not measured in quantitative plots or accuracy assessment observations, but noted during fieldwork and used to characterize a vegetation class in Appendix E.

Appendix E. Detailed local and global descriptions of vegetation associations of the Upper Delaware Scenic and Recreational River.

Vascular plant species nomenclature within the local and global descriptions follows the nationally standardized list of Kartesz (1999), with very few exceptions. This nomenclature differs from PLANTS 3.5 in only a very few cases, and when this difference occurs, synonymy is indicated parenthetically in the local description information. Nomenclature for nonvascular plants follows Anderson (1990) and Anderson et al. (1990) for mosses, Egan (1987, 1989, 1990, 1991) and Esslinger and Egan (1995) for lichens, and Stotler and Crandall-Stotler (1977) for liverworts/hornworts. English names for associations and alliances use NatureServe Central Ecology-accepted names and may differ slightly from PLANTS 3.5 common names that are used within the local description information and throughout the rest of the report.

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COMMON NAME (PARK-SPECIFIC): MIXED PINE CONIFER PLANTATION

SYNONYMS
USNVC English Name: **Pine species Planted Forest**
USNVC Scientific Name: ***Pinus* spp. Planted Forest**
USNVC Identifier: **CEGL006313**

LOCAL INFORMATION

Environmental Description: This plantation type is typically located on well-drained sites that are flat to gently sloping. It can occur on a variety of soils at a range of aspects and elevations; documented examples in the Upper Delaware River valley occur on moderately stony sandy loam, are south- to southwest-facing, and vary in elevation from 155-323 m (510-1,060 feet). A plantation's age and its management history have significant effects on its species composition and vegetation structure.

Vegetation Description: This association is characterized by an even-aged, regularly-spaced stand of eastern white pine (*Pinus strobus*), most commonly; red pine (*Pinus resinosa*), Scotch pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), or blue spruce (*Picea pungens*) could also be dominant. The herbaceous layer is usually sparse with low diversity. Within the canopy and subcanopy combined, conifers have relative cover of 75% or greater. The tree canopy layer (25 m tall) can range from somewhat open to nearly closed (to 90% cover) and is strongly dominated by eastern white pine, with lesser amounts of scotch pine, black cherry (*Prunus serotina*), pitch pine (*Pinus rigida*), and red maple (*Acer rubrum*) depending on the level of stand management. The tree subcanopy layer (7 m) typically has low cover (under 10%) and contains a mix of species, including sweet birch (*Betula lenta*), eastern white pine, northern red oak (*Quercus rubra*), eastern hemlock (*Tsuga canadensis*), red maple, and black cherry. The tall-shrub layer (3 m) also has low cover (under 10%) and consists of saplings of many of the tree species found in the subcanopy: sweet birch, eastern hemlock, shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), red maple, eastern white pine, chestnut oak (*Quercus prinus*), and blackgum (*Nyssa sylvatica*). The short-shrub layer (0.5 m) has less than 20% cover and is largely dominated by the ericaceous species Blue Ridge blueberry (*Vaccinium pallidum*), deerberry (*Vaccinium stamineum*), and lowbush blueberry (*Vaccinium angustifolium*). Associated seedlings and shrubs are varied and can include sweet birch, black huckleberry (*Gaylussacia baccata*), white ash (*Fraxinus americana*), red maple, American beech (*Fagus grandifolia*), northern red oak, Allegheny blackberry (*Rubus allegheniensis*), shagbark hickory, black cherry, black oak (*Quercus velutina*), black raspberry (*Rubus occidentalis*), eastern white pine, Japanese barberry (*Berberis thunbergii*), chestnut oak, eastern hemlock, red spruce (*Picea rubens*), mountain holly (*Ilex montana*), scotch pine, and dwarf red blackberry (*Rubus pubescens*). Eastern poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), climbing false buckwheat (*Polygonum scandens*), and riverbank grape (*Vitis riparia*) can be present in low abundance (less than 2% cover) in the vine layer (0.1 m). The herbaceous layer can be moderately dense (32% cover) and primarily consists of disturbance-tolerant species, such as Nepalese browntop (*Microstegium vimineum*) and eastern hayscented fern (*Dennstaedtia punctilobula*). Additional herbaceous species can include ricegrass (*Oryzopsis* spp.), intermediate woodfern (*Dryopteris intermedia*), trailing arbutus (*Epigaea repens*), eastern teaberry (*Gaultheria procumbens*), gray goldenrod (*Solidago nemoralis*), rock polypody (*Polypodium virginianum*), whorled yellow loosestrife (*Lysimachia quadrifolia*), Canada mayflower

(*Maianthemum canadense*), partridgeberry (*Mitchella repens*), narrowleaf cowwheat (*Melampyrum lineare*), smallspike false nettle (*Boehmeria cylindrica*), wrinkleleaf goldenrod (*Solidago rugosa*), striped prince's pine (*Chimaphila maculata*), white snakeroot (*Ageratina altissima* var. *altissima*), and American pokeweed (*Phytolacca americana*). Polytrichum moss (*Polytrichum commune*) and leucobryum moss (*Leucobryum glaucum*) are common bryophytes, present at low abundance. Disturbance from silvicultural treatments and landscape fragmentation leaves these communities prone to invasion by exotic or invasive species, including some species listed above (Japanese barberry, Nepalese browntop) and others, which are locally abundant.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Pinus sylvestris* (Scotch pine)
Tree subcanopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula lenta* (sweet birch)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum* (Blue Ridge blueberry)

Characteristic Species: *Pinus strobus* (eastern white pine), *Pinus sylvestris* (Scotch pine).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	State Name	Reference
NY	S5*	1	Pine Plantation	Edinger et al. 2002
PA	SNA		[not crosswalked]	

Local Range: This pine plantation occurs throughout the park.

Classification Comments: Conceivably, one could treat several different types of evergreen conifer plantations at Upper Delaware Scenic and Recreational River based on dominants (Scotch pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), red pine (*Pinus resinosa*), eastern white pine (*Pinus strobes*), etc.), but for this project all are considered within this type (CEGL006313).

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.35, UPDE.137, UPDE.217, UPDE.220.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Planted/Cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.)
Formation	Planted/cultivated temperate or subpolar needle-leaved evergreen forest (I.A.8.C.x.)
Alliance	*Pinus strobus* Planted Forest Alliance (A.98)
Alliance (English name)	Eastern White Pine Planted Forest Alliance
Association	*Pinus* spp. Planted Forest
Association (English name)	Pine species Planted Forest
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: These plantations consist of mature *Pinus strobus* (eastern white pine) or *Pinus sylvestris* (Scotch pine), with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa* (red

pine), *Picea abies* (Norway spruce), *Picea pungens* (blue spruce), or *Larix decidua* (European larch). The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods dominate the sapling and seedling layers in some areas; *Juniperus virginiana* (eastern red-cedar) is common in others. Cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina* (black cherry), *Acer rubrum* (red maple), and *Fraxinus americana* (white ash). A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* (hawthorn) spp., *Hamamelis virginiana* (American witch-hazel), and *Lindera benzoin* (northern spicebush). Common short shrubs include *Viburnum recognitum* (southern arrow-wood), *Vaccinium pallidum* (Blue Ridge blueberry), *Rubus hispidus* (bristly dewberry), and *Rubus flagellaris* (northern dewberry). The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima* (white snakeroot), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Oxalis stricta* (common yellow oxalis), *Potentilla simplex* (common cinquefoil), *Mitchella repens* (partridgeberry), *Galium aparine* (stickywilly), *Galium asprellum* (rough bedstraw), *Brachyelytrum erectum* (bearded shorthusk), *Veronica officinalis* (common gypsyweed), *Polystichum acrostichoides* (Christmas fern), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Lycopodium clavatum* (running clubmoss), and *Lycopodium digitatum* (fan clubmoss). Graminoid and forb species associated with disturbed areas, such as *Agrostis stolonifera* (creeping bentgrass), *Dichanthelium clandestinum* (deertongue), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Hypericum perforatum* (common St. Johnswort), are often dominant in these communities. Vines such as *Toxicodendron radicans* (eastern poison-ivy), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis* (grape) spp., and *Parthenocissus quinquefolia* (Virginia creeper) may be present, but not abundant, in these plantations. Disturbance from silvicultural treatments and landscape fragmentation leaves these communities prone to invasion by exotic species, including *Lonicera tatarica* (Tatarian honeysuckle), *Berberis vulgaris* (common barberry), *Rosa multiflora* (multiflora rose), *Celastrus orbiculata* (Asian bittersweet), *Microstegium vimineum* (Nepalese browntop), and *Alliaria petiolata* (garlic mustard), which are locally abundant.

Environmental Description: These mature plantations are planted in post-agricultural fields and pastures. The trees are typically even-aged and regularly-spaced. Soils are usually moderately well-drained to well-drained and vary from sandy to loamy.

Vegetation Description: These plantations consist of mature *Pinus strobus* (eastern white pine) or *Pinus sylvestris* (Scotch pine), with other conifers sometimes present in smaller amounts, planted in post-agricultural fields and pastures. Associated canopy conifers include *Pinus resinosa* (red pine), *Picea abies* (Norway spruce), *Picea pungens* (blue spruce), or *Larix decidua* (European larch). The understory varies widely in its degree of development and may be virtually absent. Northern hardwoods dominate the sapling and seedling layers in some areas; *Juniperus virginiana* (eastern red-cedar) is common in others. Cover is proportional to the degree of canopy break-up or opening that has occurred. Common hardwoods include *Prunus serotina* (black cherry), *Acer rubrum* (red maple), and *Fraxinus americana* (white ash). A tall-shrub layer may be present; common species (aside from smaller individuals of the hardwood saplings) include *Crataegus* (hawthorn) spp., *Hamamelis virginiana* (American witch-hazel), and *Lindera benzoin* (northern spicebush). Common short shrubs include *Viburnum recognitum* (southern arrow-wood), *Vaccinium pallidum* (Blue Ridge blueberry), *Rubus hispidus* (bristly dewberry),

and *Rubus flagellaris* (northern dewberry). The species composition and abundance of the herbaceous layer vary widely due to variation in canopy tree species composition, stand stocking, and soil drainage. Herbaceous species include *Ageratina altissima* (white snakeroot), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Oxalis stricta* (common yellow oxalis), *Potentilla simplex* (common cinquefoil), *Mitchella repens* (partridgeberry), *Galium aparine* (stickywilly), *Galium asprellum* (rough bedstraw), *Brachyelytrum erectum* (bearded shorthusk), *Veronica officinalis* (common gypsyweed), *Polystichum acrostichoides* (Christmas fern), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Lycopodium clavatum* (running clubmoss), and *Lycopodium digitatum* (fan clubmoss). Graminoid and forb species associated with disturbed areas, such as *Agrostis stolonifera* (creeping bentgrass), *Dichanthelium clandestinum* (deertongue), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Hypericum perforatum* (common St. Johnswort), are often dominant in these communities. Vines such as *Toxicodendron radicans* (eastern poison-ivy), *Smilax glauca* (cat greenbrier), *Smilax rotundifolia* (roundleaf greenbrier), *Vitis* (grape) spp., and *Parthenocissus quinquefolia* (Virginia creeper) may be present, but not abundant, in these plantations. Disturbance from silvicultural treatments and landscape fragmentation leaves these communities prone to invasion by exotic species, including *Lonicera tatarica* (Tatarian honeysuckle), *Berberis vulgaris* (common barberry), *Rosa multiflora* (multiflora rose), *Celastrus orbiculata* (Asian bittersweet), *Microstegium vimineum* (Nepalese browntop), and *Alliaria petiolata* (garlic mustard), which are locally abundant.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Pinus sylvestris* (Scotch pine)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Veronica officinalis* (common gypsyweed)

Characteristic Species: *Pinus strobus* (eastern white pine), *Pinus sylvestris* (Scotch pine), *Veronica officinalis* (common gypsyweed).

Other Noteworthy Species:

Species	GRank	Type	Note
Alliaria petiolata (garlic mustard)		plant	exotic
Berberis vulgaris (common barberry)		plant	exotic
Celastrus orbiculata (Asian bittersweet)		plant	exotic
Hypericum perforatum (common St. Johnswort)		plant	exotic
Lonicera tatarica (Tatarian honeysuckle)		plant	exotic
Microstegium vimineum (Nepalese browntop)		plant	exotic
Picea abies (Norway spruce)		plant	exotic
Pinus sylvestris (Scotch pine)		plant	exotic
Rosa multiflora (multiflora rose)		plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Mixed pine plantations are common throughout the northeastern United States.

States/Provinces: NJ, NY, PA, VT.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill, Johnstown Flood, Marsh-Billings-Rockefeller, Upper Delaware); USFWS (Erie, Iroquois).

CONSERVATION STATUS
Rank: GNA (modified/managed) (1-Dec-2004).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: This type is intended for plantations of mixed pines or pine mixed with other nonnative planted conifers.
Similar Associations:
- *Pinus strobus* Planted Forest (CEGL007178)--monotypic white pine.

Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler.
References: Eastern Ecology Working Group n.d., Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2007.



Figure E1. Mixed Pine Conifer Plantation in Upper Delaware Scenic and Recreational River (Plot UPDE.35). August 2005. NAD 1983 / UTM easting 494408, northing 4628404.



Figure E2. Mixed Pine Conifer Plantation in Upper Delaware Scenic and Recreational River (Plot UPDE.137). July 2005. NAD 1983 / UTM easting 520633, northing 458658.

COMMON NAME (PARK-SPECIFIC): SWAMP FOREST - BOG COMPLEX (SPRUCE TYPE)

SYNONYMS

USNVC English Name: **Red Spruce - (Eastern Hemlock) / Great Laurel Saturated Forest**

USNVC Scientific Name: ***Picea rubens - (Tsuga canadensis) / Rhododendron maximum* Saturated Forest**

USNVC Identifier: **CEGL006277**

LOCAL INFORMATION

Environmental Description: This wetland type occurs in isolated upland depressions typically on ridgetops in Pennsylvania. This association occurs on shallow organic soils or mineral soils with substantial accumulation of organic matter.

Vegetation Description: The canopy is dominated by conifers, primarily red spruce (*Picea rubens*), with eastern white pine (*Pinus strobus*) and occasionally eastern hemlock (*Tsuga canadensis*). Hardwood associates, such as red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), and blackgum (*Nyssa sylvatica*), may also be scattered throughout. Dense tall-shrub and short-shrub layers of highbush blueberry (*Vaccinium corymbosum*) are present. Sphagnum (*Sphagnum* spp.) and a liverwort (*Bazzania trilobata*) blanket well-developed hummocks and hollows. The herbaceous and graminoid species are scattered sparsely. Common species include cinnamon fern (*Osmunda cinnamomea*), threeleaf goldthread (*Coptis trifolia*), partridgeberry (*Mitchella repens*), and sedges (*Carex* spp.).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Picea rubens* (red spruce)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)

Characteristic Species: *Picea rubens* (red spruce), *Pinus strobus* (eastern white pine), *Vaccinium corymbosum* (highbush blueberry).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S1*	1	Spruce-Fir Swamp	Edinger et al. 2002
PA	S1*	1	Red Spruce Palustrine Forest	Fike 1999

Local Range: This association does not occur within the park boundary, however, it was mapped at one location outside the park boundary within the mapped buffer in Pennsylvania. Other occurrences are likely to exist just outside of the park boundary in Pennsylvania.

Classification Comments: This association is distinguished by the clear dominance of red spruce in a palustrine evergreen forest.

Other Comments: Information not available.

Local Description Authors: S. J. Perles (PNHP).

Plots: UPDE.AA.236 (Fike 1999).

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Saturated temperate or subpolar needle-leaved evergreen forest (I.A.8.N.g.)
Alliance	*Picea rubens* Saturated Forest Alliance (A.198)
Alliance (English name)	Red Spruce Saturated Forest Alliance
Association	*Picea rubens - (Tsuga canadensis) / Rhododendron maximum* Saturated Forest
Association (English name)	Red Spruce - (Eastern Hemlock) / Great Laurel Saturated Forest
Ecological System(s):	North-Central Appalachian Acidic Swamp (CES202.604). Southern and Central Appalachian Bog and Fen (CES202.300). High Allegheny Wetland (CES202.069).

GLOBAL DESCRIPTION

Concept Summary: This spruce-hemlock wetland forest of the central and southern Appalachian Mountains occurs on relatively flat terrain in poorly drained bottomlands of small streams at high elevations (above 1067 m [3500 feet] elevation in the Southern Blue Ridge to above 610 m [2000 feet] in the Central Appalachians). Small patches of this community also occur in the High Alleghany Plateau of Pennsylvania and New York. It historically occurred in Tennessee. Soils are seasonally to semipermanently saturated due to a high water table or seepage from adjacent slopes. The tree canopy is dominated by *Picea rubens* (red spruce) or mixtures of *Picea rubens* (red spruce) and *Tsuga canadensis* (eastern hemlock). Other tree species that may occur in the canopy or subcanopy include *Tsuga canadensis* (eastern hemlock), *Betula alleghaniensis* (yellow birch), *Acer rubrum* var. *rubrum* (red maple), *Taxus canadensis* (Canada yew), and *Amelanchier arborea* (common serviceberry). This forest often has a dense shrub layer dominated by *Rhododendron maximum* (great laurel), with other associates often including *Kalmia latifolia* (mountain laurel), *Ilex verticillata* (common winterberry), *Ilex collina* (longstalk holly), *Viburnum nudum* var. *cassinoides* (withe-rod), *Photinia melanocarpa* (black chokeberry), and *Vaccinium* (blueberry) spp. The herbaceous layer is sparse, with the majority of herbaceous species restricted to openings, and includes *Carex trisperma* (threeseeded sedge), *Carex folliculata* (northern long sedge), *Glyceria melicaria* (melic mannagrass), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Maianthemum canadense* (Canada mayflower). *Listera smallii* (kidneyleaf twayblade), *Oclemena acuminata* (whorled wood aster), *Huperzia lucidula* (shining clubmoss), and *Dryopteris campyloptera* (mountain woodfern) are characteristic herbs. The bryophyte layer is of variable cover but is dominated by *Sphagnum* (sphagnum). The absence of *Abies balsamea* (balsam fir) and the importance of *Rhododendron maximum* (great laurel) differentiate this forest from *Picea rubens - Abies balsamea / Sphagnum magellanicum* Forest (CEGL006311).

Environmental Description: This community occurs in poorly drained bottomlands of small streams at high elevations: 1300-1400 m (4200-4500 feet) in North Carolina, 770-1150 m (2500-3800 feet) in West Virginia, and 1070 m (3500 feet) in Virginia. It also occurs in isolated upland depressions on ridgetops in the High Alleghany Plateau of Pennsylvania and New York. Flooding is rare and soils are seasonally to semipermanently saturated due to a high water table or seepage from adjacent slopes.

Vegetation Description: This community generally occurs as an open canopy woodland dominated by *Picea rubens* (red spruce), with an open to dense shrub layer, interspersed with

small, open *Sphagnum* (sphagnum)-herb-dominated depressions. Other tree species that may occur in the canopy or subcanopy include *Tsuga canadensis* (eastern hemlock), *Betula alleghaniensis* (yellow birch), *Acer rubrum* var. *rubrum* (red maple), *Pinus strobus* (eastern white pine), and *Amelanchier arborea* (common serviceberry). A dense shrub layer, dominated by *Kalmia latifolia* (mountain laurel) and *Rhododendron maximum* (great laurel) or *Rhododendron catawbiense* (Catawba rosebay), is usually present. Other characteristic shrubs include *Ilex verticillata* (common winterberry), *Ilex collina* (longstalk holly), *Taxus canadensis* (Canada yew), *Viburnum nudum* var. *cassinoides* (withe-rod), *Photinia melanocarpa* (black chokeberry), and *Vaccinium* (blueberry) spp. The herbaceous layer is sparse and patchy and generally restricted to openings with plenty of light. Characteristic herbs include *Carex trisperma* (threeseeded sedge), *Carex folliculata* (northern long sedge), *Glyceria melicaria* (melic mannagrass), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* var. *spectabilis* (royal fern), *Listera smallii* (kidneyleaf twayblade), *Maianthemum canadense* (Canada mayflower), and *Houstonia serpyllifolia* (thymeleaf bluet). *Sphagnum* (sphagnum) patches may occur scattered beneath the canopy as well as in small depressions. Other nonvascular plants include *Bazzania trilobata* and *Leucobryum glaucum* (leucobryum moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Picea rubens* (red spruce)
Tall shrub/sapling	Broad-leaved evergreen tree	*Rhododendron catawbiense* (Catawba rosebay), *Rhododendron maximum* (great laurel)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Kalmia latifolia* (mountain laurel)

Characteristic Species: *Bazzania trilobata* (three-lobed bazzania), *Carex trisperma* (threeseeded sedge), *Ilex collina* (longstalk holly), *Sphagnum palustre* (prairie sphagnum).

Other Noteworthy Species:

Species	GRank	Type	Note
Ageratina altissima var. *roanensis* (white snakeroot)	G5T3T4	plant	
Ilex collina (longstalk holly)	G3	plant	

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This red spruce wetland forest occurs in small patches in the southern and central Appalachian Mountains north to the High Alleghany Plateau.
States/Provinces: MD, NC, NY:S1, PA:S1, TN?:SH, VA?, WV:S2.
Federal Lands: NPS (Upper Delaware?); USFS (Jefferson?, Monongahela, Nantahala, Pisgah).

CONSERVATION STATUS

Rank: G2? (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: This community is rare in the Southern Blue Ridge, and remaining examples are in poor condition throughout its range. It is known from the Blue Ridge of North Carolina (Alarka Laurel, Long Hope Valley), and was historic in Tennessee.

Similar Associations:

- *Picea rubens / Rhododendron maximum - Kalmia latifolia / Eriophorum virginicum / Sphagnum* spp. Forest (CEGL006588).

Related Concepts:

- *Picea rubens - Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. - *Bazzania trilobata* swamp (Byers et al. 2007) =
- *Tsuga canadensis - Picea rubens* Forest (Walton et al. 1997) ?
- IIE1a. Southern Appalachian Bog Complex (Allard 1990) B
- Oligotrophic Forest (Rawinski 1992) ?
- Red Spruce-Northern Hardwoods (17) (USFS 1988) ?
- Red Spruce: 32 (Eyre 1980) B
- Red spruce-hemlock/great laurel swamp (CAP pers. comm. 1998) ?
- Spruce forest community (Robinette 1966) =
- Swamp Forest-Bog Complex (Spruce Subtype) (Schafale 1998a) ?

SOURCES

Description Authors: M. G. Anderson, mod. K. D. Patterson and E. Largay.

References: Allard 1990, Anderson 1990, Anderson et al. 1990, Byers et al. 2007, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Francl et al. 2004, Harrison 2004, Peet et al. unpubl. data 2002, Rawinski 1992, Rawinski et al. 1994, Richardson and Gibbons 1993, Robinette 1966, Schafale 1998a, Schafale and Weakley 1990, Stotler and Crandall-Stotler 1977, TDNH unpubl. data, USFS 1988, Walton et al. 1997, Weakley and Schafale 1994.



Figure E3. Swamp Forest - Bog Complex (Spruce Type) in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.236). August 2006. NAD 1983 / UTM easting 494619, northing 4602706.

COMMON NAME (PARK-SPECIFIC): HEMLOCK - HARDWOOD SWAMP

SYNONYMS

USNVC English Name: **Eastern Hemlock - Yellow Birch / Common Winterberry / Peatmoss species Forest**

USNVC Scientific Name: ***Tsuga canadensis - Betula alleghaniensis / Ilex verticillata Sphagnum* spp. Forest**

USNVC Identifier: **CEGL006226**

LOCAL INFORMATION

Environmental Description: This swamp type occurs in small basins, often associated with headwater seepage. The acidic, organic soils remain saturated for most or all of the growing season; they may partially dry out, particularly in smaller basins.

Vegetation Description: The tree canopy is dominated by eastern hemlock (*Tsuga canadensis*) with at least 25% relative canopy cover. Common canopy associates include red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), and/or blackgum (*Nyssa sylvatica*). Scattered shrubs can include highbush blueberry (*Vaccinium corymbosum*) and common winterberry (*Ilex verticillata*). Cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), and sensitive fern (*Onoclea sensibilis*) are prominent ferns; associated herbs can include northern long sedge (*Carex folliculata*), threeseeded sedge (*Carex trisperma*), softleaf sedge (*Carex disperma*), Canada mayflower (*Maianthemum canadense*), threeleaf goldthread (*Coptis trifolia*), crested woodfern (*Dryopteris cristata*), dwarf red blackberry (*Rubus pubescens*), and partridgeberry (*Mitchella repens*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Vaccinium corymbosum* (highbush blueberry)
Herb (field)	Graminoid	*Carex folliculata* (northern long sedge), *Carex trisperma* (threeseeded sedge)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern)

Characteristic Species: *Osmunda cinnamomea* (cinnamon fern), *Tsuga canadensis* (eastern hemlock), *Vaccinium corymbosum* (highbush blueberry).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	Srank	Conf	Sname	Reference
NY	S4*	2	Hemlock-Hardwood Swamp	Edinger et al. 2002
PA	SNR*	2	Hemlock-Mixed Hardwood Palustrine Forest	Fike 1999

Local Range: This association is most common in the southern half of Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.AA.239.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Evergreen forest (I.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
Formation	Saturated temperate or subpolar needle-leaved evergreen forest (I.A.8.N.g.)
Alliance	*Tsuga canadensis* Saturated Forest Alliance (A.201)
Alliance (English name)	Eastern Hemlock Saturated Forest Alliance
Association	*Tsuga canadensis - Betula alleghaniensis / Ilex verticillata / Sphagnum* spp. Forest
Association (English name)	Eastern Hemlock - Yellow Birch / Common Winterberry / Peatmoss species Forest
Ecological System(s):	North-Central Appalachian Acidic Swamp (CES202.604)

GLOBAL DESCRIPTION

Concept Summary: These hemlock-hardwood swamps are common throughout most of New England, New York and Pennsylvania, mostly in glaciated areas south of spruce-fir forest regions. Most are mixed-canopy wetland forests, but in some may be strongly coniferous. They occur in poorly drained basins over bedrock or compacted till. "Pocket swamps," small isolated basins in upland forests, are one setting, and these swamps also occur adjacent to streams and lakes in larger basins. The acidic, organic soils remain saturated for most or all of the growing season; they may partially dry out, particularly in smaller basins. Canopy closure is nearly complete, and shrubs are sparse. The herbaceous layer may be well-developed, with ferns especially characteristic. Bryophyte cover varies, but is usually extensive. *Tsuga canadensis* (eastern hemlock) is either canopy dominant or is mixed with other trees including *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), *Nyssa sylvatica* (blackgum), and *Fraxinus nigra* (black ash). Scattered shrubs include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), *Lyonia ligustrina* (maleberry), *Nemopanthus mucronatus* (catberry), and *Viburnum nudum* var. *cassinoides* (withe-rod). *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Onoclea sensibilis* (sensitive fern) are prominent ferns; associated herbs include *Carex folliculata* (northern long sedge), *Carex trisperma* (threeseeded sedge), *Carex disperma* (softleaf sedge), *Maianthemum canadense* (Canada mayflower), *Coptis trifolia* (threeleaf goldthread), *Dryopteris cristata* (crested woodfern), *Rubus pubescens* (dwarf red blackberry), and *Mitchella repens* (partridgeberry). Bryophytes include *Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum), and other *Sphagnum* (sphagnum) species, as well as *Pleurozium schreberi* (Schreber's big red stem moss) and *Bazzania trilobata*. These forests lack the species of more southerly affinity, such as *Rhododendron maximum* (great laurel) or *Liriodendron tulipifera* (tuliptree), that characterize hemlock swamps to the south, which are covered by *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279). Mixed expression of these swamps may be similar in canopy composition to *Betula alleghaniensis - Acer rubrum - (Tsuga canadensis, Abies balsamea) / Osmunda cinnamomea* Forest (CEGL006380); those are mineral-soil wetlands in seepage-influenced areas, typically at wetland-upland ecotones, and usually occur on slopes rather than in basins. *Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest (CEGL006014) is ecologically similar but is more strongly deciduous, with limited hemlock.

Environmental Description: These hemlock-hardwood swamps are common throughout most of New England, New York and Pennsylvania, mostly in glaciated areas south of spruce-fir forest regions. Most are mixed-canopy wetland forests, but in some may be strongly coniferous.

They occur in poorly drained basins over bedrock or compacted till. "Pocket swamps," small isolated basins in upland forests, are one setting, and these swamps also occur adjacent to streams and lakes in larger basins. The acidic, organic soils remain saturated for most or all of the growing season; they may partially dry out, particularly in smaller basins.

Vegetation Description: Canopy closure is nearly complete, and shrubs are sparse. The herbaceous layer may be well-developed, with ferns especially characteristic. Bryophyte cover varies, but is usually extensive. *Tsuga canadensis* (eastern hemlock) is either canopy dominant or is mixed with other trees including *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), *Nyssa sylvatica* (blackgum), and *Fraxinus nigra* (black ash). Scattered shrubs include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), *Lyonia ligustrina* (maleberry), *Nemopanthus mucronatus* (catberry), and *Viburnum nudum* var. *cassinoides* (withe-rod). *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), and *Onoclea sensibilis* (sensitive fern) are prominent ferns; associated herbs include *Carex folliculata* (northern long sedge), *Carex trisperma* (threeseeded sedge), *Carex disperma* (softleaf sedge), *Maianthemum canadense* (Canada mayflower), *Coptis trifolia* (threeleaf goldthread), *Dryopteris cristata* (crested woodfern), *Rubus pubescens* (dwarf red blackberry), and *Mitchella repens* (partridgeberry). Bryophytes include *Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum), and other *Sphagnum* (sphagnum) species, as well as *Pleurozium schreberi* (Schreber's big red stem moss) and *Bazzania trilobata*. These forests lack the species of more southerly affinity, such as *Rhododendron maximum* (great laurel) or *Liriodendron tulipifera* (tuliptree), that characterize hemlock swamps to the south.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry)
Herb (field)	Fern or fern ally	*Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern)
Nonvascular	Moss	*Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum)

Characteristic Species: *Betula alleghaniensis* (yellow birch), *Ilex verticillata* (common winterberry), *Sphagnum girgensohnii* (Girgensohn's sphagnum), *Sphagnum palustre* (prairie sphagnum), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community occurs in glaciated areas ranging from New Jersey and Pennsylvania north through New York and New England to New Brunswick and possibly Nova Scotia, Canada.

States/Provinces: CT, MA, ME, MI, NB, NH, NJ:S2, NS?, NY, PA, RI, VT:S2.

Federal Lands: NPS (Upper Delaware); USFWS (Erie, Iroquois).

CONSERVATION STATUS

Rank: G5 (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

- *Acer rubrum - Nyssa sylvatica - Betula alleghaniensis / Sphagnum* spp. Forest (CEGL006014).
- *Betula alleghaniensis - Acer rubrum - (Tsuga canadensis, Abies balsamea) / Osmunda cinnamomea* Forest (CEGL006380).
- *Betula alleghaniensis - Acer rubrum - Tsuga canadensis / Sphagnum* spp. Forest (CEGL006955).
- *Tsuga canadensis - Betula alleghaniensis* Saturated Forest (CEGL005003).
- *Tsuga canadensis / Rhododendron maximum / Sphagnum* spp. Forest (CEGL006279).

Related Concepts:

- Hardwood-Conifer Swamp (Breden 1989) B
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- Hemlock Swamp (Thompson 1996) ?
- Hemlock-hardwood swamp (Reschke 1990) ?
- Inland Atlantic white cedar swamp (Reschke 1990) B
- Northern New England basin swamp (Rawinski 1984) B
- Palustrine Needle-leaved Evergreen Forested Wetland (PFO4) (Cowardin et al. 1979) ?

SOURCES

Description Authors: J. Lundgren, mod. E. Largay.

References: Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fike 1999, Gawler 2002, Kost et al. 2007, Lundgren 2000, Metzler and Barrett 2001, Rawinski 1984, Reschke 1990, Sperduto 2000b, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E4. Hemlock - Hardwood Swamp in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.239). August 2006. NAD 1983 / UTM easting 511315, northing 4586874.

COMMON NAME (PARK-SPECIFIC): LARCH PLANTATION

SYNONYMS
USNVC English Name: **(Tamarack, European Larch) Planted Forest**
USNVC Scientific Name: ***Larix (laricina, decidua)* Planted Forest**
USNVC Identifier: **CEGL006408**

LOCAL INFORMATION

Environmental Description: These plantations typically occur in small patches, often on abandoned agricultural or cleared lands in a variety of environmental settings.
Vegetation Description: This association consists of an even-aged, regularly-spaced stand of European larch (*Larix decidua*). The herbaceous layer is usually sparse with low diversity.
Most Abundant Species:

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

Characteristic Species: *Larix decidua* (European larch).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Conf	Sname	Reference
NY	S5*	1	Conifer Plantation	Edinger et al. 2002
PA	SNA		[not crosswalked]	

Local Range: This association is uncommon at Upper Delaware Scenic and Recreational River; it occurs in the north and center of the park.
Classification Comments: Information not available.
Other Comments: Information not available.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: None.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Planted/Cultivated cold-deciduous forest (I.B.2.C.)
Formation	Planted/cultivated cold-deciduous forest (I.B.2.C.x.)
Alliance	*Larix* spp. Planted Forest Alliance (A.3029)
Alliance (English name)	Larch species Planted Forest Alliance
Association	*Larix (laricina, decidua)* Planted Forest
Association (English name)	(Tamarack, European Larch) Planted Forest
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept 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: These plantations typically occur in small patches, often on abandoned agricultural or cleared lands in a variety of environmental settings.
Vegetation Description: 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:

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

Characteristic Species: *Larix decidua* (European larch), *Larix laricina* (tamarack).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
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.
States/Provinces: ME, NY, PA, VT.
Federal Lands: NPS (Marsh-Billings-Rockefeller, Upper Delaware).

CONSERVATION STATUS
Rank: GNA (cultural) (6-Dec-2005).
Reasons: 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 INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler.
References: Eastern Ecology Working Group n.d.

No photo available.

COMMON NAME (PARK-SPECIFIC): CENTRAL APPALACHIAN NORTHERN HARDWOOD FOREST

SYNONYMS

USNVC English Name: **Sugar Maple - Yellow Birch - American Beech / Hobblebush Forest**

USNVC Scientific Name: ***Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides*** **Forest**

USNVC Identifier: **CEGL006252**

LOCAL INFORMATION

Environmental Description: This association occurs most commonly with an east-facing aspect on gentle (about 15-degree) slopes. Documented examples in the Upper Delaware River valley have been found in topographic settings ranging from low- to high-slope positions at 256 to 481 m (840-1580 feet) in elevation, with an average elevation of 358 m (1175 feet). The community occurs on circumneutral loams (silty loams to sandy loams) that are somewhat moist to dry, well-drained, and typically very stony. Underlying bedrock is Devonian-age sandstone, siltstone, or shale in the Catskill Formation.

Vegetation Description: The canopy of this semi-mesic forest association is codominated by sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), and sweet birch (*Betula lenta*) and is sometimes overtopped by a few emergent eastern white pine (*Pinus strobus*) trees. Canopy height generally ranges from 20-30 m tall, and canopy closure is nearly complete (75-80%). Common associates in the canopy include white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), yellow birch (*Betula alleghaniensis*), chestnut oak (*Quercus prinus*), American basswood (*Tilia americana*), white oak (*Quercus alba*), and eastern hemlock (*Tsuga canadensis*). The subcanopy layer reaches about 15 m tall and can be moderately well-developed (33% cover). Representative species are often those that are found in the canopy: sweet birch, American beech, sugar maple, red maple, eastern hemlock, black cherry, and white ash. The tall-shrub layer (2-5 m tall) can also be well-developed (up to 20% cover) and can be dominated by American beech root sprouts. Other tall-shrub species include American witchhazel (*Hamamelis virginiana*), striped maple (*Acer pensylvanicum*), sweet birch, great laurel (*Rhododendron maximum*), sugar maple, black cherry, eastern hemlock, hophornbeam (*Ostrya virginiana*), American hornbeam (*Carpinus caroliniana*), white ash, and yellow birch. Many of the same species appear in the short-shrub layer (1 m tall), which can also be dominated by American beech root sprouts. Seedlings of canopy and subcanopy species are common. Species unique to the short-shrub layer are American red raspberry (*Rubus idaeus*), Allegheny blackberry (*Rubus allegheniensis*), Japanese barberry (*Berberis thunbergii*), dwarf red blackberry (*Rubus pubescens*), mountain holly (*Ilex montana*), Blue Ridge blueberry (*Vaccinium pallidum*), northern dewberry (*Rubus flagellaris*), eastern prickly gooseberry (*Ribes cynosbati*), hobblebush (*Viburnum lantanoides*), mapleleaf viburnum (*Viburnum acerifolium*), lowbush blueberry (*Vaccinium angustifolium*), and red elderberry (*Sambucus racemosa*). Woody vines are occasional (<10% cover) on the forest floor; species include fringed black bindweed (*Polygonum cilinode*) and Virginia creeper (*Parthenocissus quinquefolia*). A moderately rich and diverse herbaceous flora is associated with this forest type and enrichment indicators, such as northern maidenhair (*Adiantum pedatum*), can be present but are uncommon. Eastern hayscented fern (*Dennstaedtia punctilobula*) can be strongly dominant (40-50% cover) after disturbance events.

Ferns are commonly important species and could also include intermediate woodfern (*Dryopteris intermedia*), marginal woodfern (*Dryopteris marginalis*), common ladyfern (*Athyrium filix-femina*), interrupted fern (*Osmunda claytoniana*), rock polypody (*Polypodium virginianum*), broad beechfern (*Phegopteris hexagonoptera*), and New York fern (*Thelypteris noveboracensis*). Woodland grasses and sedges are likely to include drooping woodreed (*Cinna latifolia*), Swan's sedge (*Carex swanii*), graceful sedge (*Carex gracillima*), Appalachian sedge (*Carex appalachica*), fibrousroot sedge (*Carex communis*), slender looseflower sedge (*Carex gracilescens*), white edge sedge (*Carex debilis*), eastern woodland sedge (*Carex blanda*), nodding fescue (*Festuca subverticillata*), and hairy woodrush (*Luzula acuminata*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech)
Herb (field)	Forb	*Polygonum cilinode* (fringed black bindweed)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech).

Other Noteworthy Species:

Species	GRank	Type	Note
Quercus rubra (northern red oak)		plant	can be present
Tsuga canadensis (eastern hemlock)		plant	can be present

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Beech-Maple Mesic Forest	Edinger et al. 2002
PA	S4*	2	Northern Hardwood Forest	Fike 1999

Local Range: This association is found in the northern half of Upper Delaware Scenic and Recreational River, from Skinner's Falls north.

Classification Comments: Enrichment indicators are either lacking or uncommon

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.27, UPDE.36, UPDE.39, UPDE.42, UPDE.50, UPDE.52, UPDE.56, UPDE.58, UPDE.60, UPDE.63, UPDE.113, UPDE.115.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Acer saccharum - Betula alleghaniensis - (Fagus grandifolia)* Forest Alliance (A.216)
Alliance (English name)	Sugar Maple - Yellow Birch - (American Beech) Forest Alliance
Association	*Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest
Association (English name)	Sugar Maple - Yellow Birch - American Beech / Hobblebush Forest

Ecological System(s): Laurentian-Acadian Northern Hardwoods Forest (CES201.564).
Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593).

GLOBAL DESCRIPTION

Concept Summary: This association, known commonly as "northern hardwood forest," is a widespread matrix forest in central New England and at lower elevations in northern New England. This forest occurs most commonly on acidic (pH 5-6), moderate to well-drained tills at elevations generally below 762 m (2500 feet). In northern New England, they cover extensive mid-elevation ridges; elsewhere, slope settings are common. The closed-canopy forest has sparse to moderate shrub and herb cover and may have local carpets of tree seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. The closed-canopy forest has sparse to moderate shrub and herb cover and may have local carpets of tree seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. On some rocky, higher-elevation sites, dense ferns and other herbs may form a lush understory (the "fern-glade variant"). The canopy is dominated by *Acer saccharum* (sugar maple) mixed with variable amounts of *Fagus grandifolia* (American beech) and/or *Betula alleghaniensis* (yellow birch). Associated hardwood species include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), and *Fraxinus americana* (white ash). At the southern end of this type's range, especially in mid-successional stands, *Betula lenta* (sweet birch) may be present. Conifers are usually present at low abundance. Characteristic species include *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and in the northern portion of the range, *Picea rubens* (red spruce). Oaks are generally not present, although *Quercus rubra* (northern red oak) and (southward) *Quercus alba* (white oak) are sometimes present in low numbers. The shrub layer is often dominated by saplings of canopy tree species Characteristic understory shrubs or small trees include *Acer pensylvanicum* (striped maple), *Ostrya virginiana* (hophornbeam), *Viburnum lantanoides* (hobblebush), *Acer spicatum* (mountain maple) (in the northern part of this type's range), and *Lindera benzoin* (northern spicebush) (in the southern part of this type's range. The patchy herbaceous layer is a mix of ferns, rhizomatous herbs and clubmosses. Characteristic species include *Dryopteris intermedia* (intermediate woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Polystichum acrostichoides* (Christmas fern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Clintonia borealis* (bluebead), *Trientalis borealis* (starflower), *Oclemena acuminata* (whorled wood aster), and *Uvularia sessilifolia* (sessileleaf bellwort). Occasional species include *Aralia nudicaulis* (wild sarsaparilla), *Trillium erectum* (red trillium), *Trillium undulatum* (painted trillium), *Dryopteris campyloptera* (mountain woodfern), *Streptopus lanceolatus* (twistedstalk), *Cinna latifolia* (drooping woodreed), *Thelypteris noveboracensis* (New York fern), *Mitchella repens* (partridgeberry), *Solidago macrophylla* (largeleaf goldenrod), and *Medeola virginiana* (Indian cucumber). The bryophyte layer may include *Dicranum* (dicranum moss) spp. and *Leucobryum glaucum* (leucobryum moss). Sugar maple leaf litter is high in nitrogen relative to lignin and thus decomposes rapidly, increasing the nutrient pool in the soil organic layer. Structure and composition of the forest are maintained primarily by single small tree-fall gaps. Yellow birch is maintained in the system by mineral soils on "tip-up mounds."

Environmental Description: This association, known commonly as 'northern hardwood forest,' is a widespread matrix forest in central New England, and at lower elevations in northern New England. This forest occurs most commonly on acid (pH 5-6), moderate to well-drained tills at elevations generally below 2500 feet. In northern New England, they cover extensive mid-elevation ridges; elsewhere, slope settings are common.

Vegetation Description: The closed-canopy forest has sparse to moderate shrub and herb cover and may have local carpets of tree seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. On some rocky, higher-elevation sites, dense ferns and other herbs may form a lush understory (the "fern-glade variant"). The canopy is dominated by *Acer saccharum* (sugar maple) mixed with variable amounts of *Fagus grandifolia* (American beech) and/or *Betula alleghaniensis* (yellow birch). Associated hardwood species include *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), and *Fraxinus americana* (white ash). At the southern end of this type's range, especially in mid-successional stands, *Betula lenta* (sweet birch) may be present. Conifers are usually present at low abundance. Characteristic species include *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and in the northern portion of the range, *Picea rubens* (red spruce). Oaks are generally not present, although *Quercus rubra* (northern red oak) and (southward) *Quercus alba* (white oak) are sometimes present in low numbers. The shrub layer is often dominated by saplings of canopy tree species. Characteristic understory shrubs or small trees include *Acer pensylvanicum* (striped maple), *Ostrya virginiana* (hophornbeam), *Viburnum lantanoides* (hobblebush), *Acer spicatum* (mountain maple) (in the northern part of this type's range), and *Lindera benzoin* (northern spicebush) (in the southern part of this type's range. The patchy herbaceous layer is a mix of ferns, rhizomatous herbs and clubmosses. Characteristic species include *Dryopteris intermedia* (intermediate woodfern), *Dryopteris carthusiana* (spinulose woodfern), *Polystichum acrostichoides* (Christmas fern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Clintonia borealis* (bluebead), *Trientalis borealis* (starflower), *Oclemena acuminata* (whorled wood aster), and *Uvularia sessilifolia* (sessileleaf bellwort). Occasional species include *Aralia nudicaulis* (wild sarsaparilla), *Trillium erectum* (red trillium), *Trillium undulatum* (painted trillium), *Dryopteris campyloptera* (mountain woodfern), *Streptopus lanceolatus* (twistedstalk), *Cinna latifolia* (drooping woodreed), *Thelypteris noveboracensis* (New York fern), *Mitchella repens* (partridgeberry), *Solidago macrophylla* (largeleaf goldenrod), and *Medeola virginiana* (Indian cucumber). The bryophyte layer may include *Dicranum* (dicranum moss) spp. and *Leucobryum glaucum* (leucobryum moss). At higher elevations any of the understory herbs characteristic of montane spruce-fir forests may be locally abundant. In the southern portion of the range, exotic species including *Berberis thunbergii* (Japanese barberry) and *Microstegium vimineum* (Nepalese browntop) may be common in the shrub and herb layers.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech)
Shrub/sapling	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Ostrya virginiana* (hophornbeam)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech)
Herb (field)	Fern or fern ally	*Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Acer pensylvanicum* (striped maple), *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Dryopteris intermedia* (intermediate woodfern), *Fagus grandifolia* (American beech), *Ostrya virginiana* (hophornbeam), *Pinus strobus* (eastern white pine), *Polystichum acrostichoides* (Christmas fern), *Tsuga canadensis* (eastern hemlock), *Viburnum lantanoides* (hobblebush).

Other Noteworthy Species:

Species	GRank	Type	Note
Accipiter striatus (sharp-shinned hawk)		animal	
Aegolius acadicus (northern saw-whet owl)		animal	
Ambystoma maculatum (spotted salamander)		animal	
Berberis thunbergii (Japanese barberry)		plant	exotic
Contopus virens (eastern wood-pewee)		animal	
Dendroica caerulescens (black-throated blue warbler)		animal	
Dendroica virens (black-throated green warbler)		animal	
Desmognathus fuscus (dusky salamander)		animal	
Empidonax minimus (least flycatcher)		animal	
Empidonax virescens (Acadian flycatcher)		animal	
Erethizon dorsatum (north american porcupine)		animal	
Eurycea bislineata (northern two-lined salamander)		animal	
Glaucomys sabrinus (northern flying squirrel)		animal	
Hylocichla mustelina (wood thrush)		animal	
Martes pennanti (fisher)		animal	
Melanerpes carolinus (red-bellied woodpecker)		animal	
Meleagris gallopavo (wild turkey)		animal	
Microstegium vimineum (Nepalese browntop)		plant	exotic
Mniotilta varia (black-and-white warbler)		animal	
Napaeozapus insignis (woodland jumping mouse)		animal	
Notophthalmus viridescens (eastern newt)		animal	
Parula americana (northern parula)		animal	
Peromyscus leucopus (white-footed deermouse)		animal	
Peromyscus maniculatus (North American deermouse)		animal	
Picoides pubescens (downy woodpecker)		animal	
Picoides villosus (hairy woodpecker)		animal	
Piranga olivacea (scarlet tanager)		animal	
Poecile atricapillus (black-capped chickadee)		animal	
Rana sylvatica (wood frog)		animal	
Seiurus aurocapilla (ovenbird)		animal	
Setophaga ruticilla (American redstart)		animal	
Sitta carolinensis (white-breasted nuthatch)		animal	
Sorex cinereus (cinereus shrew)		animal	
Tamias striatus (eastern chipmunk)		animal	
Urocyon cinereoargenteus (gray fox)		animal	
Ursus americanus (American black bear)		animal	
Vireo olivaceus (red-eyed vireo)		animal	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is a widespread matrix forest from southern Quebec and the Maritime Provinces of Canada south through New England, continuing in more limited distribution to northern New Jersey and northeastern Pennsylvania.

States/Provinces: CT, MA, ME, NB, NH, NJ:S1S3, NY, PA, VT.

Federal Lands: NPS (Acadia, Delaware Water Gap, Marsh-Billings-Rockefeller, Upper Delaware); USFS (Finger Lakes?); USFWS (Aroostook, Moosehorn, Nulhegan Basin, Pondicherry).

CONSERVATION STATUS

Rank: G5 (7-Dec-2005).

Reasons: This association is a widespread matrix forest in New England, upstate New York, and adjacent Canada.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

- *Acer saccharum - (Fraxinus americana) / Arisaema triphyllum* Forest (CEGL006211).
- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004).
- *Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest (CEGL005008).
- *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest (CEGL005005).
- *Picea rubens - Betula alleghaniensis / Dryopteris campyloptera* Forest (CEGL006267).
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173).
- *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129).

Related Concepts:

- *Acer saccharum - Fagus grandifolia - Betula alleghaniensis / Viburnum alnifolium* Community (Metzler and Barrett 1996) ?
- Beech - Sugar Maple: 60 (Eyre 1980) B
- CNE dry transitional forest on sandy / gravelly soils (Rawinski 1984) ?
- CNE mesic conifer [transition] forest on acidic bedrock/till (Rawinski 1984) B
- Mesic Hemlock-Hardwood Forest (Breden 1989) B
- Mesic Northern Hardwood Forest (Beech-Birch-Maple Forest) (Thompson 1996) B
- Northern hardwood forest: boreal/montane type (NAP pers. comm. 1998) ?
- Sugar Maple - Beech - Yellow Birch: 25 (Eyre 1980) B
- Sugar Maple: 27 (Eyre 1980) B

SOURCES

Description Authors: S. C. Gawler.

References: Adamus 1978, Baldwin 1977, Breden 1989, Breden et al. 2001, Campbell and Eastman 1978, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Flaccus 1972, Gawler 2002, Gordon 1937b, Kern 1985, Kuchler 1956, Kuchler 1964, Little 1974, McIntosh 1972, Metzler and Barrett 1996, Metzler and Barrett 2001, Moore and Taylor 1927, NAP pers. comm. 1998, Niering 1953, Ohmann and Buell 1968, Rawinski 1984, Simko 1987, Sperduto 1996, Sperduto and Nichols 2004, Thompson 1996, Thompson and Sorenson 2000, Woods 1987.



Figure E5. Central Appalachian Northern Hardwood Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.113). July 2005. NAD 1983 / UTM easting 488917, northing 4632648.



Figure E6. Central Appalachian Northern Hardwood Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.36). August 2005. NAD 1983 / UTM easting 494501, northing 4628409.

COMMON NAME (PARK-SPECIFIC): SEMI-RICH NORTHERN HARDWOOD FOREST

SYNONYMS
USNVC English Name: **Sugar Maple - (White Ash) / Jack-in-the-Pulpit Forest**
USNVC Scientific Name: ***Acer saccharum - (Fraxinus americana) / Arisaema triphyllum* Forest**
USNVC Identifier: **CEGL006211**

LOCAL INFORMATION

Environmental Description: This slightly enriched forest association occurs, most typically, on concave midslopes at moderate elevations. Documented examples in the Upper Delaware River basin are located between 237 and 384 m (780-1260 feet) elevation with variable aspect. Soils are slightly enriched, well-drained, silty loams that can be stony and are often somewhat moist. Underlying bedrock is Devonian-age sandstone, siltstone, and shale.
Vegetation Description: This association encompasses slightly enriched deciduous forests with varied dominance and semi-rich indicators. A few emergent eastern white pine (*Pinus strobus*) may be present, overtopping the nearly closed canopy layer. Canopy species typically show codominance of mesic indicators, such as sugar maple (*Acer saccharum*) and, less commonly, American basswood (*Tilia americana*), with northern hardwoods, including white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), and/or oaks, including northern red oak (*Quercus rubra*) and chestnut oak (*Quercus prinus*). Associates can include eastern hemlock (*Tsuga canadensis*), tuliptree (*Liriodendron tulipifera*), bigtooth aspen (*Populus grandidentata*), shagbark hickory (*Carya ovata*), and pignut hickory (*Carya glabra*). The subcanopy (10 m tall) is well-developed (20-25% cover) with representatives from species in the canopy (sugar maple, sweet birch, red maple, shagbark hickory, American basswood, white ash, chestnut oak, eastern hemlock, northern red oak) and the associates hophornbeam (*Ostrya virginiana*), common serviceberry (*Amelanchier arborea*), flowering dogwood (*Cornus florida*), American hornbeam (*Carpinus caroliniana*), and blackgum (*Nyssa sylvatica*). The tall- and short-shrub component can be sparse to moderately well-developed (5-15% cover) and can contain saplings and seedlings of most canopy and subcanopy species. Common components include striped maple (*Acer pensylvanicum*), American witchhazel (*Hamamelis virginiana*), hophornbeam, roundleaf dogwood (*Cornus rugosa*), American red raspberry (*Rubus idaeus*), red elderberry (*Sambucus racemosa*), beaked hazelnut (*Corylus cornuta*), mapleleaf viburnum (*Viburnum acerifolium*), and Blue Ridge blueberry (*Vaccinium pallidum*). Vines can be sparse to somewhat common (5-10% cover) and can include fringed black bindweed (*Polygonum cilinode*), Virginia creeper (*Parthenocissus quinquefolia*), summer grape (*Vitis aestivalis*), eastern poison ivy (*Toxicodendron radicans*), and American hogpeanut (*Amphicarpaea bracteata*).

Semi-rich herbaceous indicators and spring ephemerals are common in the well-developed (about 30% cover) herb layer, such as heartleaf foamflower (*Tiarella cordifolia*), Shawnee salad (*Hydrophyllum virginianum*), hepatica (*Hepatica nobilis*), northern maidenhair (*Adiantum pedatum*), American ginseng (*Panax quinquefolius*), and wide-leaved sedges such as broadleaf sedge (*Carex platyphylla*), but strong-enrichment indicator species are missing. Many of the ground layer plants are common in circumneutral to slightly acidic settings. The most frequent associates are intermediate woodfern (*Dryopteris intermedia*), marginal woodfern (*Dryopteris*

marginalis), Christmas fern (*Polystichum acrostichoides*), spotted geranium (*Geranium maculatum*), white snakeroot (*Ageratina altissima* var. *altissima*), mountain woodsorrel (*Oxalis montana*), blackseed ricegrass (*Piptatherum racemosum*), white wood aster (*Eurybia divaricata*), Pennsylvania sedge (*Carex pensylvanica*), and wild sarsaparilla (*Aralia nudicaulis*). The bryophyte flora can contain a diversity of mosses including, but not limited to, thuidium moss (*Thuidium delicatulum*), brachytheium moss (*Brachythecium salebrosum*), polytrichum moss (*Polytrichum commune*), tree climacium moss (*Climacium dendroides*), toothed plagiomnium moss (*Plagiomnium cuspidatum*), dicranum moss (*Dicranum fulvum*) and others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple)
Herb (field)	Vine/Liana	*Polygonum cilinode* (fringed black bindweed)
Herb (field)	Fern or fern ally	*Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern)

Characteristic Species: *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood).

Other Noteworthy Species:

Species	GRank	Type	Note
Adiantum pedatum (northern maidenhair)		plant	
Hepatica nobilis (hepatica)		plant	
Hydrophyllum virginianum (Shawnee salad)		plant	
Tiarella cordifolia (heartleaf foamflower)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S3*	1	Maple-Basswood Rich Mesic Forest	Edinger et al. 2002
PA	S4*	2	Northern Hardwood Forest	Fike 1999

Local Range: This association is found throughout the Upper Delaware River valley but does become more common in the southern half of Upper Delaware Scenic and Recreational River.

Classification Comments: An enriched deciduous forest with varied dominance and semi-rich indicators.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.61, UPDE.62, UPDE.168, UPDE.191, UPDE.202, UPDE.203.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Acer saccharum - Fraxinus americana - Tilia americana* Forest Alliance (A.217)
Alliance (English name)	Sugar Maple - White Ash - American Basswood Forest Alliance
Association	*Acer saccharum - (Fraxinus americana) / Arisaema triphyllum* Forest
Association (English name)	Sugar Maple - (White Ash) / Jack-in-the-Pulpit Forest
Ecological System(s):	Laurentian-Acadian Northern Hardwoods Forest (CES201.564).

GLOBAL DESCRIPTION

Concept Summary: These are northern hardwood forests of slightly enriched soils in the northern Appalachian Mountains and adjacent northeastern United States and Canada. They occur at moderate elevations of 245 to 610 m (800-2000 feet) on slightly enriched soils, often silt loams derived from pelite or other subacidic bedrock. Ridgetops and slight concavities on hillslopes are both typical settings. They may occur as inclusions within typical northern hardwood forests or may occur over larger areas and be the locally dominant northern hardwood forest. The closed-canopy forest has sparse to moderate shrub cover, moderate herb cover, and may have local carpets of *Acer saccharum* (sugar maple) seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. The canopy is dominated by *Acer saccharum* (sugar maple), frequently with *Fraxinus americana* (white ash) as an associate or even canopy codominant. Other associated hardwood species include *Betula alleghaniensis* (yellow birch) and *Betula lenta* (sweet birch). *Fagus grandifolia* (American beech) is often present but less abundant than in matrix northern hardwood forests. *Liriodendron tulipifera* (tuliptree) may occur in southern New England. Conifers are usually sparse. Shrubs can include *Cornus alternifolia* (alternateleaf dogwood), *Lindera benzoin* (northern spicebush), *Sambucus racemosa* (red elderberry), *Acer pensylvanicum* (striped maple), and *Ostrya virginiana* (hophornbeam). Typical herbs of this semi-rich type, which are scarce or absent from standard beech-birch-maple forests, include *Arisaema triphyllum* (Jack in the pulpit), *Viola rotundifolia* (roundleaf yellow violet), *Tiarella cordifolia* (heartleaf foamflower), *Actaea pachypoda* (white baneberry), *Osmunda claytoniana* (interrupted fern), *Osmunda cinnamomea* (cinnamon fern), *Carex laxiculmis* (spreading sedge), *Carex platyphylla* (broadleaf sedge), *Carex pedunculata* (longstalk sedge), *Eurybia divaricata* (white wood aster), *Botrychium* (grapefern) spp., and *Solidago flexicaulis* (zigzag goldenrod). These forests are intermediate in nutrient regime and composition between *Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest (CEGL005008) and *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252). They are more depauperate than other communities of this alliance, for example lacking rich-soil indicators such as *Adiantum pedatum* (northern maidenhair), *Caulophyllum thalictroides* (blue cohosh), and *Tilia americana* (American basswood) that are typical of CEGL005008.

Environmental Description: These are northern hardwood forests of slightly enriched soils in the northern Appalachian Mountains and adjacent northeastern United States and Canada. They occur at moderate elevations of 245 to 610 m (800-2000 feet) on slightly enriched soils, often silt loams derived from pelite or other subacidic bedrock. Ridgetops and slight concavities on hillslopes are both typical settings.

Vegetation Description: The closed-canopy forest has sparse to moderate shrub cover, moderate herb cover, and may have local carpets of *Acer saccharum* (sugar maple) seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. The canopy is dominated by *Acer saccharum* (sugar maple), with associated hardwood species including *Betula alleghaniensis* (yellow birch) and *Fraxinus americana* (white ash). *Fraxinus* (ash) may be a canopy codominant in some areas. *Fagus grandifolia* (American beech) is often present but less abundant than in matrix northern hardwood forests. Conifers are usually sparse. Shrubs can include *Cornus alternifolia* (alternateleaf dogwood), *Sambucus racemosa* (red elderberry), *Acer pensylvanicum* (striped maple), and *Ostrya virginiana* (hophornbeam). Typical herbs of this semi-rich type, which are scarce or absent from standard beech-birch-maple forests, include *Arisaema triphyllum* (Jack in the pulpit), *Viola rotundifolia* (roundleaf yellow violet), *Tiarella*

cordifolia (heartleaf foamflower), *Actaea pachypoda* (white baneberry), *Botrychium* (grapefern) spp., and *Solidago flexicaulis* (zigzag goldenrod).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Fraxinus americana* (white ash)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Cornus alternifolia* (alternateleaf dogwood), *Ostrya virginiana* (hophornbeam), *Sambucus racemosa* (red elderberry)
Herb (field)	Forb	*Arisaema triphyllum* (Jack in the pulpit)

Characteristic Species: *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This forest association occurs in New England west to New York and Ontario.

States/Provinces: CT, MA, ME, NB, NH, NY, ON, PA, RI, VT.

Federal Lands: NPS (Marsh-Billings-Rockefeller, Saint-Gaudens, Saratoga, Upper Delaware, Weir Farm).

CONSERVATION STATUS

Rank: G4 (7-Dec-2005).

Reasons: This association is fairly well-distributed in northern New England and adjacent Canada.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type is conceptually well understood, but not well documented in published sources. Additional characterization would be helpful.

Similar Associations:

- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252).
- *Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest (CEGL005008).

Related Concepts:

- Mesic Northern Hardwood Forest (Beech-Birch-Maple Forest)? (Thompson 1996) B
- Semi-rich northern hardwood forest (NAP pers. comm. 1998) ?
- Sugar Maple: 27 (Eyre 1980) B

SOURCES

Description Authors: S. C. Gawler, mod. L. A. Sneddon.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Gawler 2002, Metzler and Barrett 2001, Metzler and Barrett 2004, NAP pers. comm. 1998, NRCS 2004, Sperduto and Nichols 2004, Thompson 1996, Thompson and Sorenson 2000.



Figure E7. Semi-rich Northern Hardwood Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.61). July 2005. NAD 1983 / UTM easting 486939, northing 4632814.



Figure E8. Semi-rich Northern Hardwood Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.62). July 2005. NAD 1983 / UTM easting 486013, northing 4633111.

COMMON NAME (PARK-SPECIFIC): SUGAR MAPLE - ASH - BASSWOOD NORTHERN RICH MESIC FOREST

SYNONYMS

USNVC English Name: **Sugar Maple - White Ash - American Basswood / Mountain Maple / Blue Cohosh Forest**

USNVC Scientific Name: ***Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides*** **Forest**

USNVC Identifier: **CEGL005008**

LOCAL INFORMATION

Environmental Description: This association occurs in cool, nutrient-rich, mesic or sometimes wet-mesic situations on semi-flat to rolling, often convex terrain. The slope of documented examples in the Upper Delaware River watershed ranges from 8 to 38 degrees; average slope is 24 degrees. Most sites are northeast-facing and midslope but exposure ranges from northwest to southeast, and location varies from low- to high slope. The elevation of local examples ranges from 195-439 m (640-1440 feet); average elevation is 287 m (941 feet). Surface soils are somewhat poorly drained to well-drained silty loam to sandy loam that is moderately to exceedingly stony; there are often stone piles at the surface. The underlying bedrock is Devonian-age sandstone, siltstone, shale of Catskill and Lower Walton formations. Ground cover is deciduous litter, predominantly of nitrogen-rich sugar maple leaves.

Vegetation Description: This nutrient-rich forest community has a well-developed tree canopy composed of deciduous species. Shrubs are scattered, but the herbaceous stratum is well-developed and often contains diagnostic enrichment indicators and abundant spring ephemerals. The tree canopy layer (24 m) has 80% cover and is strongly dominated by sugar maple (*Acer saccharum*). American basswood (*Tilia americana*), white ash (*Fraxinus americana*), and sweet birch (*Betula lenta*) can be common associates in the canopy; black cherry (*Prunus serotina*), northern red oak (*Quercus rubra*), eastern hemlock (*Tsuga canadensis*), yellow birch (*Betula alleghaniensis*), tuliptree (*Liriodendron tulipifera*), red maple (*Acer rubrum*), chestnut oak (*Quercus prinus*), hophornbeam (*Ostrya virginiana*), American beech (*Fagus grandifolia*), and white oak (*Quercus alba*) are often present at lower abundance. Subcanopy species are similar to those in the canopy with striped maple (*Acer pensylvanicum*), shagbark hickory (*Carya ovata*), American hornbeam (*Carpinus caroliniana*), pignut hickory (*Carya glabra*), and flowering dogwood (*Cornus florida*). The tall- and short-shrub layers each attain nearly 20% cover; striped maple is the most abundant species in both. Vines such as fringed black bindweed (*Polygonum cilinode*), Virginia creeper (*Parthenocissus quinquefolia*), summer grape (*Vitis aestivalis*), American hogpeanut (*Amphicarpaea bracteata*), and eastern poison ivy (*Toxicodendron radicans*) are scarce but present. The ground layer contains frequent and sometimes abundant strong enrichment indicator herbs and spring ephemerals such as northern maidenhair (*Adiantum pedatum*), heartleaf foamflower (*Tiarella cordifolia*), ebony spleenwort (*Asplenium platyneuron*), maidenhair spleenwort (*Asplenium trichomanes*), hepatica (*Hepatica nobilis*), Robert geranium (*Geranium robertianum*), Canadian wildginger (*Asarum canadense*), and ginseng (*Panax quinquefolius*). Otherwise, a rich mix of ferns, forbs, and graminoids co-occur, including intermediate woodfern (*Dryopteris intermedia*), marginal woodfern (*Dryopteris marginalis*), bearded shorthusk (*Brachyelytrum erectum*), Christmas fern (*Polystichum acrostichoides*), flattened oatgrass (*Danthonia compressa*), Jack in the pulpit (*Arisaema*

triphyllum), white edge sedge (*Carex debilis*), greater bladder sedge (*Carex intumescens*), blunt broom sedge (*Carex tribuloides*), Swan's sedge (*Carex swanii*), New York fern (*Thelypteris noveboracensis*), Pennsylvania sedge (*Carex pensylvanica*), broadleaf sedge (*Carex platyphylla*), parasol whitetop (*Doellingeria umbellata*), western oakfern (*Gymnocarpium dryopteris*), eastern rough sedge (*Carex scabrata*), Appalachian sedge (*Carex appalachica*), eastern woodland sedge (*Carex blanda*), graceful sedge (*Carex gracillima*), roundleaf yellow violet (*Viola rotundifolia*), interrupted fern (*Osmunda claytoniana*), long beechfern (*Phegopteris connectilis*), and broad beechfern (*Phegopteris hexagonoptera*). After disturbance, invasive or exotic species, such as eastern hayscented fern (*Dennstaedtia punctilobula*), garlic mustard (*Alliaria petiolata*), and ground ivy (*Glechoma hederacea*), can become abundant. The nonvascular layer is typically sparse.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash), *Tilia americana* (American basswood)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple)
Herb (field)	Vine/Liana	*Polygonum cilinode* (fringed black bindweed)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Adiantum pedatum* (northern maidenhair), *Dryopteris intermedia* (intermediate woodfern), *Fraxinus americana* (white ash), *Ostrya virginiana* (hophornbeam), *Tilia americana* (American basswood).

Other Noteworthy Species:

Species	GRank	Type	Note
Asarum canadense (Canadian wildginger)		plant	
Caulophyllum thalictroides (blue cohosh)		plant	
Panax quinquefolius (American ginseng)	G3G4	plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S3*	1	Maple-Basswood Rich Mesic Forest	Edinger et al. 2002
PA	S2?*	1	Sugar Maple - Basswood Forest	Fike 1999

Local Range: This forest type is uncommon at Upper Delaware Scenic and Recreational River but can be found throughout the park.

Classification Comments: Sugar Maple - Ash - Basswood Northern Rich Mesic Forest is an enriched, mesic deciduous forest with strong dominance by sugar maple and American basswood and abundant rich indicator herbs. Semi-rich Northern Hardwood Forest is a deciduous forest type with fewer (if any) enrichment indicators and varied canopy dominance; oak and birch species are often codominant with mesic indicators.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.33, UPDE.46, UPDE.55, UPDE.66, UPDE.68, UPDE.81, UPDE.85, UPDE.107, UPDE.160, UPDE.170, UPDE.174, UPDE.177.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Acer saccharum - Fraxinus americana - Tilia americana* Forest Alliance (A.217)
Alliance (English name)	Sugar Maple - White Ash - American Basswood Forest Alliance
Association	*Acer saccharum - Fraxinus americana - Tilia americana / Acer spicatum / Caulophyllum thalictroides* Forest
Association (English name)	Sugar Maple - White Ash - American Basswood / Mountain Maple / Blue Cohosh Forest
Ecological System(s):	Laurentian-Acadian Northern Hardwoods Forest (CES201.564).

GLOBAL DESCRIPTION

Concept Summary: This rich sugar maple - white ash - basswood forest is found from the northeastern United States and Canada to the central Great Lakes area, south to the High Alleghenies of Virginia and West Virginia. Stands occur on nutrient-rich, mesic or wet-mesic settings on sloped to rolling terrain. Slope bottoms, where colluvium collects, are a common landscape position. The surface soils are deep sand, loamy sand, or loam and may be underlain by sandy clay loam to clay loam. The sites are somewhat poorly drained to well-drained and can have a water table 0.4-2 m below the surface. Small (<1 ha) seep areas that may occur within these forests have soils that are usually saturated. This forest community has a well-developed tree canopy composed of deciduous species. Shrubs are scattered, but the herbaceous stratum is generally extensive. Bryoids are only a minor component of the ground layer, which is predominantly nitrogen-rich sugar maple leaves. *Acer saccharum* (sugar maple) and *Fraxinus americana* (white ash) are the dominant trees; *Tilia americana* (American basswood) is frequent but not necessarily abundant. *Ostrya virginiana* (hophornbeam) is very common as a small tree. *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Prunus serotina* (black cherry) are typical associates, in small amounts. *Ulmus rubra* (slippery elm) and *Juglans cinerea* (butternut) are occasional. Shrubs that may be found in this community include *Cornus alternifolia* (alternateleaf dogwood), *Viburnum lantanoides* (hobblebush), *Hamamelis virginiana* (American witch-hazel), *Dirca palustris* (eastern leatherwood), and *Lonicera canadensis* (American fly honeysuckle). The ground flora, including many spring ephemerals, is diverse and consists primarily of nutrient- and light-requiring species. Many of these flower and fruit early in the spring before the tree canopy has fully leafed out. Fern richness is often high. Various sedges are present (particularly the Laxiflorae). These forests are differentiated from less-rich northern hardwood forests, e.g., *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252), primarily by their abundant and diverse herbaceous layer, as well as by the greater prominence of sugar maple and ash in the canopy and reduced importance of beech.

Environmental Description: In Virginia, stands occur on nutrient-rich, mesic or, sometimes, wet-mesic situations on flat to rolling terrain. The surface soils are deep sand, loamy sand, or loam and underlain by sandy clay loam to clay loam. The sites are somewhat poorly drained to well-drained and can have a water table 0.4-2 m below the surface. In the northern Appalachian region, sites occur in enriched cove and concave slopes within northern hardwood forests. The

elevation of known examples ranges from 115-830 m (380-2700 feet). Ground cover is deciduous litter, predominantly of nitrogen-rich sugar maple leaves.

Vegetation Description: This forest community has a well-developed tree canopy composed of deciduous species. Shrubs are scattered, but the herbaceous stratum is well-represented. *Acer saccharum* (sugar maple) and *Fraxinus americana* (white ash) are the dominant trees; *Tilia americana* (American basswood) is frequent but not necessarily abundant. *Ostrya virginiana* (hophornbeam) is very common as a small tree. *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Prunus serotina* (black cherry) are typical associates. *Ulmus rubra* (slippery elm) and *Juglans cinerea* (butternut) are occasional. Shrubs that may be found in this community include *Cornus alternifolia* (alternateleaf dogwood), *Viburnum lantanoides* (hobblebush), *Hamamelis virginiana* (American witch-hazel), *Dirca palustris* (eastern leatherwood), and *Lonicera canadensis* (American fly honeysuckle). The ground flora, much of which is spring ephemerals, is diverse and consists primarily of nutrient- and light-requiring species. Many of these flower and fruit early in the spring before the tree canopy has fully leafed out; *Dicentra cucullaria* (Dutchman's breeches), *Dicentra canadensis* (squirrel corn), *Hepatica* (hepatica) spp., *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), *Viola canadensis* (Canadian white violet), *Viola rotundifolia* (roundleaf yellow violet), *Actaea pachypoda* (white baneberry), *Osmorhiza claytonii* (Clayton's sweetroot), *Panax quinquefolius* (American ginseng), *Sanguinaria canadensis* (bloodroot), and *Erythronium americanum* (dogtooth violet) are typical. Fern richness is often high, with characteristic species including *Adiantum pedatum* (northern maidenhair), *Cystopteris bulbifera* (bulblet bladderfern), *Deparia acrostichoides* (silver false spleenwort), *Dryopteris goldiana* (Goldie's woodfern), *Dryopteris filix-mas* (male fern), *Dryopteris marginalis* (marginal woodfern), *Botrychium virginianum* (rattlesnake fern), *Athyrium filix-femina* (common ladyfern), *Phegopteris hexagonoptera* (broad beechfern), and, especially in seepy spots, *Matteuccia struthiopteris* (ostrich fern). Various sedges are present (particularly the Laxiflorae group) such as *Carex laxiflora* (broad looseflower sedge), *Carex platyphylla* (broadleaf sedge), *Carex plantaginea* (plantainleaf sedge), *Carex leptonervia* (nerveless woodland sedge), *Carex hitchcockiana* (Hitchcock's sedge), *Carex aestivalis* (summer sedge), *Carex davisii* (Davis' sedge), *Carex bebbii* (Bebb's sedge), and others. The herbaceous flora in seeps often contains *Calamagrostis canadensis* (bluejoint), *Carex scabrata* (eastern rough sedge), *Ageratina altissima* (white snakeroot), *Glyceria melicaria* (melic mannagrass), *Impatiens capensis* (jewelweed) (sometimes *Impatiens pallida* (pale touch-me-not) as well), and *Solidago flexicaulis* (zigzag goldenrod).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash)
Tree subcanopy	Broad-leaved deciduous tree	*Ostrya virginiana* (hophornbeam)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus alternifolia* (alternateleaf dogwood), *Dirca palustris* (eastern leatherwood), *Hamamelis virginiana* (American witch-hazel), *Lonicera canadensis* (American fly honeysuckle), *Viburnum lantanoides* (hobblebush)
Herb (field)	Fern or fern ally	*Adiantum pedatum* (northern maidenhair), *Botrychium virginianum* (rattlesnake fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Adiantum pedatum* (northern maidenhair), *Allium tricoccum* (wild leek), *Botrychium virginianum* (rattlesnake fern), *Cardamine diphylla* (crinkleroot), *Caulophyllum thalictroides* (blue cohosh), *Claytonia caroliniana* (Carolina springbeauty), *Dryopteris goldiana* (Goldie's woodfern), *Fraxinus americana* (white ash), *Milium effusum* (American milletgrass), *Phlox stolonifera* (creeping phlox), *Tiarella cordifolia* (heartleaf foamflower), *Tilia americana* (American basswood), *Viola blanda* (sweet white violet), *Viola canadensis* (Canadian white violet).

Other Noteworthy Species:

Species	GRank	Type	Note
Cuscuta rostrata (beaked dodder)		plant	VA S2
Meleagris gallopavo (wild turkey)		animal	
Panax quinquefolius (American ginseng)	G3G4	plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This forest association ranges generally from Ontario and New England west to Michigan and south to New Jersey and New York, with a discontinuous southward extension in the high Allegheny Mountains to western Virginia and eastern West Virginia.

States/Provinces: CT, MA, MD?, ME:S3, MI:S3, NB, NH, NJ:S2?, NY, ON, PA, RI, VA, VT:S4, WV.

Federal Lands: NPS (Marsh-Billings-Rockefeller, Sleeping Bear Dunes, Upper Delaware); USFS (Finger Lakes, George Washington, Huron-Manistee, Huron?, Manistee, Ottawa, White Mountain).

CONSERVATION STATUS

Rank: G4? (28-Sep-2001).

Reasons: This community has a wide geographic distribution, but is locally distributed within its range due to specific requirements for mesic sites with fertile soils. In gentler topographic regions, many examples of this community have probably been destroyed for agriculture, and most remaining examples elsewhere have been altered by past logging. Consequently much of the remaining acreage is of variable quality.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: The attribution of this type to the Ridge and Valley subsection is based on the location of a single stand on the westernmost scarp slope of the Ridge Valley (east slope of Middle Mountain) at the Allegheny Front. The status of this association in Maryland is uncertain.

Similar Associations:

- *Acer saccharum - (Fraxinus americana) / Arisaema triphyllum* Forest (CEGL006211).
- *Acer saccharum - Betula alleghaniensis - (Tilia americana)* Forest (CEGL002457).
- *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest (CEGL006252).
- *Acer saccharum - Fagus grandifolia - Betula* spp. / *Maianthemum canadense* Forest (CEGL005004).

Related Concepts:

- *Acer saccharum - Tilia americana - Fagus grandifolia / Caulophyllum thalictroides - Viola blanda - (Allium tricoccum)* Forest (Fleming and Coulling 2001) ?
- *Acer saccharum - Tilia americana / Caulophyllum thalictroides - Laportea canadensis* Association (Fleming and Moorhead 1996) ?
- Dry-Mesic Calcareous Forest (Breden 1989) B
- Mesic Northern Forest - Sugar Maple-Basswood (Chapman et al. 1989) =

- Rich Northern Hardwood Forest (Thompson 1996) =
- Rich northern hardwood forest (NAP pers. comm. 1998) ?
- SNE rich mesic forest (circumneutral to basic) (Rawinski 1984) ?
- Sugar Maple - Basswood: 26 (Eyre 1980) B
- Sugar maple-white ash-basswood-bluebead cove forest (CAP pers. comm. 1998) ?

SOURCES

Description Authors: D. Faber-Langendoen, mod. L. Sneddon, G. Fleming, S. C. Gawler.

References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Chapman et al. 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Gawler 2002, Harrison 2004, Metzler and Barrett 2001, Metzler and Barrett 2004, NAP pers. comm. 1998, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E9. Sugar Maple - Ash - Basswood Northern Rich Mesic Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.33). August 2005. NAD 1983 / UTM easting 488196, northing 4632381.



Figure E10. Sugar Maple - Ash - Basswood Northern Rich Mesic Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.46). August 2005. NAD 1983 / UTM easting 476948, northing 4637772.

COMMON NAME (PARK-SPECIFIC): DRY, RICH OAK - HICKORY FOREST

SYNONYMS

USNVC English Name:	**(Pignut Hickory, Shagbark Hickory) - White Ash - Oak species Forest**
USNVC Scientific Name:	***Carya (glabra, ovata) - Fraxinus americana - Quercus* spp. Forest**
USNVC Identifier:	**CEGL006236**

LOCAL INFORMATION

Environmental Description: This association occurs on dry, usually convex, mid- to upper slopes, most frequently with a south/southwest orientation but aspect and position can be variable. Documented examples in the Upper Delaware River valley are found at elevations ranging from 219-494 m (720-1620 feet). The soils are usually loams or silty loams that are well-drained and very stony.

Vegetation Description: This enriched oak-hickory forest has abundant (roughly 10-20% of canopy cover) hickories; conifers are rare to absent. The dominant trees in the closed canopy include one or more of the following species: northern red oak (*Quercus rubra*), white oak (*Quercus alba*), chestnut oak (*Quercus prinus*), and/or scarlet oak (*Quercus coccinea*). Mixed with the oaks, commonly at lower densities, are pignut hickory (*Carya glabra*), shagbark hickory (*Carya ovata*), and/or bitternut hickory (*Carya cordiformis*). Common associates are red maple (*Acer rubrum*), sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), white ash (*Fraxinus americana*), and the enrichment indicators American basswood (*Tilia americana*) and sugar maple (*Acer saccharum*). There is typically a subcanopy stratum of small trees and tall shrubs, including hophornbeam (*Ostrya virginiana*), American hornbeam (*Carpinus caroliniana*), blackgum (*Nyssa sylvatica*), flowering dogwood (*Cornus florida*), common serviceberry (*Amelanchier arborea*), American witchhazel (*Hamamelis virginiana*), highbush blueberry (*Vaccinium corymbosum*), striped maple (*Acer pensylvanicum*), and American chestnut (*Castanea dentata*). Commonly, low shrubs are diverse and include mapleleaf viburnum (*Viburnum acerifolium*), black huckleberry (*Gaylussacia baccata*), Blue Ridge blueberry (*Vaccinium pallidum*), lowbush blueberry (*Vaccinium angustifolium*), deerberry (*Vaccinium stamineum*), pink azalea (*Rhododendron periclymenoides*), eastern prickly gooseberry (*Ribes cynosbati*), Allegheny blackberry (*Rubus allegheniensis*), American red raspberry (*Rubus idaeus*), black raspberry (*Rubus occidentalis*), beaked hazelnut (*Corylus cornuta*), American beech (*Fagus grandifolia*) sprouts, mountain holly (*Ilex montana*), northern bush honeysuckle (*Diervilla lonicera*), sassafras (*Sassafras albidum*), and Japanese barberry (*Berberis thunbergii*). Vines are sparse and can include American hogpeanut (*Amphicarpaea bracteata*), Virginia creeper (*Parthenocissus quinquefolia*), summer grape (*Vitis aestivalis*), and eastern poison ivy (*Toxicodendron radicans*). The ground layer flora can also be diverse. Characteristic herbs are Pennsylvania sedge (*Carex pensylvanica*), wild sarsaparilla (*Aralia nudicaulis*), white snakeroot (*Ageratina altissima* var. *altissima*), pointedleaf ticktrefoil (*Desmodium glutinosum*), nakedflower ticktrefoil (*Desmodium nudiflorum*), marginal woodfern (*Dryopteris marginalis*), and bearded shorthusk (*Brachyelytrum erectum*). Species associated with disturbance, such as eastern hayscented fern (*Dennstaedtia punctilobula*) and garlic mustard (*Alliaria petiolata*), can be nearly dominant in patches, depending on land-use history. Bryophyte cover, overall, is sparse but likely correlated to land-use history and substrate availability, primarily coarse woody debris.

Widespread species associated with deciduous forests are most common: dicranum mosses (*Dicranum scoparium*, *Dicranum fulvum*), leucobryum moss (*Leucobryum glaucum*), atrichum moss (*Atrichum* sp.), polytrichum moss (*Polytrichum commune*), juniper polytrichum moss (*Polytrichum juniperinum*), brachythecium moss (*Brachythecium salebrosum*), toothed plagiomnium moss (*Plagiomnium cuspidatum*), and delicate thuidium moss (*Thuidium delicatulum*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Quercus alba* (white oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula lenta* (sweet birch)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Vine/Liana	*Amphicarpaea bracteata* (American hogpeanut)
Herb (field)	Forb	*Ageratina altissima* var. *altissima* (white snakeroot), *Aralia nudicaulis* (wild sarsaparilla)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)
Nonvascular	Moss	*Dicranum scoparium* (dicranum moss), *Leucobryum glaucum* (leucobryum moss)

Characteristic Species: *Ageratina altissima* var. *altissima* (white snakeroot), *Aralia nudicaulis* (wild sarsaparilla), *Betula lenta* (sweet birch), *Carex pensylvanica* (Pennsylvania sedge), *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Hamamelis virginiana* (American witchhazel), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Vaccinium pallidum* (Blue Ridge blueberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Acer saccharum (sugar maple)		plant	
Ostrya virginiana (hophornbeam)		plant	
Tilia americana (American basswood)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Appalachian Oak-Hickory Forest	Edinger et al. 2002
PA	S4*	2	Dry Oak - Mixed Hardwood Forest	Fike 1999

Local Range: This association is found throughout Upper Delaware Scenic and Recreational River on dry, slightly enriched, upper slopes.

Classification Comments: This association is characterized by dominance of dry oak species. with codominant hickories and the rich indicators American basswood, sugar maple, and hophornbeam.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.20, UPDE.44, UPDE.126, UPDE.130, UPDE.131, UPDE.162, UPDE.186, UPDE.206, UPDE.207.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Carya (glabra, ovata)* - *Fraxinus americana* - *Quercus (alba, rubra)* Forest Alliance (A.258)
Alliance (English name)	(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance
Association	*Carya (glabra, ovata)* - *Fraxinus americana* - *Quercus* spp. Forest
Association (English name)	(Pignut Hickory, Shagbark Hickory) - White Ash - Oak species Forest
Ecological System(s):	Northeastern Interior Dry-Mesic Oak Forest (CES202.592).

GLOBAL DESCRIPTION

Concept Summary: This dry to dry-mesic, rich, oak - hickory forest occurs in the northeastern United States. This association is found on dry to dry-mesic, mid to upper slopes on slightly acidic to circumneutral, well-drained loams or sandy loams. The tree canopy is closed to partially open and codominated by *Quercus* (oak) and *Carya* (hickory) species (typically over 20% cover *Carya* (hickory)) with *Fraxinus americana* (white ash) common but not abundant. Dominant species include *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Carya ovalis* (red hickory), *Carya glabra* (pignut hickory), and *Carya cordiformis* (bitternut hickory). Common associates include *Acer saccharum* (sugar maple), *Tilia americana* (American basswood), and *Celtis occidentalis* (common hackberry) in the southern portion of the range. The interrupted shrub layer contains *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam), *Corylus* (hazelnut) spp., *Viburnum rafinesquianum* (downy arrow-wood), *Vaccinium* (blueberry) spp., and *Viburnum acerifolium* (mapleleaf viburnum). Ericaceous species are present but not prominent. The diverse herbaceous layer includes *Carex pensylvanica* (Pennsylvania sedge), *Asplenium platyneuron* (ebony spleenwort), *Schizachyrium scoparium* (little bluestem), *Ageratina altissima* (white snakeroot), *Polygonatum pubescens* (hairy Solomon's seal), *Viola rotundifolia* (roundleaf yellow violet), *Carex blanda* (eastern woodland sedge), *Carex laxiflora* (broad looseflower sedge), *Carex laxiculmis* (spreading sedge), *Actaea rubra* (red baneberry), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Asclepias quadrifolia* (fourleaf milkweed), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Carex retroflexa* (reflexed sedge), *Viola pedata* (birdfoot violet), *Hieracium venosum* (rattlesnakeweed), *Carex siccata* (dryspike sedge), *Antennaria plantaginifolia* (woman's tobacco), *Aureolaria pedicularia* (fernleaf yellow false foxglove), *Solidago odora* (anisescented goldenrod), and *Arabis canadensis* (sicklepod).

Environmental Description: This association is found on dry-mesic, mid to upper slopes on slightly acidic to circumneutral, well-drained loams or sandy loams.

Vegetation Description: The tree canopy is closed to partially open and codominated by *Quercus* (oak) and *Carya* (hickory) species (typically over 20% cover *Carya* (hickory)) with *Fraxinus americana* (white ash) common but not abundant. Dominant species include *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Carya ovalis* (red hickory), *Carya glabra* (pignut hickory), and *Carya cordiformis* (bitternut hickory). Common associates include *Acer saccharum* (sugar maple), *Tilia americana* (American

basswood), and *Celtis occidentalis* (common hackberry) in the southern portion of the range. The interrupted shrub layer contains *Ostrya virginiana* (hophornbeam), *Carpinus caroliniana* (American hornbeam), *Corylus* (hazelnut) spp., *Viburnum rafinesquianum* (downy arrow-wood), *Vaccinium* (blueberry) spp., *Gaylussacia baccata* (black huckleberry), and *Viburnum acerifolium* (mapleleaf viburnum). Ericaceous species are present but not prominent. The diverse herbaceous layer includes *Carex pensylvanica* (Pennsylvania sedge), *Asplenium platyneuron* (ebony spleenwort), *Schizachyrium scoparium* (little bluestem), *Ageratina altissima* (white snakeroot), *Polygonatum pubescens* (hairy Solomon's seal), *Viola rotundifolia* (roundleaf yellow violet), *Carex blanda* (eastern woodland sedge), *Carex laxiflora* (broad looseflower sedge), *Carex laxiculmis* (spreading sedge), *Actaea rubra* (red baneberry), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Asclepias quadrifolia* (fourleaf milkweed), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium rotundifolium* (prostrate ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Dryopteris marginalis* (marginal woodfern), *Carex retroflexa* (reflexed sedge), *Viola pedata* (birdfoot violet), *Hieracium venosum* (rattlesnakeweed), *Carex siccata* (dryspike sedge), *Antennaria plantaginifolia* (woman's tobacco), *Aureolaria pedicularia* (fernleaf yellow false foxglove), *Solidago odora* (anisescented goldenrod), and *Arabis canadensis* (sicklepod).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Carya cordiformis* (bitternut hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam), *Ostrya virginiana* (hophornbeam)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

Characteristic Species: *Carya glabra* (pignut hickory), *Hepatica nobilis* var. *obtusa* (roundlobe hepatica), *Polygonatum pubescens* (hairy Solomon's seal), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Viola rotundifolia* (roundleaf yellow violet).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This forest occurs in the Lower New England - Northern Piedmont, Central Appalachians, Western Allegheny Plateau, and High Allegheny Plateau ecoregions.

States/Provinces: CT, MA, MD?, NH, NJ?, NY, PA, VT, WV.

Federal Lands: NPS (Harpers Ferry, Saratoga, Upper Delaware).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

- *Acer saccharum - Quercus rubra / Hepatica nobilis* var. *obtusa* Forest (CEGL006046).
- *Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest (CEGL006336)--tend to be slightly more acidic with ericads being more characteristic.
- *Quercus rubra - Carya (glabra, ovata) / Ostrya virginiana / Carex lucorum* Forest (CEGL006301).
- *Quercus rubra - Quercus alba - Fraxinus americana - Carya (ovata, ovalis) / Actaea racemosa* Forest (CEGL008518).

Related Concepts:

- Mesic Transition Hardwood Forest (Mesic Oak-Hickory-Northern Hardwood Forest) (Thompson 1996) ?

SOURCES

Description Authors: S. L. Neid, mod. E. Largay.

References: Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Harrison 2004, Lundgren 2000, Lundgren 2001, Metzler and Barrett 2001, NRCS 2004, Rawinski 1984, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, Vanderhorst 2000b.



Figure E11. Dry, Rich Oak - Hickory Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.20). June 2005. NAD 1983 / UTM easting 485812, northing 4636169.

COMMON NAME (PARK-SPECIFIC): RED MAPLE - SWEET BIRCH HARDWOOD FOREST

SYNONYMS

USNVC English Name: **Sweet Birch - Red Maple / Stiff Clubmoss - Hay-scented Fern Forest**

USNVC Scientific Name: ***Betula lenta - Acer rubrum / Lycopodium annotinum - Dennstaedtia punctilobula* Forest**

USNVC Identifier: **CEGL008503**

LOCAL INFORMATION

Environmental Description: This successional forest type can be found in varied settings. Generally, examples in the Upper Delaware River valley are on dry-mesic to mesic, east-facing, midslopes at elevations that range from 207-463 m (680-1520 feet). Soils are well-drained, stony, silt loams. Current species composition and forest structure are generally influenced significantly by previous silvicultural or agricultural activities.

Vegetation Description: These young forests show canopy dominance by red maple (*Acer rubrum*) and sweet birch (*Betula lenta*). Associated northern hardwood species in the canopy and subcanopy can vary widely depending on site conditions. Dry oak species, such as northern red oak (*Quercus rubra*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), and chestnut oak (*Quercus prinus*), and hickories, including pignut hickory (*Carya glabra*) and/or shagbark hickory (*Carya ovata*), can be abundant. Enrichment indicators, such as sugar maple (*Acer saccharum*), American basswood (*Tilia americana*), and hophornbeam (*Ostrya virginiana*), or mixed hardwoods, including yellow birch (*Betula alleghaniensis*), sweet birch, gray birch (*Betula populifolia*), white ash (*Fraxinus americana*), blackgum (*Nyssa sylvatica*), and/or tuliptree (*Liriodendron tulipifera*), could also share dominance. Small trees and tall shrubs include striped maple (*Acer pensylvanicum*), common serviceberry (*Amelanchier arborea*), American chestnut (*Castanea dentata*), flowering dogwood (*Cornus florida*), American witchhazel (*Hamamelis virginiana*), northern spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), common winterberry (*Ilex verticillata*), and American beech (*Fagus grandifolia*) sprouts. There can be an abundance of tree seedlings in the short-shrub stratum; ericaceous species are also common and include Blue Ridge blueberry (*Vaccinium pallidum*), deerberry (*Vaccinium stamineum*), lowbush blueberry (*Vaccinium angustifolium*), black huckleberry (*Gaylussacia baccata*), mountain laurel (*Kalmia latifolia*), and pink azalea (*Rhododendron periclymenoides*). Other low-shrub species are northern dewberry (*Rubus flagellaris*), mapleleaf viburnum (*Viburnum acerifolium*), northern spicebush, and Japanese barberry (*Berberis thunbergii*). Herbaceous dominants, which occur sparsely, are eastern hayscented fern (*Dennstaedtia punctilobula*), intermediate woodfern (*Dryopteris intermedia*), Pennsylvania sedge (*Carex pensylvanica*), Christmas fern (*Polystichum acrostichoides*), New York fern (*Thelypteris noveboracensis*), and western brackenfern (*Pteridium aquilinum*). Many additional ground layer species can be present in extremely low abundance and are not diagnostic.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tree subcanopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula lenta* (sweet birch)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern)

Characteristic Species: *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Dennstaedtia punctilobula* (eastern hayscented fern).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Successional Northern Hardwoods	Edinger et al. 2002
PA	S5	1	Red Maple (Terrestrial) Forest	Fike 1999

Local Range: This forest type can be found throughout Upper Delaware Scenic and Recreational River.

Classification Comments: Sweet birch and/or red maple constitute at least 50% relative cover in the canopy and subcanopy.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.43, UPDE.48, UPDE.103, UPDE.187, UPDE.200, UPDE.211.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Prunus serotina* - *Acer rubrum* - *Amelanchier canadensis* - *Quercus* spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Betula lenta* - *Acer rubrum* / *Lycopodium annotinum* - *Dennstaedtia punctilobula* Forest
Association (English name)	Sweet Birch - Red Maple / Stiff Clubmoss - Hay-scented Fern Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593). Northeastern Interior Dry-Mesic Oak Forest (CES202.592).

GLOBAL DESCRIPTION

Concept Summary: This vegetation type is associated with mesic, generally infertile sites that have been altered by logging and fires. Its distribution is centered in the Central Appalachians. Stands are floristically depauperate and characterized by even-aged, nearly pure *Betula lenta* (sweet birch), *Acer rubrum* (red maple), or mixtures of the two. Associated species, minor in importance, vary somewhat with geography and include *Betula alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), *Prunus serotina* (black cherry), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Liriodendron tulipifera* (tuliptree), *Populus tremuloides* (quaking aspen), *Populus*

grandidentata (bigtooth aspen), and/or *Robinia pseudoacacia* (black locust). *Magnolia acuminata* (cucumber-tree) and *Magnolia fraseri* (mountain magnolia) are sometimes associates in the southern portion of the range. The subcanopy, when developed, consists mainly of *Fagus grandifolia* (American beech). *Tsuga canadensis* (eastern hemlock) forms a scattered canopy or understory in some stands. *Ilex montana* (mountain holly) is a characteristic shrub in the southern portion of the type's range, and *Lindera benzoin* (northern spicebush) is typical elsewhere. Shrub associates include *Kalmia latifolia* (mountain laurel), *Acer pensylvanicum* (striped maple), *Hamamelis virginiana* (American witch-hazel), *Amelanchier arborea* (common serviceberry), *Viburnum prunifolium* (blackhaw), *Fagus* (beech) sprouts, *Rhododendron calendulaceum* (flame azalea), *Rhododendron periclymenoides* (pink azalea), and *Rhododendron maximum* (great laurel). Herb layers may be dominated by dense and extensive colonies of *Lycopodium annotinum* (stiff clubmoss), often in association with *Lycopodium dendroideum* (tree groundpine), *Lycopodium clavatum* (running clubmoss), and/or *Lycopodium digitatum* (fan clubmoss), or by *Dennstaedtia punctilobula* (eastern hayscented fern). Herbaceous associates include *Thelypteris noveboracensis* (New York fern), *Polystichum acrostichoides* (Christmas fern), *Carex swanii* (Swan's sedge), and others.

Environmental Description: This vegetation type is associated with mesic, generally infertile sites that have been severely altered by logging and fires. It occupies various slope and aspect positions. The type is rarely found on bouldery or rocky sites. Soils vary but are often acidic and low in base status. Deep surficial duff, with small pieces of charred wood or thin charcoal lenses are typical of soils at Virginia sampling sites (Fleming and Moorhead 1996).

Vegetation Description: Stands are floristically depauperate and characterized by even-aged, nearly pure *Betula lenta* (sweet birch), *Acer rubrum* (red maple), or mixtures of the two. Associated species vary somewhat with geography and include *Betula alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), *Prunus serotina* (black cherry), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), and/or *Robinia pseudoacacia* (black locust). *Magnolia acuminata* (cucumber-tree) and *Magnolia fraseri* (mountain magnolia) are sometimes associates in the southern portion of the range. The subcanopy, when developed, consists mainly of *Fagus grandifolia* (American beech). *Tsuga canadensis* (eastern hemlock) forms a scattered canopy or understory in some stands. *Ilex montana* (mountain holly) is a characteristic shrub in the southern portion of the type's range, and *Lindera benzoin* (northern spicebush) is typical elsewhere. Shrub associates include *Kalmia latifolia* (mountain laurel), *Acer pensylvanicum* (striped maple), *Amelanchier arborea* (common serviceberry), *Viburnum prunifolium* (blackhaw), *Fagus* (beech) sprouts, *Rhododendron calendulaceum* (flame azalea), *Rhododendron periclymenoides* (pink azalea), and *Rhododendron maximum* (great laurel). Herb layers may be dominated by dense and extensive colonies of *Lycopodium annotinum* (stiff clubmoss), often in association with *Lycopodium dendroideum* (tree groundpine), *Lycopodium clavatum* (running clubmoss), and/or *Lycopodium digitatum* (fan clubmoss), or by *Dennstaedtia punctilobula* (eastern hayscented fern). Herbaceous associates include *Thelypteris noveboracensis* (New York fern), *Polystichum acrostichoides* (Christmas fern), *Carex swanii* (Swan's sedge), *Dryopteris intermedia* (intermediate woodfern), *Smilax rotundifolia* (roundleaf greenbrier), *Medeola virginiana* (Indian cucumber), *Maianthemum canadense* (Canada mayflower), *Monotropa uniflora* (Indianpipe), and *Oclemena acuminata* (whorled wood aster). Mean species richness of plot-sampled stands in Virginia is 15 taxa per 400 m^2.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tree canopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Dennstaedtia punctilobula* (eastern hayscented fern), *Lycopodium annotinum* (stiff clubmoss), *Lycopodium clavatum* (running clubmoss), *Lycopodium dendroideum* (tree groundpine).

Other Noteworthy Species:

Species	GRank	Type	Note
Carex arctata (drooping woodland sedge)		plant	VA S1
Pyrola elliptica (waxflower shinleaf)		plant	VA S2; dwarf-shrub
Schizachne purpurascens (false melic)		plant	VA S1

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community has been documented from the Central Appalachians in Virginia and West Virginia, north to New York, Pennsylvania and New Jersey. Its range may extend further in the northeastern United States.

States/Provinces: MD?, NJ, NY, PA:S5, VA, WV.

Federal Lands: NPS (Delaware Water Gap, Upper Delaware); USFS (George Washington, Monongahela); USFWS (Great Swamp).

CONSERVATION STATUS

Rank: GNA (modified/managed) (21-Jun-2001).

Reasons: This association appears to be an early-successional but persistent vegetation type resulting from major anthropogenic disturbances. It has some significance for conservation in Virginia, however, since its successional development most likely will result in one of the state-rare community types that are confined in Virginia to Allegheny Mountain. For conservation planning in Virginia it is best considered a low-quality occurrence of *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088) or *Picea rubens / Acer rubrum / Maianthemum canadense - (Lycopodium clavatum, Lycopodium dendroideum)* Forest (CEGL008501).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Because of the consistent dominance of *Betula lenta* (sweet birch) and/or *Acer rubrum* (red maple) and locally dense *Lycopodium* (clubmoss) or *Dennstaedtia punctilobula* (eastern hayscented fern) ground cover, this community type is readily identifiable in the field. *Lycopodium* (clubmoss) spp. as well as *Dennstaedtia punctilobula* (eastern hayscented fern) are specialized colonizers of moist, sterile, exposed mineral soils, which were plentiful in these habitats after the burning off of the original forest humus. Current stand composition suggests that the likely successors to this association in Virginia are *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088) or *Picea rubens / Acer rubrum / Maianthemum canadense - (Lycopodium clavatum, Lycopodium dendroideum)* Forest (CEGL008501). However, potentially devastating impacts of beech bark disease and hemlock woolly adelgid on Allegheny Mountain could alter some of the present successional trends (Fleming and Moorhead 1996).

Similar Associations:

- *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest (CEGL006506)--occupies similar mid-successional settings but is generally more northern (*Betula papyrifera* more typical than *Betula lenta*)and contains a component of white pine.

Related Concepts:

- *Betula lenta / Ilex montana / Lycopodium annotinum* Association (Fleming and Moorhead 1996) ?
- *Betula lenta / Ilex montana / Lycopodium annotinum* Forest (Fleming et al. 2004) =
- *Betula lenta / Ilex montana / Lycopodium annotinum* Forest (Fleming and Coulling 2001) =

SOURCES

Description Authors: G. Fleming, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Fleming et al. 2004.



Figure E12. Red Maple - Sweet Birch Hardwood Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.43). August 2005. NAD 1983 / UTM easting 476691, northing 4637966.



Figure E13. Red Maple - Sweet Birch Hardwood Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.48). August 2005. NAD 1983 / UTM easting 476509, northing 4637296.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN MODIFIED SUCCESSIONAL FOREST

SYNONYMS

USNVC English Name: **Black Cherry - Tuliptree - Red Maple - White Ash - (Black Locust) Forest**

USNVC Scientific Name: ***Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)*** **Forest**

USNVC Identifier: **CEGL006599**

LOCAL INFORMATION

Environmental Description: This successional forest association occurs on low, flat terraces above the Upper Delaware River (sometimes replacing floodplain forest), abandoned agricultural fields, poorly-drained soils surrounding development, and/or on broad, flat areas with saturated soils. These disturbed forests can be located on moderately well-drained to poorly-drained to saturated soils and can be temporarily flooded, depending on their landscape position.

Vegetation Description: In the Upper Delaware River valley, the somewhat open canopy of this disturbed forest is dominated by early-successional, weedy species, primarily black locust (*Robinia pseudoacacia*). Bitternut hickory (*Carya cordiformis*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), tree-of-heaven (*Ailanthus altissima*), and white ash (*Fraxinus americana*) can be associates in the canopy or subcanopy layers. Invasive shrub species, such as barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*) are characteristic and can be abundant; black raspberry (*Rubus occidentalis*) can also be common. In response to the somewhat open tree canopy, ground flora can be quite dense (to 95% cover). Some of the varied herbs that occur at UPDE are white snakeroot (*Ageratina altissima* var. *altissima*), Virginia wildrye (*Elymus virginicus*), jumpseed (*Polygonum virginianum*), flat-top goldentop (*Euthamia graminifolia*), deertongue (*Dichanthelium clandestinum*), common yellow oxalis (*Oxalis stricta*), rough bedstraw (*Galium asprellum*), creeping bentgrass (*Agrostis stolonifera*), and whitegrass (*Leersia virginica*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Robinia pseudoacacia* (black locust)
Tree subcanopy	Broad-leaved deciduous tree	*Carya cordiformis* (bitternut hickory)
Short shrub/sapling	Broad-leaved deciduous shrub	*Robinia pseudoacacia* (black locust)
Herb (field)	Vine/Liana	*Vitis riparia* (riverbank grape)
Herb (field)	Forb	*Ageratina altissima* var. *altissima* (white snakeroot)

Characteristic Species: *Robinia pseudoacacia* (black locust).

Other Noteworthy Species:

Species	GRank	Type	Note
Berberis thunbergii (Japanese barberry)		plant	invasive exotic

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Successional Southern Hardwoods	Edinger et al. 2002
PA	SNR*	1	Black Locust Forest	Fike 1999

Local Range: This association occurs throughout the park.

Classification Comments: This forest is distinguished by being dominated by weedy, early-successional species [*Robinia pseudoacacia* (black locust), *Prunus serotina* (black cherry), *Acer*

rubrum (red maple)] with abundant invasive shrubs [*Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose)].
Other Comments: None.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.129.
Upper Delaware Scenic and Recreational River Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus* spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana - (Robinia pseudoacacia)* Forest
Association (English name)	Black Cherry - Tuliptree - Red Maple - White Ash - (Black Locust) Forest
Ecological System(s):	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept Summary: This early-successional woody vegetation of the northeastern United States occurs on sites that are becoming reforested after having been cleared for agriculture. Environmental setting varies, but generally sites are dry-mesic to mesic, with small seepage inclusions in some examples. Physiognomy of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. In the Central Appalachians and Mid-Atlantic Piedmont, many stands represent decadent forests that were once dominated by *Robinia pseudoacacia* (black locust) but are now mixed with various mid-successional hardwoods; other stands in this region regenerated as mixed stands. Tree species often include some combination of *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus* (ash) *americana*, *Robinia pseudoacacia* (black locust), and *Acer rubrum* (red maple). Other associates can include *Juglans nigra* (black walnut), *Sassafras albidum* (sassafras), *Betula populifolia* (gray birch), *Juniperus virginiana* (eastern red-cedar), *Acer negundo* (boxelder), *Acer saccharinum* (silver maple), *Ailanthus altissima* (tree of heaven), *Ulmus americana* (American elm), *Quercus* (oak) spp., *Betula lenta* (sweet birch), *Amelanchier* (serviceberry) spp., *Pinus strobus* (eastern white pine), and *Populus grandidentata* (bigtooth aspen). Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* (northern spicebush) and *Carpinus caroliniana* (American hornbeam). The low-shrub layer, if present, is usually characterized by the presence of *Rubus* (blackberry) spp. such as *Rubus flagellaris* (northern dewberry), *Rubus allegheniensis* (Allegheny blackberry), *Rubus phoenicolasius* (wine raspberry), or *Rubus hispidus* (bristly dewberry). This layer is often dominated by exotic species such as *Lonicera tatarica* (Tatarian honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Rhamnus cathartica* (common buckthorn), *Crataegus* (hawthorn) spp., *Rosa multiflora* (multiflora rose), and *Berberis thunbergii* (Japanese barberry). The herbaceous layer is variable, often containing grasses and forbs of both native and exotic

origin. Common species include *Ageratina altissima* var. *altissima* (white snakeroot), *Polygonum persicaria* (spotted ladysthumb), *Impatiens capensis* (jewelweed), *Glechoma hederacea* (ground ivy), *Polystichum acrostichoides* (Christmas fern), *Calystegia sepium* ssp. *sepium* (hedge false bindweed), *Galium aparine* (stickywilly), *Oxalis stricta* (common yellow oxalis), *Polygonum virginianum* (jumpseed), *Dennstaedtia punctilobula* (eastern hayscented fern), *Arisaema triphyllum* (Jack in the pulpit), *Allium vineale* (wild garlic), and *Veronica officinalis* (common gypsyweed), among many others. The invasive species *Alliaria petiolata* (garlic mustard), *Microstegium vimineum* (Nepalese browntop), and *Polygonum caespitosum* (oriental ladysthumb) can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), *Vitis labrusca* (fox grape), and the invasive vines *Celastrus orbiculata* (Asian bittersweet) and *Lonicera japonica* (Japanese honeysuckle). These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. It is unlikely that these stands will succeed to a natural plant community dominated by native species.

Environmental Description: This vegetation occurs on sites that have been cleared for agriculture or otherwise heavily modified in the past. Generally sites are dry-mesic and may have small seepage inclusions in some examples. Occasionally this type may occur in formerly agricultural bottomlands, in which case the soils may be temporarily flooded or saturated.

Vegetation Description: Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. In the Central Appalachians and Mid-Atlantic Piedmont, many stands represent decadent forests that were once dominated by *Robinia pseudoacacia* (black locust) but are now mixed with various mid-successional hardwoods; other stands in this region regenerated as mixed stands. Tree species often include some combination of *Prunus serotina* (black cherry), *Liriodendron tulipifera* (tuliptree), *Fraxinus americana* (white ash), *Robinia pseudoacacia* (black locust), and *Acer rubrum* (red maple). Other associates can include *Juglans nigra* (black walnut), *Sassafras albidum* (sassafras), *Betula populifolia* (gray birch), *Juniperus virginiana* (eastern red-cedar), *Acer negundo* (boxelder), *Acer saccharinum* (silver maple), *Ailanthus altissima* (tree of heaven), *Ulmus americana* (American elm), *Quercus* (oak) spp., *Betula lenta* (sweet birch), *Amelanchier* (serviceberry) spp., *Pinus strobus* (eastern white pine), and *Populus grandidentata* (bigtooth aspen). Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* (northern spicebush) and *Carpinus caroliniana* (American hornbeam). The low-shrub layer, if present, is usually characterized by the presence of *Rubus* (blackberry) spp. such as *Rubus flagellaris* (northern dewberry), *Rubus allegheniensis* (Allegheny blackberry), *Rubus phoenicolasius* (wine raspberry), or *Rubus hispidus* (bristly dewberry). This layer is often dominated by exotic species such as *Lonicera tatarica* (Tatarian honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Rhamnus cathartica* (common buckthorn), *Crataegus* (hawthorn) spp., *Rosa multiflora* (multiflora rose), and *Berberis thunbergii* (Japanese barberry). The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima* var. *altissima* (white snakeroot), *Polygonum persicaria* (spotted ladysthumb), *Impatiens capensis* (jewelweed), *Glechoma hederacea* (ground ivy), *Polystichum acrostichoides* (Christmas fern), *Calystegia sepium* ssp. *sepium* (hedge false bindweed), *Galium aparine* (stickywilly), *Oxalis stricta* (common yellow oxalis), *Polygonum virginianum*

(jumpseed), *Dennstaedtia punctilobula* (eastern hayscented fern), *Arisaema triphyllum* (Jack in the pulpit), *Allium vineale* (wild garlic), and *Veronica officinalis* (common gypsyweed), among many others. The invasive species *Alliaria petiolata* (garlic mustard), *Microstegium vimineum* (Nepalese browntop), and *Polygonum caespitosum* (oriental ladysthumb) can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy), *Vitis labrusca* (fox grape), and the invasive vines *Celastrus orbiculata* (Asian bittersweet) and *Lonicera japonica* (Japanese honeysuckle).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush), *Rosa multiflora* (multiflora rose)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Polygonum persicaria* (spotted ladysthumb)
Herb (field)	Graminoid	*Microstegium vimineum* (Nepalese browntop)

Characteristic Species: *Acer rubrum* (red maple), *Alliaria petiolata* (garlic mustard), *Berberis thunbergii* (Japanese barberry), *Elaeagnus umbellata* (autumn olive), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), *Liriodendron tulipifera* (tuliptree), *Microstegium vimineum* (Nepalese browntop), *Polygonum persicaria* (spotted ladysthumb), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), *Rosa multiflora* (multiflora rose), *Rubus allegheniensis* (Allegheny blackberry).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is currently described from Pennsylvania, New York, and New Jersey but is of broader distribution in the northeastern U.S.

States/Provinces: CT, DE, MA, NJ, NY, PA, VA.

Federal Lands: NPS (Allegheny Portage Railroad, Boston Harbor Islands, Delaware Water Gap, Fort Necessity, Friendship Hill, Gateway, George Washington Parkway?, Gettysburg, Johnstown Flood, Morristown, Sagamore Hill, Saratoga, Saugus Iron Works, Shenandoah, Upper Delaware, Valley Forge, Weir Farm); USFWS (Erie, Great Meadows?, Montezuma, Prime Hook).

CONSERVATION STATUS

Rank: GNA (ruderal) (29-Nov-2004).

Reasons: This vegetation is modified by human activity and not of conservation concern.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.

Similar Associations:

- *Juglans nigra / Verbesina alternifolia* Forest (CEGL007879).
- *Liriodendron tulipifera - Quercus* spp. Forest (CEGL007221)--is more strongly dominated by *Liriodendron* and is generally in a later successional state as evidenced by taller trees and more closed canopy.
- *Prunus serotina - Sassafras albidum - (Fraxinus americana) / Juniperus virginiana* Forest (CEGL004133).
- *Robinia pseudoacacia* Forest (CEGL007279).

Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler, E. Largay, G. P. Fleming.

References: Eastern Ecology Working Group n.d., Ehrenfeld 1977, Fike 1999, NRCS 2001b, NRCS 2004, Perles et al. 2006c, Perles et al. 2007, Soil Conservation Service 1987, Young et al. 2006.



Figure E14. Northeastern Modified Successional Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.129). August 2005. NAD 1983 / UTM easting 498181, northing 4599131.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN DRY OAK - HICKORY FOREST

SYNONYMS

USNVC English Name: **(White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf Viburnum Forest**

USNVC Scientific Name: ***Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest**

USNVC Identifier: **CEGL006336**

LOCAL INFORMATION

Environmental Description: This association occurs in varied settings but consistently on dry to dry-mesic substrates. It can be located on low, mid-, or upper slopes that are gentle to somewhat steep (to 35 degrees). Soils are well-drained, stony, sandy loams, and boulders and large rocks may be scattered throughout. Documented examples at Upper Delaware Scenic and Recreational River are found with variable aspect at elevations ranging from 134-360 m (440-1180 feet).

Vegetation Description: This oak-hickory to mixed oak forest is diverse floristically but lacks many enrichment indicators. Typically, the nearly closed canopy is codominated by oak species, including scarlet oak (*Quercus coccinea*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), chestnut oak (*Quercus prinus*), and occasionally black oak (*Quercus velutina*). Associated species in the canopy and subcanopy are red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), sweet birch (*Betula lenta*), sassafras (*Sassafras albidum*), flowering dogwood (*Cornus florida*), blackgum (*Nyssa sylvatica*), and striped maple (*Acer pensylvanicum*). Conifers and hickories, including pignut hickory (*Carya glabra*) and shagbark hickory (*Carya ovata*), can be present but only in low abundance. Uncommonly, American basswood (*Tilia americana*) and sugar maple (*Acer saccharum*) are present. Tall shrubs can be moderately abundant and include canopy and subcanopy species as well as American witchhazel (*Hamamelis virginiana*), highbush blueberry (*Vaccinium corymbosum*), American hornbeam (*Carpinus caroliniana*), American chestnut (*Castanea dentata*), and American beech (*Fagus grandifolia*) sprouts. Ericaceous species dominate the lower shrub layer. Black huckleberry (*Gaylussacia baccata*), Blue Ridge blueberry (*Vaccinium pallidum*), lowbush blueberry (*Vaccinium angustifolium*), and deerberry (*Vaccinium stamineum*) are most common with many associates that include mapleleaf viburnum (*Viburnum acerifolium*), beaked hazelnut (*Corylus cornuta*), pink azalea (*Rhododendron periclymenoides*), common serviceberry (*Amelanchier arborea*), mountain holly (*Ilex montana*), and eastern prickly gooseberry (*Ribes cynosbati*). Virginia creeper (*Parthenocissus quinquefolia*) is the most common vine. The most abundant species in the diverse herbaceous layer are western brackenfern (*Pteridium aquilinum*), eastern hayscented fern (*Dennstaedtia punctilobula*), garlic mustard (*Alliaria petiolata*), wild sarsaparilla (*Aralia nudicaulis*), Pennsylvania sedge (*Carex pensylvanica*), and Nepalese browntop (*Microstegium vimineum*). Swan's sedge (*Carex swanii*), partridgeberry (*Mitchella repens*), and marginal woodfern (*Dryopteris marginalis*) are common associates, among others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Aralia nudicaulis* (wild sarsaparilla)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Microstegium vimineum* (Nepalese browntop)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern), *Pteridium aquilinum* (western brackenfern)

Characteristic Species: *Betula lenta* (sweet birch), *Gaylussacia baccata* (black huckleberry), *Quercus alba* (white oak), *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak).

Other Noteworthy Species:

Species	GRank	Type	Note
Alliaria petiolata (garlic mustard)		plant	invasive exotic disturbance indicator
Dennstaedtia punctilobula (eastern hayscented fern)		plant	disturbance indicator
Microstegium vimineum (Nepalese browntop)		plant	disturbance indicator

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Appalachian Oak-Hickory Forest	Edinger et al. 2002
PA	S4*	1	Dry Oak - Mixed Hardwood Forest	Fike 1999

Local Range: This forest type occurs throughout Upper Delaware Scenic and Recreational River.

Classification Comments: This is a dry to dry-mesic oak forest with an ericaceous shrub layer and low to no coverage of hickories. Enrichment indicators are lacking or present at low abundance.

Other Comments: None.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.2, UPDE.7, UPDE.16, UPDE.98, UPDE.105, UPDE.111, UPDE.128, UPDE.167, UPDE.194, UPDE.195, UPDE.197, UPDE.201, UPDE.213, UPDE.225.

Upper Delaware Scenic and Recreational River Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus alba - (Quercus rubra, Carya* spp.) Forest Alliance (A.239)
Alliance (English name)	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	*Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest

Association (English name)	(White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf Viburnum Forest
Ecological System(s):	Northeastern Interior Dry-Mesic Oak Forest (CES202.592) Central Appalachian Dry Oak-Pine Forest (CES202.591)

GLOBAL DESCRIPTION

Concept Summary: This oak-hickory forest occurs on well-drained loamy sand of midslopes in the northeastern United States. This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak species-poor forests. *Quercus rubra* (northern red oak), *Quercus alba* (white oak), and *Quercus velutina* (black oak) are prominent in the canopy. *Quercus prinus* (chestnut oak) and *Quercus coccinea* (scarlet oak) are canopy associates in the southern portion of the range. Typical hickory species include *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), and *Carya ovalis* (red hickory). Other canopy associates may include *Acer rubrum* (red maple), *Sassafras albidum* (sassafras), and *Amelanchier arborea* (common serviceberry). At the northern range limit of this type, *Pinus strobus* (eastern white pine) and *Betula lenta* (sweet birch) also occur as minor associates. *Cornus florida* (flowering dogwood) is a characteristic understory tree in portions of the range. The shrub layer is characterized by *Viburnum acerifolium* (mapleleaf viburnum), with other frequent associates including *Hamamelis virginiana* (American witch-hazel), *Vaccinium corymbosum* (highbush blueberry), *Corylus cornuta* (beaked hazelnut), and *Corylus americana* (American hazelnut). A dwarf-shrub layer may be common, but is generally not abundant, and is characterized by *Vaccinium pallidum* (Blue Ridge blueberry) and *Gaylussacia baccata* (black huckleberry), with *Vaccinium angustifolium* (lowbush blueberry) occurring more frequently to the north. The herbaceous layer is characterized by *Carex pensylvanica* (Pennsylvania sedge), *Carex rosea* (rosy sedge), *Maianthemum racemosum* (feathery false lily of the valley), *Aralia nudicaulis* (wild sarsaparilla), *Hieracium venosum* (rattlesnakeweed), *Solidago bicolor* (white goldenrod), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Melampyrum lineare* (narrowleaf cowwheat), *Chimaphila maculata* (striped prince's pine), *Eurybia divaricata* (white wood aster), *Danthonia spicata* (poverty oatgrass), *Aureolaria* (false foxglove) spp., *Pteridium aquilinum* (western brackenfern), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Helianthemum canadense* (longbranch frostweed).

Environmental Description: This forest type occurs on well-drained loamy sand of midslopes and other dry-mesic sites.

Vegetation Description: This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak-species-poor forests. *Quercus rubra* (northern red oak), *Quercus alba* (white oak), and *Quercus velutina* (black oak) are prominent in the canopy. Typical hickory species include *Carya glabra* (pignut hickory), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), and *Carya ovalis* (red hickory). Other canopy associates may include *Acer rubrum* (red maple), *Quercus prinus* (chestnut oak), *Sassafras albidum* (sassafras), and *Amelanchier arborea* (common serviceberry). *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and *Betula lenta* (sweet birch) may also occur as minor associates. *Cornus florida* (flowering dogwood) is a characteristic understory tree in portions of the range. The shrub layer is typically rather sparse and characterized by *Viburnum acerifolium* (mapleleaf viburnum), with other frequent associates including *Hamamelis virginiana* (American witch-hazel), *Vaccinium corymbosum* (highbush blueberry), *Kalmia latifolia* (mountain laurel), *Corylus cornuta* (beaked hazelnut), and *Corylus americana* (American hazelnut). A dwarf-shrub layer may be common but generally not abundant,

characterized by *Vaccinium pallidum* (Blue Ridge blueberry) and *Gaylussacia baccata* (black huckleberry), with *Vaccinium angustifolium* (lowbush blueberry) occurring more frequently to the north. The herbaceous layer is characterized by *Carex pensylvanica* (Pennsylvania sedge), *Maianthemum racemosum* (feathery false lily of the valley), *Dryopteris marginalis* (marginal woodfern), *Aralia nudicaulis* (wild sarsaparilla), *Hieracium venosum* (rattlesnakeweed), *Solidago bicolor* (white goldenrod), *Desmodium glutinosum* (pointedleaf ticktrefoil), *Desmodium paniculatum* (panicledleaf ticktrefoil), *Melampyrum lineare* (narrowleaf cowwheat), *Chimaphila maculata* (striped prince's pine), *Eurybia divaricata* (white wood aster), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Dennstaedtia punctilobula* (eastern hayscented fern), *Aureolaria* (false foxglove) spp., *Pteridium aquilinum* (western brackenfern), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Helianthemum canadense* (longbranch frostweed). The invasive species *Microstegium vimineum* (Nepalese browntop) and *Berberis thunbergii* (Japanese barberry) may also be present in this forest type.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Cornus florida* (flowering dogwood)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

Characteristic Species: *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Carya ovalis* (red hickory), *Cornus florida* (flowering dogwood), *Gaylussacia baccata* (black huckleberry), *Maianthemum racemosum* (feathery false lily of the valley), *Quercus prinus* (chestnut oak), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs from Maine to Maryland.

States/Provinces: CT, DE:S3?, MA, MD, ME, NH, NJ:S4S5, NY, PA, RI, VT.

Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Delaware Water Gap, Fort Necessity, Gettysburg, Minute Man, Morristown, Sagamore Hill, Saratoga, Upper Delaware, Weir Farm); USFWS (Assabet River, Great Meadows).

CONSERVATION STATUS

Rank: G4G5 (24-Jan-2005).

Reasons: This type is not naturally rare and has a wide geographic distribution. Mature stands, however, are uncommon and most stands are subject to logging disturbances or even complete destruction if located in rapidly developing suburban areas.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

- *Acer saccharum - Betula alleghaniensis - Quercus rubra / Viburnum acerifolium* Forest (CEGL006943).
- *Carya (glabra, ovata) - Fraxinus americana - Quercus* spp. Forest (CEGL006236).
- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293)--can intergrade with this type in New England but is characterized by *Fagus grandifolia* (more or less absent in CEGL006336), a greater amount of *Pinus strobus* in the canopy (usually >20%), and little or no *Carya*.
- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acidic Forest (CEGL002067)--also contains *Actaea racemosa* and can occur on cherty limestone, and *Quercus velutina* is not characteristic.
- *Quercus alba - Quercus rubra - Carya alba / Cornus florida / Vaccinium stamineum / Desmodium nudiflorum* Piedmont Forest (CEGL008475)--southern analogue of CEGL006336; is more diverse and occupies soils with slightly higher base status. *Quercus velutina* is not as characteristic of this type. A number of southern herbs such as *Aristolochia serpentaria* are not found in CEGL006336; northern species such as *Corylus cornuta, Vaccinium angustifolium*, and *Aralia nudicaulis* are not found in CEGL008475.
- *Quercus coccinea - Quercus velutina / Sassafras albidum / Vaccinium pallidum* Forest (CEGL006375)--lacks *Viburnum acerifolium* and *Cornus florida* and in general is less diverse and occurring on relatively more nutrient-poor soils.
- *Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium* Forest (CEGL006282).
- *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076)--also contains *Quercus ellipsoidalis* or *Quercus macrocarpa* and is of shorter stature and more open canopy.
- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078)--is drier and more infertile, and lacks *Viburnum acerifolium, Hamamelis virginiana* and other shrubs.

Related Concepts:

- *Quercus (alba, rubra, velutina) / Cornus florida - Viburnum acerifolium* Forest (Bartgis 1986) =
- *Quercus alba - Quercus coccinea - Carya glabra / Cornus florida / Viburnum acerifolium* Forest (VDNH 2003) =
- Mesic Coastal Plain mixed oak forest (Breden 1989) ?
- SNE mesic central hardwood forest on acidic till (Rawinski 1984) ?

SOURCES

Description Authors: S. L. Neid and L. A. Sneddon, mod. S. C. Gawler.

References: Bartgis 1986, Berdine 1998, Breden 1989, Breden et al. 2001, Clancy 1996, Damman 1977, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Fleming et al. 2001, Fleming pers. comm., Gawler 2002, Harrison 2004, Hunt 1997a, MENHP 1991, McCoy and Fleming 2000, Metzler and Barrett 2001, NRCS 2004, Patterson pers. comm., Rawinski 1984, Soil Conservation Service 1987, Sperduto 1997b, Sperduto and Nichols 2004, Swain and Kearsley 2001, VDNH 2003.



Figure E15. Northeastern Dry Oak - Hickory Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.2). June 2005. NAD 1983 / UTM easting 486425, northing 4634032.



Figure E16. Northeastern Dry Oak - Hickory Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.7). June 2005. NAD 1983 / UTM easting 487080, northing 4633313.

COMMON NAME (PARK-SPECIFIC): INLAND PITCH PINE - OAK FOREST

SYNONYMS
USNVC English Name: **Pitch Pine - (Black Oak, Chestnut Oak) Forest**
USNVC Scientific Name: ***Pinus rigida* - *Quercus (velutina, prinus)* Forest**
USNVC Identifier: **CEGL006290**

LOCAL INFORMATION

Environmental Description: This association occurs on flat ridgetops and knobs at moderate elevation. Soils are thin, rocky, and well-drained. The forest is likely to be dependent on fire to develop and perpetuate.

Vegetation Description: The nearly closed canopy of this inland dry oak-pine forest is strongly dominated by pitch pine (*Pinus rigida*). Associates in the canopy, subcanopy, and tall-shrub strata are dry oak species, including northern red oak (*Quercus rubra*), scarlet oak (*Quercus coccinea*), white oak (*Quercus alba*), black oak (*Quercus velutina*), as well as pignut hickory (*Carya glabra*) and red maple (*Acer rubrum*). The potentially dense short-shrub layer (20-60% cover) can be dominated by Blue Ridge blueberry (*Vaccinium pallidum*) with other ericads, including deerberry (*Vaccinium stamineum*) and lowbush blueberry (*Vaccinium angustifolium*). Allegheny serviceberry (*Amelanchier laevis*), sassafras (*Sassafras albidum*), and American hazelnut (*Corylus americana*) occur at low abundance. The ground flora is sparse; fan clubmoss (*Lycopodium digitatum*), striped prince's pine (*Chimaphila maculata*), and moccasin flower (*Cypripedium acaule*) can appear infrequently.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus rigida* (pitch pine)
Tree subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Fern or fern ally	*Lycopodium digitatum* (fan clubmoss)

Characteristic Species: *Pinus rigida* (pitch pine), *Quercus rubra* (northern red oak), *Vaccinium pallidum* (Blue Ridge blueberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Quercus alba (white oak)		plant	
Quercus coccinea (scarlet oak)		plant	
Quercus velutina (black oak)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Pitch Pine-Oak Forest	Edinger et al. 2002
PA	SNR*	2	Pitch Pine - Mixed Oak Forest	Fike 1999

Local Range: This association seems to be limited to the southern half of Upper Delaware Scenic and Recreational River in flat settings at moderate elevation.

Classification Comments: Canopy coverage is greater than 60% and is dominated by pitch pine with dry oak species and an ericaceous understory. An open canopy (25-60% cover) dominated by *Pinus rigida* (pitch pine) with *Quercus prinus* (chestnut oak) found at high elevations is Pitch Pine Rocky Summit, a woodland type.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.135.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	*Pinus rigida - Quercus (velutina, prinus)* Forest
Association (English name)	Pitch Pine - (Black Oak, Chestnut Oak) Forest
Ecological System(s):	Central Appalachian Dry Oak-Pine Forest (CES202.591). Northeastern Interior Pine Barrens (CES202.590).

GLOBAL DESCRIPTION

Concept Summary: This inland dry oak-pine forest of the Northeast occurs on well-drained to droughty soils of glacial outwash or till and on shallow soils on ridges and south-facing slopes. The tree canopy is codominated by *Pinus rigida* (pitch pine) and several oak species, including *Quercus velutina* (black oak), *Quercus alba* (white oak), and *Quercus prinus* (chestnut oak), and an understory of ericaceous species. Canopy associates include *Pinus strobus* (eastern white pine) and, less frequently, *Quercus rubra* (northern red oak), *Pinus resinosa* (red pine) (to the north), or *Pinus virginiana* (Virginia pine) (to the south). The shrub layer tends to be fairly open, with *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium pallidum* (Blue Ridge blueberry) and occasionally *Quercus ilicifolia* (bear oak) (although this species is generally absent in the Western Allegheny Plateau). Typical herbs include *Aralia nudicaulis* (wild sarsaparilla), *Pteridium aquilinum* (western brackenfern), *Gaultheria procumbens* (eastern teaberry), *Comptonia peregrina* (sweet fern), *Carex pensylvanica* (Pennsylvania sedge), and *Carex communis* (fibrousroot sedge). *Lespedeza capitata* (roundhead lespedeza) and *Desmodium* (ticktrefoil) spp. are associates as well. *Solidago odora* (anisescented goldenrod) also occurs on the High Allegheny Plateau.
Environmental Description: This inland dry oak-pine forest of the Northeast occurs on shallow soils on ridges and south-facing slopes.
Vegetation Description: The tree canopy is codominated by *Pinus rigida* (pitch pine) and several oak species, including *Quercus velutina* (black oak), *Quercus alba* (white oak), and *Quercus prinus* (chestnut oak), and an understory of ericaceous species. Canopy associates include *Pinus strobus* (eastern white pine) and, less frequently, *Quercus rubra* (northern red oak), or *Pinus virginiana* (Virginia pine) (to the south). The shrub layer tends to be fairly open, with *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), and *Vaccinium pallidum* (Blue Ridge blueberry) and occasionally *Quercus ilicifolia* (bear oak) (although this species is generally absent in the Western Allegheny Plateau and *Vaccinium stamineum* (deerberry) may be more common). Typical herbs include *Aralia nudicaulis* (wild sarsaparilla), *Pteridium aquilinum* (western brackenfern), *Gaultheria procumbens* (eastern teaberry), *Comptonia peregrina* (sweet fern), *Carex pensylvanica* (Pennsylvania sedge), and *Carex communis* (fibrousroot sedge). *Lespedeza*

capitata (roundhead lespedeza) and *Desmodium* (ticktrefoil) spp. are associates as well. *Solidago odora* (anisescented goldenrod) also occurs on the High Allegheny Plateau.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus rigida* (pitch pine)
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus velutina* (black oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

Characteristic Species: *Pinus rigida* (pitch pine).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This forest occurs in inland portions of New England and west and south to Ontario and Pennsylvania.
States/Provinces: CT, MA, ME, NH, NY, ON:S1, PA, RI, VT.
Federal Lands: NPS (Upper Delaware).

CONSERVATION STATUS

Rank: GNR (31-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: Relative to more coastal pitch pine-oak forests, this type lacks *Quercus coccinea* (scarlet oak), *Quercus falcata* (southern red oak), *Quercus marilandica* (blackjack oak), *Quercus stellata* (post oak), as well as has less scrub oaks (*Quercus ilicifolia* (bear oak), *Quercus prinoides* (dwarf chinkapin oak)). There are also fewer pine species; it lacks *Pinus echinata* (shortleaf pine), *Pinus pungens* (Table Mountain pine), *Pinus virginiana* (Virginia pine). This type generally has a greater mix of deciduous canopy species.

Similar Associations:

- *Acer rubrum - Pinus virginiana - Pinus rigida / Microstegium vimineum - Smilax* spp. Serpentine Forest (CEGL006439).
- *Acer rubrum - Quercus* spp. / *Smilax* spp. Serpentine Forest (CEGL006438).
- *Juniperus virginiana - Pinus virginiana / Smilax rotundifolia* Serpentine Forest (CEGL006440).
- *Pinus rigida - Quercus coccinea / Vaccinium pallidum - (Morella pensylvanica)* Woodland (CEGL006381).
- *Pinus virginiana / Quercus marilandica* Serpentine Forest (CEGL006266).
- *Schizachyrium scoparium - Sporobolus heterolepis* Serpentine Herbaceous Vegetation (CEGL006442).
- *Sorghastrum nutans - Schizachyrium scoparium* Serpentine Herbaceous Vegetation (CEGL006441).

Related Concepts:

- Pine-Oak-Heath Sandplain Forest (Thompson 1996) ?
- Pitch Pine: 45 (Eyre 1980) B
- SNE dry oak/pine forest on sandy/gravelly soils (Rawinski 1984) B
- SNE dry oak/pine forests on acidic bedrock or till (Rawinski 1984) B

SOURCES

Description Authors: S. L. Neid, mod. E. Largay.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fike 1999, Lundgren 2000, Lundgren 2001, Metzler and Barrett 2001, Rawinski 1984, Seischab and Bernard 1991, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E17. Inland Pitch Pine - Oak Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.135). June 2005. NAD 1983 / UTM easting 520040, northing 4585996.

COMMON NAME (PARK-SPECIFIC): LOWER NEW ENGLAND SLOPE CHESTNUT OAK FOREST

SYNONYMS

USNVC English Name: **Chestnut Oak - (Northern Red Oak, Black Oak) / Lowbush Blueberry Forest**

USNVC Scientific Name: ***Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium*** **Forest**

USNVC Identifier: **CEGL006282**

LOCAL INFORMATION

Environmental Description: This association develops on very xeric knobs and ridges at mid- to high elevations. The rocky soils are shallow, acidic, well-drained sandy loams. Large boulders and bedrock outcrops are common. Typically, the forest develops on level ground, but it can occur on a somewhat steep incline (to 30-degree slope). Windthrow, fire, and ice storms are common natural disturbances in these habitats.

Vegetation Description: This xeric forest association is strongly dominated by chestnut oak (*Quercus prinus*). Associates in the canopy and subcanopy are varied and can include dry oak species, such as white oak (*Quercus alba*), northern red oak (*Quercus rubra*), scarlet oak (*Quercus coccinea*), as well as hickories, including pignut hickory (*Carya glabra*) and shagbark hickory (*Carya ovata*), pines, including pitch pine (*Pinus rigida*) and eastern white pine (*Pinus strobus*), red maple (*Acer rubrum*), sweet birch (*Betula lenta*), and white ash (*Fraxinus americana*). Sassafras (*Sassafras albidum*), common serviceberry (*Amelanchier arborea*), blackgum (*Nyssa sylvatica*), flowering dogwood (*Cornus florida*), sugar maple (*Acer saccharum*), and hophornbeam (*Ostrya virginiana*) can be minor associates. Tall shrubs can include American witchhazel (*Hamamelis virginiana*), American chestnut (*Castanea dentata*), bear oak (*Quercus ilicifolia*), highbush blueberry (*Vaccinium corymbosum*), and American beech (*Fagus grandifolia*) sprouts. The dense short-shrub layer (40-95% absolute cover) is dominated by ericaceous species, especially black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*), deerberry (*Vaccinium stamineum*), mountain laurel (*Kalmia latifolia*), and sheep laurel (*Kalmia angustifolia*). Pink azalea (*Rhododendron periclymenoides*), dwarf red blackberry (*Rubus pubescens*), sweet fern (*Comptonia peregrina*), and mapleleaf viburnum (*Viburnum acerifolium*) occur in lower abundance. Herb cover can be sparse to moderately abundant; the most common species are Pennsylvania sedge (*Carex pensylvanica*), western brackenfern (*Pteridium aquilinum*), eastern teaberry (*Gaultheria procumbens*), wavy hairgrass (*Deschampsia flexuosa*), eastern hayscented fern (*Dennstaedtia punctilobula*), poverty oatgrass (*Danthonia spicata*), and wild sarsaparilla (*Aralia nudicaulis*). Quite a few additional species occur sporadically, including marginal woodfern (*Dryopteris marginalis*), intermediate woodfern (*Dryopteris intermedia*), New York fern (*Thelypteris noveboracensis*), interrupted fern (*Osmunda claytoniana*), rock polypody (*Polypodium virginianum*), deertongue (*Dichanthelium clandestinum*), white snakeroot (*Ageratina altissima* var. *altissima*), bearded shorthusk (*Brachyelytrum erectum*), Canada mayflower (*Maianthemum canadense*), white wood aster (*Eurybia divaricata*), starved panicgrass (*Dichanthelium depauperatum*), wreath goldenrod (*Solidago caesia*), common sheep sorrel (*Rumex acetosella*), little bluestem (*Schizachyrium scoparium*), dwarf cinquefoil (*Potentilla canadensis*), starflower (*Trientalis borealis*), nakedflower ticktrefoil (*Desmodium*

nudiflorum), rock muhly (*Muhlenbergia sobolifera*), and many others. Polytrichum moss (*Polytrichum commune*) and leucobryum moss (*Leucobryum glaucum*) are the most common bryophytes.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry)
Herb (field)	Forb	*Gaultheria procumbens* (eastern teaberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Characteristic Species: *Carex pensylvanica* (Pennsylvania sedge), *Gaylussacia baccata* (black huckleberry), *Quercus prinus* (chestnut oak).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Chestnut Oak Forest	Edinger et al. 2002
PA	S5*	1	Dry Oak - Heath Forest	Fike 1999

Local Range: Association occurs most commonly in the southern portions of Upper Delaware Scenic and Recreational River.

Classification Comments: Association is strongly dominated by *Quercus prinus* (chestnut oak).

Other Comments: None.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.29, UPDE.73, UPDE.75, UPDE.79, UPDE.102, UPDE.110, UPDE.125, UPDE.136, UPDE.165, UPDE.166, UPDE.172, UPDE.175, UPDE.179, UPDE.180, UPDE.181, UPDE.183, UPDE.184, UPDE.190, UPDE.192, UPDE.196, UPDE.198, UPDE.199, UPDE.204, UPDE.209, UPDE.210, UPDE.212, UPDE.215, UPDE.224.

Upper Delaware Scenic and Recreational River Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus prinus - (Quercus coccinea, Quercus velutina)* Forest Alliance (A.248)
Alliance (English name)	Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance
Association	*Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium* Forest
Association (English name)	Chestnut Oak - (Northern Red Oak, Black Oak) / Lowbush Blueberry Forest
Ecological System(s):	Central Appalachian Dry Oak-Pine Forest (CES202.591).

GLOBAL DESCRIPTION

Concept Summary: This dry to xeric oak-heath forest of central and southern New England ranges south to the northern Piedmont and central Appalachian Mountains. It occurs on upper slopes and ridgetops with thin, nutrient-poor, acidic soils. Windthrow, fire and ice damage are common natural disturbances. The canopy is closed to partially open and is dominated by *Quercus prinus* (chestnut oak), which can be codominant with *Quercus rubra* (northern red oak). *Quercus alba* (white oak), *Quercus velutina* (black oak), and *Acer rubrum* (red maple) are

common associates, with other less frequent trees including *Betula lenta* (sweet birch), *Quercus coccinea* (scarlet oak), *Amelanchier arborea* (common serviceberry), *Pinus rigida* (pitch pine), and *Pinus strobus* (eastern white pine). *Sassafras albidum* (sassafras), *Cornus florida* (flowering dogwood), and *Nyssa sylvatica* (blackgum) can be minor associates at the southern and western portions of the range. The low-shrub layer is well-developed and comprised chiefly of ericaceous species, including *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia baccata* (black huckleberry), or *Kalmia angustifolia* (sheep laurel). A tall-shrub layer is often lacking but when present may include *Castanea dentata* (American chestnut), *Kalmia latifolia* (mountain laurel), *Viburnum acerifolium* (mapleleaf viburnum), *Hamamelis virginiana* (American witch-hazel), *Quercus ilicifolia* (bear oak), and *Viburnum prunifolium* (blackhaw). *Ilex montana* (mountain holly), *Rhododendron prinophyllum* (early azalea), and *Menziesia pilosa* (minniebush) are minor shrub associates at the southern end of the range. The herbaceous layer is of sparse to moderate cover, depending on shrub cover, and may include *Carex pensylvanica* (Pennsylvania sedge), *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Ageratina altissima* var. *altissima* (white snakeroot), *Antennaria plantaginifolia* (woman's tobacco), *Aralia nudicaulis* (wild sarsaparilla), *Aureolaria laevigata* (entireleaf yellow false foxglove), *Gaultheria procumbens* (eastern teaberry), *Chimaphila maculata* (striped prince's pine), *Carex rosea* (rosy sedge), *Carex swanii* (Swan's sedge), *Carex pensylvanica* (Pennsylvania sedge), *Corydalis sempervirens* (rock harlequin), *Comandra umbellata* (bastard toadflax), *Cypripedium acaule* (moccasin flower), *Dryopteris marginalis* (marginal woodfern), *Epigaea repens* (trailing arbutus), *Goodyera pubescens* (downy rattlesnake plantain), *Hieracium venosum* (rattlesnakeweed), *Lycopodium clavatum* (running clubmoss), *Medeola virginiana* (Indian cucumber), *Melampyrum lineare* (narrowleaf cowwheat), *Monotropa uniflora* (Indianpipe), *Potentilla canadensis* (dwarf cinquefoil), *Pteridium aquilinum* (western brackenfern), and *Uvularia sessilifolia* (sessileleaf bellwort).

Environmental Description: This forest generally occurs on xeric upper slopes and ridgetops and steep sideslopes with shallow, acidic, rocky, infertile soils. Windthrow, fire, and ice storms are common natural disturbances in these habitats.

Vegetation Description: The canopy is closed to partially open and dominated by *Quercus prinus* (chestnut oak), which can be codominant with *Quercus rubra* (northern red oak). *Quercus alba* (white oak), *Quercus velutina* (black oak), and *Acer rubrum* (red maple) are common associates, with other less frequent trees including *Betula lenta* (sweet birch), *Quercus coccinea* (scarlet oak), *Amelanchier arborea* (common serviceberry), *Pinus rigida* (pitch pine), and *Pinus strobus* (eastern white pine). *Sassafras albidum* (sassafras), *Cornus florida* (flowering dogwood), and *Nyssa sylvatica* (blackgum) can be minor associates at the southern and western portions of the range. The low-shrub layer is well-developed and comprised chiefly of ericaceous species, including *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), *Gaylussacia baccata* (black huckleberry), or *Kalmia angustifolia* (sheep laurel). A tall-shrub layer is often lacking but when present may include *Castanea dentata* (American chestnut), *Kalmia latifolia* (mountain laurel), *Viburnum acerifolium* (mapleleaf viburnum), *Hamamelis virginiana* (American witch-hazel), *Quercus ilicifolia* (bear oak), and *Viburnum prunifolium* (blackhaw). *Ilex montana* (mountain holly), *Rhododendron prinophyllum* (early azalea), and *Menziesia pilosa* (minniebush) are minor shrub associates at the southern end of the range. The herbaceous layer is of sparse to moderate cover, depending on shrub cover, and may include *Carex pensylvanica* (Pennsylvania sedge),

Deschampsia flexuosa (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Ageratina altissima* var. *altissima* (white snakeroot), *Antennaria plantaginifolia* (woman's tobacco), *Aralia nudicaulis* (wild sarsaparilla), *Aureolaria laevigata* (entireleaf yellow false foxglove), *Gaultheria procumbens* (eastern teaberry), *Chimaphila maculata* (striped prince's pine), *Carex rosea* (rosy sedge), *Carex swanii* (Swan's sedge), *Carex pensylvanica* (Pennsylvania sedge), *Corydalis sempervirens* (rock harlequin), *Comandra umbellata* (bastard toadflax), *Cypripedium acaule* (moccasin flower), *Dryopteris marginalis* (marginal woodfern), *Epigaea repens* (trailing arbutus), *Goodyera pubescens* (downy rattlesnake plantain), *Hieracium venosum* (rattlesnakeweed), *Lycopodium clavatum* (running clubmoss), *Medeola virginiana* (Indian cucumber), *Melampyrum lineare* (narrowleaf cowwheat), *Monotropa uniflora* (Indianpipe), *Potentilla canadensis* (dwarf cinquefoil), *Pteridium aquilinum* (western brackenfern), and *Uvularia sessilifolia* (sessileleaf bellwort).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium stamineum* (deerberry)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Characteristic Species: *Acer rubrum* (red maple), *Amelanchier arborea* (common serviceberry), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (Pennsylvania sedge), *Castanea dentata* (American chestnut), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Gaultheria procumbens* (eastern teaberry), *Gaylussacia baccata* (black huckleberry), *Kalmia latifolia* (mountain laurel), *Nyssa sylvatica* (blackgum), *Pteridium aquilinum* (western brackenfern), *Quercus coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak), *Sassafras albidum* (sassafras), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community ranges from southern Maine through the Central Appalachians to higher elevations in Virginia and West Virginia, and north more locally in the Piedmont (an estimated 215,000 square km based on approximate acreage of subsections of occurrence).

States/Provinces: CT, DC, MA, MD, ME, NH, NJ:S3S4, NY, PA, RI, VA, VT, WV.

Federal Lands: NPS (Delaware Water Gap, Harpers Ferry, Rock Creek, Upper Delaware, Valley Forge, Weir Farm); USFS (George Washington, Jefferson).

CONSERVATION STATUS

Rank: G5 (31-Jan-2007).

Reasons: This is a very widely distributed oak / ericad forest that covers large areas.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This community type is closely related to other oak / heath. It is distinguished by the presence of northern species, such as *Pinus strobus* (eastern white pine) and *Vaccinium angustifolium* (lowbush blueberry), and its general lack of southern Appalachian species, such as *Gaylussacia ursina* (bear huckleberry), *Leucothoe recurva* (redtwig doghobble), and *Galax urceolata* (beetleweed). In comparison to *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023), it lacks *Oxydendrum arboreum* (sourwood), *Pinus echinata* (shortleaf pine), and *Pinus virginiana* (Virginia pine). It occupies poorer sites and has a more abundant ericaceous shrub component than *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057) and *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522). The Chestnut Oak / Low-Elevation Subtype of Virginia intergrades with the more southern *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271) throughout west-central Virginia. A well-developed Piedmont example of the Chestnut Oak / Low-Elevation Subtype is described by Allard and Leonard (1943). The Chestnut Oak - Northern Red Oak / High-Elevation Subtype of Virginia is similar to *Quercus prinus - Quercus rubra / Vaccinium pallidum - (Rhododendron periclymenoides)* Forest (CEGL008523) of high-elevation granitic terrain on the northern Blue Ridge, but lacks *Quercus velutina* (black oak), *Rhododendron periclymenoides* (pink azalea), and the suite of low-cover herbaceous species characteristic of mineral soil microhabitats in that unit. The recognition of global subtypes equivalent to two distinct state community types is well supported by quantitative analysis of compositional and environmental data. Further study may support the elevation of these subtypes to full association-level status in the USNVC.

Similar Associations:

- *Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest (CEGL006336)--is similar to the more mesic end of the range of variation found in this type at Valley Forge National Historical Park.
- *Quercus (prinus, coccinea) / Kalmia latifolia / (Galax urceolata, Gaultheria procumbens)* Forest (CEGL006271)--of Southern Appalachians.
- *Quercus prinus - (Quercus coccinea, Quercus rubra) / Kalmia latifolia / Vaccinium pallidum* Forest (CEGL006299).
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023)--of Western Alleghenies, Interior Low Plateau, etc.
- *Quercus prinus - Quercus rubra / Hamamelis virginiana* Forest (CEGL006057).
- *Quercus prinus - Quercus rubra / Vaccinium pallidum - (Rhododendron periclymenoides)* Forest (CEGL008523).
- *Quercus prinus - Quercus* spp. / *Vaccinium arboreum - (Kalmia latifolia, Styrax grandifolius)* Forest (CEGL007700).
- *Quercus prinus - Quercus velutina / Oxydendrum arboreum - Cornus florida* Forest (CEGL008522).

Related Concepts:

- *Quercus (prinus, rubra) / Calamagrostis porteri* Ridgetop Forest (Walton et al. 1997) ?
- *Quercus prinus - Quercus rubra / Acer pensylvanicum* Association: *Betula lenta / Ilex montana* Subassociation (Fleming and Moorhead 1996) ?
- *Quercus prinus - Quercus rubra / Kalmia latifolia / Vaccinium angustifolium - Gaultheria procumbens* Forest (Fleming and Coulling 2001) F
- *Quercus velutina - (Quercus prinus)* Forest (Metzler and Barrett 1996) ?
- CNE dry hardwood forest on acidic bedrock or till (Rawinski 1984) ?
- Chestnut Oak Forest (Breden 1989) =
- Chestnut Oak: 44 (Eyre 1980) B
- Dry Oak Woodland (Thompson 1996) B
- SNE dry oak/pine forests on acidic bedrock or till (Rawinski 1984) B
- SNE mesic oak/pine forest on acidic bedrock or till (Rawinski 1984) ?

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. L. Neid, L. A. Sneddon, S. C. Gawler.

References: Allard and Leonard 1943, Breden 1989, Breden et al. 2001, Clancy 1996, Collins and Anderson 1994, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming and Moorhead 2000, Fleming et al. 2001, Gawler 2002, Harrison 2004, Harshberger 1919, Hunt 1997a, Kasmer et al. 1984, Keever 1973, Metzler and Barrett 1996, Metzler and Barrett 2001, Nerurkar 1974, Overlease 1978, Overlease 1987, Pearson 1963, Pearson 1974, Pearson 1979, Rawinski 1984, Rawinski et al. 1994, Rawinski et al. 1996, Russell and Schuyler 1988, Shreve et al. 1910, Sperduto 1997a, Sperduto 2000a, Sperduto and Nichols 2004, Swain and Kearsley 2000, Thompson 1996, Thompson and Sorenson 2000, Vanderhorst 2000b, Walton et al. 1997.



Figure E18. Lower New England Slope Chestnut Oak Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.165). August 2005. NAD 1983 / UTM easting 495999, northing 4621114.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN OAK - RED MAPLE SUCCESSIONAL FOREST

SYNONYMS

USNVC English Name: **Northern Red Oak - Red Maple - Birch species - Eastern White Pine Forest**

USNVC Scientific Name: ***Quercus rubra* - *Acer rubrum* - *Betula* spp. - *Pinus strobus* Forest**

USNVC Identifier: **CEGL006506**

LOCAL INFORMATION

Environmental Description: This successional forest or woodland community develops after disturbance and is generally located on abandoned pasture and post-agricultural fields. Environmental characteristics are not reliable predictors of occurrence.

Vegetation Description: This successional forest or woodland is dominated by eastern white pine (*Pinus strobus*). Adventitious, early-successional hardwoods such as white ash (*Fraxinus americana*), black locust (*Robinia pseudoacacia*), bigtooth aspen (*Populus grandidentata*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*) can be codominant; northern red oak (*Quercus rubra*) and American beech (*Fagus grandifolia*) may also be compositionally important. Ground story vegetation is generally dominated by nonnative, early-successional grasses and herbs. Dominant species can include orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*), wrinkleleaf goldenrod (*Solidago rugosa*), and sweet vernalgrass (*Anthoxanthum odoratum*) with numerous associated invasive herb, shrub, and vine species.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash), *Robinia pseudoacacia* (black locust)

Characteristic Species: *Fraxinus americana* (white ash), *Pinus strobus* (eastern white pine), *Robinia pseudoacacia* (black locust).

Other Noteworthy Species:

Species	GRank	Type	Note
Populus grandidentata (bigtooth aspen)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Successional Northern Hardwoods	Edinger et al. 2002
PA	SNR		[not crosswalked]	

Local Range: This community can occur throughout Upper Delaware Scenic and Recreational River on abandoned agricultural land.

Classification Comments: Distinguished from other successional forests and woodland by dominance by white pine.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: None.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)
Alliance (English name)	Northern Red Oak - (Sugar Maple) Forest Alliance
Association	*Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest
Association (English name)	Northern Red Oak - Red Maple - Birch species - Eastern White Pine Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563). Northern Atlantic Coastal Plain Hardwood Forest (CES203.475). Laurentian-Acadian Northern Pine-(Oak) Forest (CES201.719).

GLOBAL DESCRIPTION

Concept Summary: This deciduous to mixed forest of northern New England is a broadly defined community, usually developing after severe disturbance, including clearing, pasturing, logging, fires, severe hurricanes, or simply heavily fragmented residential development. While in some cases it is a successional type, it may persist in some settings, particularly where soils are limited, for example along ridgelines. The canopy trees are mostly 40-100 years old. The canopy ranges from somewhat open to closed; the shrub, herb and bryoid layers are patchy and rarely extensive. Composition is variable depending on site history. The canopy is usually mostly deciduous, dominated by a heterogeneous mixture of *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *Pinus strobus* (eastern white pine), and *Fagus grandifolia* (American beech). Typically these occur in association with light-requiring, wind-dispersed trees such as *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), *Betula papyrifera* (paper birch), *Betula populifolia* (gray birch), *Fraxinus americana* (white ash), and *Prunus serotina* (black cherry). Minor associates include *Picea rubens* (red spruce) and *Acer saccharum* (sugar maple). Understory species tend to reflect predisturbance conditions and include *Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), or *Hamamelis virginiana* (American witch-hazel) in the shrub layer. *Vaccinium angustifolium* (lowbush blueberry) is a typical low shrub, although it does not form a coherent layer. *Pteridium aquilinum* (western brackenfern) is characteristic and may be abundant in the herbaceous layer; other common herbs include *Trientalis borealis* (starflower), *Maianthemum canadense* (Canada mayflower), *Deschampsia flexuosa* (wavy hairgrass), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer is of variable cover and may include *Polytrichum commune* (polytrichum moss) and *Dicranum polysetum* (dicranum moss). This association is differentiated from similar forests and woodlands by its thin canopy that usually includes early-successional species, particularly *Acer rubrum* (red maple), low abundance of tolerant hardwoods other than red oak, and the lack of a well-developed heath shrub layer (as is typical in oak-pine woodlands). Unlike oak and oak-pine forests to the south, *Quercus rubra* (northern red oak) is the only oak species present in any abundance.

Environmental Description: This deciduous to mixed forest of northern New England is a broadly defined community, usually developing after severe disturbance including clearing, pasturing, logging, fires, severe hurricanes, or simply heavily fragmented residential development. While in some cases it is a successional type, it may persist in some settings, particularly where soils are limited, for example along ridgelines.

Vegetation Description: Canopy trees are mostly 40-100 years old. The canopy ranges from somewhat open to closed; the shrub, herb, and bryoid layers are patchy and rarely extensive. Composition is variable depending on site history. The canopy is usually mostly deciduous, dominated by a heterogeneous mixture of *Quercus rubra* (northern red oak), *Pinus strobus* (eastern white pine), and *Fagus grandifolia* (American beech). Typically these occur in association with light-requiring, wind-dispersed trees such as *Acer rubrum* (red maple), *Populus tremuloides* (quaking aspen), *Populus grandidentata* (bigtooth aspen), *Betula papyrifera* (paper birch), *Betula populifolia* (gray birch), *Fraxinus americana* (white ash), and *Prunus serotina* (black cherry). Minor associates include *Picea rubens* (red spruce) and *Acer saccharum* (sugar maple). Understory species tend to reflect predisturbance conditions and include *Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), or *Hamamelis virginiana* (American witch-hazel) in the shrub layer. *Vaccinium angustifolium* (lowbush blueberry) is a typical low shrub. *Pteridium aquilinum* (western brackenfern) is characteristic, and may be abundant, in the herbaceous layer; other common herbs include *Trientalis borealis* (starflower), *Maianthemum canadense* (Canada mayflower), *Deschampsia flexuosa* (wavy hairgrass), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer is of variable cover and may include *Polytrichum commune* (polytrichum moss) and *Dicranum polysetum* (dicranum moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Corylus cornuta* (beaked hazelnut), *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Characteristic Species: *Fagus grandifolia* (American beech), *Pinus strobus* (eastern white pine), *Pteridium aquilinum* (western brackenfern), *Quercus rubra* (northern red oak), *Vaccinium angustifolium* (lowbush blueberry).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This forest occurs in northern and central New England.
States/Provinces: CT, MA, ME, NB, NH, NY, PA, RI, VT.
Federal Lands: NPS (Acadia, Minute Man, Saratoga, Upper Delaware); USFWS (Assabet River, Eastern Massachusetts, Great Meadows, Moosehorn?, Oxbow).

CONSERVATION STATUS
Rank: GNR (2-Jul-1999).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.

Comments: This association was first described from the Northern Appalachian-Acadian ecoregion, where it approaches a matrix landscape pattern in the southern portions of the region while being absent from areas to the north. Similar forests extend southward. Further work in Lower New England suggests that this type may represent an earlier successional version of *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293), and possibly of other later-successional types, distinguished by the preponderance of *Acer rubrum* (red maple) in the canopy.

Similar Associations:

- (*Pinus strobus, Quercus rubra*) / *Danthonia spicata* Acidic Bedrock Wooded Herbaceous Vegetation (CEGL005101).
- *Betula lenta - Acer rubrum / Lycopodium annotinum - Dennstaedtia punctilobula* Forest (CEGL008503).
- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293).
- *Quercus (rubra, velutina, alba) - Betula lenta - (Pinus strobus)* Forest (CEGL006454).
- *Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland (CEGL006134).
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173).

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Gawler 2002, Kuchler 1956, Moore and Taylor 1927, NRCS 2004, Sperduto 2000a, Thompson and Jenkins 1992.

No photo available.

COMMON NAME (PARK-SPECIFIC): HIGH ALLEGHENY RICH RED OAK - SUGAR MAPLE FOREST

SYNONYMS

USNVC English Name: **Northern Red Oak - Sugar Maple - Tuliptree Forest**

USNVC Scientific Name: ***Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest**

USNVC Identifier: **CEGL006125**

LOCAL INFORMATION

Environmental Description: This association occurs on moist, potentially seepy, gentle to moderate (10-degree) toeslopes. Aspect is variable but the community is often east/southeast-facing. Soils are well-drained, somewhat enriched loam, sandy loam, or silty loam with scattered large stones. The underlying bedrock is typically Devonian age sandstone, siltstone, or shale.

Vegetation Description: This semi-rich forest association is characterized by tuliptree (*Liriodendron tulipifera*) codominance in the canopy with northern red oak (*Quercus rubra*), white oak (*Quercus alba*), and sugar maple (*Acer saccharum*). Canopy and subcanopy associates can include red maple (*Acer rubrum*), American basswood (*Tilia americana*), chestnut oak (*Quercus prinus*), sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), American beech (*Fagus grandifolia*), white ash (*Fraxinus amercana*), and hickories [(pignut hickory (*Carya glabra*); bitternut hickory (*Carya cordiformis*); shagbark hickory (*Carya ovata*)]. There is typically a well-developed tall-shrub layer with any of the following: American witchhazel (*Hamamelis virginiana*), hophornbeam (*Ostrya virginiana*), American hornbeam (*Carpinus caroliniana*), sassafras (*Sassafras albidum*), striped maple (*Acer pensylvanicum*), common serviceberry (*Amelanchier arborea*), American chestnut (*Castanea dentata*), mountain holly (*Ilex montana*), common winterberry (*Ilex verticillata*), and northern spicebush (*Lindera benzoin*). The short-shrub layer is also well-developed and diverse. Mapleleaf viburnum (*Viburnum acerifolium*) can be dominant; common associates, in addition to canopy and tall-shrub species, are beaked hazelnut (*Corylus cornuta*), Japanese barberry (*Berberis thunbergii*), and highbush blueberry (*Vaccinium angustifolium*). A great number of herbs can co-occur in the ground layer but don't show overwhelming dominance. Some of the more abundant species are eastern hayscented fern (*Dennstaedtia punctilobula*), wild sarsaparilla (*Aralia nudicaulis*), New York fern (*Thelypteris noveboracensis*), Chrismas fern (*Polystichum acrostichoides*), sessileleaf bellwort (*Uvularia sessilifolia*), Canada mayflower (*Maianthemum canadense*), intermediate woodfern (*Dryopteris intermedia*), white wood aster (*Eurybia divaricata*), feathery false lily of the valley (*Maianthemum racemosum*), pointedleaf ticktreefoil (*Desmodium glutinosum*), marginal woodfern (*Dryopteris marginalis*), starflower (*Trientalis borealis*), whitetinge sedge (*Carex albicans*), western brakenfern (*Pteridium aquilinum*), mayapple (*Podophyllum peltatum*), smooth Solomon's seal (*Polygonatum biflorum*), sweet white violet (*Viola blanda*), common ladyfern (*Athyrium filix-femina*), bearded shorthusk (*Brachyelytrum erectum*), partridgeberry (*Mitchella repens*), fourflower yellow loosestrife (*Lysimachia quadriflora*), white rattlesnakeroot (*Prenanthes alba*), gall of the earth (*Prenanthes trifoliolata*), Pennsylvania sedge (*Carex pensylvanica*), northern maidenhair (*Adiantum pedatum*), eastern woodland sedge (*Carex blanda*), and Appalachian sedge (*Carex appalachica*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Liriodendron tulipifera* (tuliptree), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple), *Hamamelis virginiana* (American witchhazel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), *Quercus rubra* (northern red oak).

Other Noteworthy Species: None.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Oak-Tuliptree Forest	Edinger et al. 2002
PA	SNR*		Red Oak - Mixed Hardwood Forest	Fike 1999

Local Range: This association can occur throughout the park.

Classification Comments: This association is distinguished by *Liriodendron tulipifera* (tuliptree) codominance in the canopy with *Quercus rubra* (northern red oak).

Other Comments: None.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.1, UPDE.6, UPDE.10, UPDE.17, UPDE.18, UPDE.84, UPDE.169, UPDE.178.

Upper Delaware Scenic and Recreational River Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	*Quercus rubra - (Acer saccharum)* Forest Alliance (A.251)
Alliance (English name)	Northern Red Oak - (Sugar Maple) Forest Alliance
Association	*Quercus rubra - Acer saccharum - Liriodendron tulipifera* Forest
Association (English name)	Northern Red Oak - Sugar Maple - Tuliptree Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593).

GLOBAL DESCRIPTION

Concept Summary: This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountains of the United States, as well as on the northern Piedmont north to the Hudson Valley, with possible extensions east and west of those areas. It is typically found in coves, on moist north- and east-facing slopes and on well-drained flats. Soils are slightly acidic and of intermediate fertility. The closed-canopy tree layer is dominated by a mixture of oaks, primarily *Quercus alba* (white oak) and *Quercus rubra* (northern red oak), with other hardwoods including *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Liriodendron tulipifera* (tuliptree). *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), and *Quercus velutina* (black oak) are possible associates. *Carya* (hickory) spp. may share dominance in some stands. Dominance by *Acer rubrum* (red

maple) or *Liriodendron* (tuliptree) may indicate a past disturbance history. A wide variety of more mesic associates, such as *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), and *Tilia americana* (American basswood) could occur but are negligible in dominance. In addition to *Acer saccharum* (sugar maple) reproduction, some understory species may include *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), *Cornus florida* (flowering dogwood), and *Ostrya virginiana* (hophornbeam). Shrub and vine species include *Amelanchier laevis* (Allegheny serviceberry), *Amelanchier arborea* (common serviceberry), *Cornus* (dogwood) spp., *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (southern arrow-wood), and *Vitis riparia* (riverbank grape). Ericaceous shrubs, such as *Kalmia latifolia* (mountain laurel), *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry), may also be present but are not abundant. The ground layer species are highly variable but include *Caulophyllum thalictroides* (blue cohosh), *Ageratina altissima* (white snakeroot), *Dennstaedtia punctilobula* (eastern hayscented fern), *Podophyllum peltatum* (mayapple), *Maianthemum racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Thelypteris noveboracensis* (New York fern), *Dryopteris marginalis* (marginal woodfern), *Dryopteris intermedia* (intermediate woodfern), *Actaea* (baneberry) spp., and *Uvularia sessilifolia* (sessileleaf bellwort). Exotic species, including *Rosa multiflora* (multiflora rose) and *Alliaria petiolata* (garlic mustard), may be present in the shrub and herb layers of disturbed stands.

Environmental Description: Throughout the range, stands are typically found in coves, on moist north- and east-facing slopes, and on well-drained flats. Soils are slightly acidic and of intermediate fertility (Anderson 1982, Reschke 1990, Fike 1999). In the Catoctin Mountains of Maryland, sites occupied by this community are often covered by bouldery colluvium weathered from metabasalt bedrock. Soils collected from these sites are strongly acidic (mean pH = 4.8) but have moderately high calcium and magnesium levels, typical of soils weathered from iron- and aluminum-rich mafic bedrock.

Vegetation Description: Stands of this red oak - sugar maple forest contain a closed-canopy tree layer. *Acer saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak) are the leading dominants. *Acer rubrum* (red maple), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), and *Quercus velutina* (black oak) are associates on various sites. *Liriodendron tulipifera* (tuliptree) dominance may indicate a past disturbance history, and *Carya* (hickory) spp. may share dominance in some stands. A wide variety of more mesic associates, such as *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), and *Fraxinus americana* (white ash), may occur but are negligible in dominance. In addition to *Acer saccharum* (sugar maple) reproduction, understory species may include *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), and *Ostrya virginiana* (hophornbeam). Shrub and vine species include *Amelanchier laevis* (Allegheny serviceberry), *Amelanchier arborea* (common serviceberry), *Cornus* (dogwood) spp., *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (southern arrow-wood), and *Vitis riparia* (riverbank grape). Ericaceous shrubs such as *Kalmia latifolia* (mountain laurel), *Vaccinium angustifolium* (lowbush blueberry) and *Vaccinium pallidum* (Blue Ridge blueberry) may also be present. The ground layer species are highly variable but include *Caulophyllum thalictroides* (blue cohosh),

Dennstaedtia punctilobula (eastern hayscented fern), *Podophyllum peltatum* (mayapple), *Maianthemum racemosum* (feathery false lily of the valley), *Medeola virginiana* (Indian cucumber), *Thelypteris noveboracensis* (New York fern), and *Uvularia sessilifolia* (sessileleaf bellwort). At the southern end of the type's range in the Catoctin Mountains of Maryland, *Liriodendron tulipifera* (tuliptree) and *Quercus rubra* (northern red oak) are the leading overstory dominants, with *Acer saccharum* (sugar maple) common in both the overstory and understory. Minor tree associates include *Fraxinus americana* (white ash), *Tilia americana* (American basswood), *Quercus alba* (white oak), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), and *Acer rubrum* (red maple). *Lindera benzoin* (northern spicebush) and *Hamamelis virginiana* (American witch-hazel) are the most constant and abundant species in a rather open shrub layer. The most constant herbs in eight plot samples are *Arisaema triphyllum* (Jack in the pulpit), *Brachyelytrum erectum* (bearded shorthusk), *Carex digitalis* (slender woodland sedge), *Erythronium americanum* (dogtooth violet), *Eurybia divaricata* (white wood aster), *Galium triflorum* (fragrant bedstraw), *Pilea pumila* (Canadian clearweed), *Polystichum acrostichoides* (Christmas fern), *Thalictrum thalictroides* (rue-anemone), *Uvularia sessilifolia* (sessileleaf bellwort), *Viola pubescens* (downy yellow violet), and *Viola sororia* (common blue violet). Many other species occur at lower constancies.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus rubra* (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Viburnum acerifolium* (mapleleaf viburnum)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Forb	*Podophyllum peltatum* (mayapple)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Carex pensylvanica* (Pennsylvania sedge), *Carpinus caroliniana* (American hornbeam), *Caulophyllum thalictroides* (blue cohosh), *Liriodendron tulipifera* (tuliptree), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountain regions of the United States, with possible extensions east and west of those areas, ranging from southeastern New York and New Jersey to Pennsylvania, Maryland, West Virginia, and southeastern Ohio.

States/Provinces: CT, MD, NJ, NY, OH, PA, WV?

Federal Lands: NPS (Allegheny Portage Railroad, Catoctin Mountain, Delaware Water Gap, Fort Necessity, Friendship Hill, Upper Delaware); USFS (Wayne); USFWS (Erie).

CONSERVATION STATUS

Rank: G4? (2-Oct-2006).

Reasons: This community is reported as a matrix or large-patch type in every ecoregion where it occurs. Despite covering large areas, high-quality stands are probably rare because of widespread historical impacts and ongoing susceptibility to exotics weeds.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: According to Anderson (1982) in Ohio, where this community is found in the southeastern unglaciated plateau region, it is differentiated from the oak-maple type, *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059), and the Appalachian oak forest type, *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023), by the substantial presence (over 20% canopy or basal area) of *Liriodendron tulipifera* (tuliptree) and insignificant amounts of *Fagus grandifolia* (American beech) or other mesic tree species. This type concept may overlap considerably with that of the oak-maple type, *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059). Braun (1950, e.g., p. 140) reports stands similar to this type in the Shawnee Hills and Mammoth Cave area of Kentucky, as well as other Interior Low Plateau sites. In New York, this type is reported primarily from the southeastern part of the State (Reschke 1990). In the mid-Atlantic states, this type is differentiated from *Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest (CEGL006336) by somewhat more mesic conditions, a higher non-oak canopy component, and the absence of *Quercus prinus* (chestnut oak).

Similar Associations:

- *Fagus grandifolia - Quercus alba - Quercus rubra* Forest (CEGL006377).
- *Quercus alba - (Quercus rubra, Acer saccharum, Fagus grandifolia) / Aesculus flava* Forest (CEGL007233)--is a related type to the south and west.
- *Quercus alba - Quercus rubra - Quercus prinus - Acer saccharum / Lindera benzoin* Forest (CEGL002059).
- *Quercus prinus - Quercus (alba, coccinea, velutina) / Viburnum acerifolium - (Kalmia latifolia)* Forest (CEGL005023).
- *Quercus rubra - Acer saccharum - Tilia americana* var. *heterophylla - Aesculus flava - (Cladrastis kentukea)* Forest (CEGL007698).
- *Quercus rubra - Acer saccharum / Ostrya virginiana / Cardamine concatenata* Forest (CEGL008517)--related vegetation occurring on calcareous substrates at low elevations in the Ridge and Valley province of Virginia and Maryland.
- *Quercus rubra - Tsuga canadensis - Liriodendron tulipifera / Hamamelis virginiana* Forest (CEGL006566).

Related Concepts:

- Dry-Mesic Inland Mixed Oak Forest, mixed oak-hardwood type (Breden 1989) ?

SOURCES

Description Authors: D. Faber-Langendoen, mod. E. Largay, S. C. Gawler, G. P. Fleming.

References: Anderson 1982, Braun 1950, Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Fike 1999, Fleming 1999, Lundgren 2001, Metzler and Barrett 2001, Reschke 1990.



Figure E19. High Allegheny Rich Red Oak - Sugar Maple Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.1). June 2005. NAD 1983 / UTM easting 487174, northing 463311.

COMMON NAME (PARK-SPECIFIC): SILVER MAPLE FLOODPLAIN FOREST

SYNONYMS
USNVC English Name: **Silver Maple - American Elm Forest**
USNVC Scientific Name: ***Acer saccharinum* - *Ulmus americana* Forest**
USNVC Identifier: **CEGL002586**

LOCAL INFORMATION

Environmental Description: This floodplain forest occurs on the downstream ends of islands and on high terraces along the shoreline of the Delaware River. The substrate is typically silt loam or sandy loam, as in Delaware fine sandy loam or Pope fine sandy loam. The forest floor frequently has numerous parallel swales created by flood scour. These forests are inundated only during larger flood events.

Vegetation Description: This floodplain forest is dominated by silver maple (*Acer saccharinum*), covering 40-75% of the canopy. Sugar maple (*Acer saccharum*) can be a canopy codominant with American sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), and willows (*Salix* spp.) as occasional associates. Other occasional canopy associates include red maple (*Acer rubrum*), cottonwood (*Populus* spp.), ash (*Fraxinus* spp.), walnut (*Juglans* spp.), and bitternut hickory (*Carya cordiformis*). The canopy trees typically extend 20-30 m in height, while subcanopy trees range in height from 5-10 m. The sparse subcanopy can contain sugar maple, bitternut hickory, silver maple, boxelder (*Acer negundo*), white ash (*Fraxinus americana*), hophornbeam (*Ostrya virginiana*), black cherry (*Prunus serotina*), and black walnut (*Juglans nigra*). The sparse short-shrub layer includes black raspberry (*Rubus occidentalis*) and is often dominated by the invasive species Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*). The dense herbaceous layer contains reed canarygrass (*Phalaris arundinacea*), ground ivy (*Glechoma hederacea*), whitegrass (*Leersia virginica*), ostrich fern (*Matteuccia struthiopteris*), marshpepper knotweed (*Polygonum hydropiper*), Pennsylvania smartweed (*Polygonum pensylvanicum*), deertongue (*Dichanthelium clandestinum*), upland bentgrass (*Agrostis perennans*), smallspike false nettle (*Boehmeria cylindrica*), sensitive fern (*Onoclea sensibilis*), Canada clearweed (*Pilea pumila*), swamp smartweed (*Polygonum hydropiperoides*), hedge false bindweed (*Calystegia sepium* ssp. *sepium*), dogtooth violet (*Erythronium americanum*), Jack in the pulpit (*Arisaema triphyllum*), giant goldenrod (*Solidago gigantea*), and sweet woodreed (*Cinna arundinacea*). The invasive species Japanese knotweed (*Polygonum cuspidatum*) can form dense thickets on the forest floor. Garlic mustard (*Alliaria petiolata*) and Nepalese browntop (*Microstegium vimineum*) are other common herbaceous invasive species in this forest. Vines such as eastern poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) can be common.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharinum* (silver maple)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison-ivy)
Herb (field)	Forb	*Glechoma hederacea* (ground ivy), *Polygonum cuspidatum* (Japanese knotweed)
Herb (field)	Graminoid	*Leersia virginica* (whitegrass), *Phalaris arundinacea* (reed canarygrass)
Herb (field)	Fern or fern ally	*Matteuccia struthiopteris* (ostrich fern)

Characteristic Species: *Acer saccharinum* (silver maple), *Acer saccharum* (sugar maple), *Matteuccia struthiopteris* (ostrich fern).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Floodplain Forest	Edinger et al. 2002
PA	S5*	1	Silver Maple Floodplain Forest	Fike 1999

Local Range: This forest occurs on island and terrace shorelines associated with the Delaware River in the park.
Classification Comments: Silver Maple Floodplain Forest can be distinguished from other floodplain forests by the dominance of *Acer saccharinum* (silver maple) (40-75% cover), often with *Acer saccharum* (sugar maple) as codominant in the canopy or subcanopy.
Other Comments: Information not available.
Local Description Authors: S. J. Perles (PNHP).
Plots: UPDE.AA.35, UPDE.AA.403, UPDE.AA.466, UPDE.AA.469, UPDE.AA.478, UPDE.AA.482, UPDE.AA.495, UPDE.AA.498, UPDE.AA.503, UPDE.AA.518 (Fike 1999, Podniesinski and Wagner 2002, Perles et al. 2007).
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Acer saccharinum* Temporarily Flooded Forest Alliance (A.279)
Alliance (English name)	Silver Maple Temporarily Flooded Forest Alliance
Association	*Acer saccharinum - Ulmus americana* Forest
Association (English name)	Silver Maple - American Elm Forest
Ecological System(s):	Laurentian-Acadian Floodplain Forest (CES201.587). Central Appalachian River Floodplain (CES202.608). Mississippi River Riparian Forest (CES203.190). North-Central Interior Floodplain (CES202.694). South-Central Interior Large Floodplain (CES202.705).

GLOBAL DESCRIPTION

Concept Summary: This silver maple - elm - cottonwood forest community 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* (boxelder), *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: 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.

Vegetation Description: 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* (boxelder), *Salix nigra* (black willow), *Celtis occidentalis* (common hackberry), *Carya cordiformis* (bitternut hickory), *Juglans nigra* (black walnut), *Fraxinus pennsylvanica* (green ash), and occasionally *Halesia* (silverbell) *tetraptera*. 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:

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: *Acer negundo* (boxelder), *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:

Species	GRank	Type	Note
Glechoma hederacea (ground ivy)		plant	invasive exotic
Lonicera japonica (Japanese honeysuckle)		plant	invasive exotic
Microstegium vimineum (Nepalese browntop)		plant	invasive exotic
Polygonum cuspidatum (Japanese knotweed)		plant	invasive exotic
Rosa multiflora (multiflora rose)		plant	invasive exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

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.

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

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

CONSERVATION STATUS

Rank: G4? (3-Oct-1996).

Reasons: There has been significant conversion of stands to agriculture, hydrologic modifications due to river dams, etc., and siltation caused by modified flooding regimes.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

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).

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).

Related Concepts:

- Silver Maple - American Elm: 62 (Eyre 1980) B
- Silver maple-American elm-cottonwood floodplain forest (CAP pers. comm. 1998) ?
- Southern Floodplain Forest (Chapman et al. 1989) B

SOURCES

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

References: Anderson 1996, CAP pers. comm. 1998, Chapman et al. 1989, Eyre 1980, Fike 1999, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Perles et al. 2007, Podniesinski and Wagner 2002, TDNH unpubl. data, Vanderhorst et al. 2007, WNHIP unpubl. data, WPC and TNC 2002, Walton et al. 1996.



Figure E20. Silver Maple Floodplain Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.469). September 2006. NAD 1983 / UTM easting 495713, northing 462126.

COMMON NAME (PARK-SPECIFIC): SUGAR MAPLE FLOODPLAIN FOREST

SYNONYMS

USNVC English Name: **Sugar Maple - Carolina Ash / American Hornbeam / Mayapple Forest**

USNVC Scientific Name: ***Acer saccharum - Fraxinus americana / Carpinus caroliniana / Podophyllum peltatum* Forest**

USNVC Identifier: **CEGL006459**

LOCAL INFORMATION

Environmental Description: This association occurs on low to mid terraces of the Delaware River and low terraces of major tributaries. The soils appear to be primarily alluvial in origin and include Barbour fine sandy loam, Galway loam, Pope silt loam, and undifferentiated alluvium. These soils tend to be slightly acidic to alkaline. Stands on lower terraces may flood occasionally, but the period of inundation is short.

Vegetation Description: The canopy height varies from 20 to 35 m with total cover from 70 to 90%. The dominant canopy tree is sugar maple (*Acer saccharum*). White ash (*Fraxinus americana*) is a common associate and may be codominant in some stands. Other minor associate species include black cherry (*Prunus serotina*), bitternut hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), American basswood (*Tilia americana*), pignut hickory (*Carya glabra*), and American elm (*Ulmus americana*). The subcanopy can vary from 5 to 25 m in height with total cover ranging from sparse (5%) up to 30%. Sugar maple is often the only species in the subcanopy, or sometimes occurs with American hornbeam (*Carpinus caroliniana*) as a minor associate. The tall-shrub layer is 2-5 m in height and is usually sparse (<10% cover) or absent. The most characteristic tall shrubs/saplings are northern spicebush (*Lindera benzoin*) and sugar maple. The short-shrub layer, less than 2 m in height, may also be sparse (under 5% total cover) or have up to 30% cover. Common short-shrub/sapling species include Japanese barberry (*Berberis thunbergii*), northern spicebush, and sugar maple. The herbaceous layer can be quite variable with respect to cover, ranging from as little as 20% to over 80%. The herbaceous layer is usually less than 1 m in height. The herbaceous layer is often diverse but is often dominated by invasive herbs, especially garlic mustard (*Alliaria petiolata*), ground ivy (*Glechoma hederacea*), Nepalese browntop (*Microstegium vimineum*), and oriental ladysthumb (*Polygonum caespitosum*). Common native herbs include silver false spleenwort (*Deparia acrostichoides*), Christmas fern (*Polystichum acrostichoides*), stickywilly (*Galium aparine*), sensitive fern (*Onoclea sensibilis*), whitegrass (*Leersia virginica*), and mayapple (*Podophyllum peltatum*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Berberis thunbergii* (Japanese barberry)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Glechoma hederacea* (ground ivy), *Polygonum caespitosum* (oriental ladysthumb)
Herb (field)	Graminoid	*Leersia virginica* (whitegrass), *Microstegium vimineum* (Nepalese browntop)

Stratum	Lifeform	Species
Herb (field)	Fern or fern ally	*Deparia acrostichoides* (silver false spleenwort), *Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Caulophyllum thalictroides* (blue cohosh), *Deparia acrostichoides* (silver false spleenwort), *Fraxinus americana* (white ash), *Galium aparine* (stickywilly), *Lindera benzoin* (northern spicebush), *Onoclea sensibilis* (sensitive fern), *Podophyllum peltatum* (mayapple), *Polystichum acrostichoides* (Christmas fern).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Floodplain Forest	Edinger et al. 2002
PA	SNR		[not crosswalked]	

Local Range: This association appears to be restricted primarily to floodplain terraces of the Delaware River and its major tributaries. Only one occurrence of this association was observed within the park, however, additional examples are likely to occur along the Delaware River and tributaries in the park.

Classification Comments: This association is characterized by the dominance of *Acer saccharum* (sugar maple) in nearly all strata. It differs from Central Appalachian Northern Forest in that the latter does not occur on floodplain terraces. It differs from other floodplain forest communities in that *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), and *Acer saccharinum* (silver maple) are rare or absent.

Other Comments: Information not available.

Local Description Authors: G. S. Podniesinski (PNHP).

Plots: UPDE.AA.470 (Perles et al. 2007).

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Acer saccharum - Carya cordiformis* Temporarily Flooded Forest Alliance (A.302)
Alliance (English name)	Sugar Maple - Bitternut Hickory Temporarily Flooded Forest Alliance
Association	*Acer saccharum - Fraxinus americana / Carpinus caroliniana / Podophyllum peltatum* Forest
Association (English name)	Sugar Maple - Carolina Ash / American Hornbeam / Mayapple Forest
Ecological System(s):	Central Appalachian River Floodplain (CES202.608).

GLOBAL DESCRIPTION

Concept Summary: These rich floodplain forests are found on slightly elevated alluvial terraces and active floodplains of larger rivers in the mid-Atlantic states, interior to the Coastal Plain. The setting is a raised river terrace; however, this forest may occur very close to the riverbank if the water channel is well-entrenched. The alluvial soils are slightly acidic to alkaline and less regularly inundated than the soils supporting floodplain forests dominated by silver maple or sycamore. Stands on lower terraces may flood occasionally, but the period of inundation is short. The canopy is closed to somewhat open, and a subcanopy is often present.

Shrubs are typically sparse but may range up to about 30% cover. The herb layer is well-developed, fairly diverse, and seasonally variable, with spring ephemerals giving way to taller ferns, graminoids and forbs. Bryoids are very minor. The canopy dominants are usually some combination of *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and sometimes *Carya cordiformis* (bitternut hickory). Canopy associates include *Quercus rubra* (northern red oak), *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), *Fraxinus nigra* (black ash), *Liriodendron tulipifera* (tuliptree), *Ulmus americana* (American elm), *Tilia americana* (American basswood), and *Fagus grandifolia* (American beech). *Carpinus caroliniana* (American hornbeam) is often present as a small tree, along with *Acer saccharum* (sugar maple). *Lindera benzoin* (northern spicebush) is the most common shrub; *Asimina triloba* (pawpaw) is characteristic in the southern portion of this type's range. Vines such as *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper) are frequent but usually at low cover. The herb layer usually features spring ephemerals, including *Claytonia virginica* (Virginia springbeauty), *Dicentra canadensis* (squirrel corn), and *Erythronium americanum* (dogtooth violet), followed by a mixture of ferns, forbs and graminoids. Characteristic species include *Arisaema triphyllum* (Jack in the pulpit), *Caulophyllum thalictroides* (blue cohosh), *Carex laxiculmis* (spreading sedge), *Deparia acrostichoides* (silver false spleenwort), *Elymus virginicus* (Virginia wildrye), *Elymus riparius* (riverbank wildrye), *Galium aparine* (stickywilly), *Onoclea sensibilis* (sensitive fern), and *Podophyllum peltatum* (mayapple). Exotic species, such as *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), and *Alliaria petiolata* (garlic mustard), may be abundant, especially in disturbed areas. These terrace forests are related to lower floodplain forests, e.g. *Platanus occidentalis - Acer negundo - Juglans nigra / Asimina triloba / Mertensia virginica* Forest (CEGL004073), but distinguished by the reduced importance of *Acer saccharinum* (silver maple) and *Platanus occidentalis* (American sycamore); they differ from enriched upland hardwood forests, e.g., *Acer (nigrum, saccharum) - Tilia americana / Asimina triloba / Jeffersonia diphylla - Caulophyllum thalictroides* Forest (CEGL008412), in their alluvial soils and flooding regime.

Environmental Description: These rich floodplain forests are found on slightly elevated alluvial terraces of mid-sized to larger rivers. The setting is a raised river terrace; however, this forest may occur very close to the riverbank if the water channel is well-entrenched. The alluvial soils are slightly acidic to alkaline. Stands on lower terraces may flood occasionally, but the period of inundation is short. Along the Potomac River west of Washington, DC, this community occupies alluvial fill overlying terraces interpreted as the Penholoway and Wicomico. It is often the higher of paired alluvial benches downstream of defending bedrock outcrops on major islands, with *Platanus occidentalis - Acer negundo - Juglans nigra / Asimina triloba / Mertensia virginica* Forest (CEGL004073) occupying the lower bench. Soils are generally deep sandy loams, loamy sands or sands and are likely Inceptisols. The mean flooding recurrence interval along the Potomac is 15 to 30 years.

Vegetation Description: The canopy is closed to somewhat open, and a subcanopy is often present. Shrubs are typically sparse but may range up to about 30% cover. The herb layer is well-developed, fairly diverse, and seasonally variable, with spring ephemerals giving way to taller ferns, graminoids and forbs. Bryoids are very minor. The canopy dominants are usually some combination of *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), and sometimes *Carya cordiformis* (bitternut hickory). Canopy associates include *Quercus rubra* (northern red oak), *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), *Fraxinus nigra* (black ash), *Liriodendron tulipifera* (tuliptree), *Ulmus americana* (American elm), *Tilia americana*

(American basswood), *Celtis occidentalis* (common hackberry), and *Fagus grandifolia* (American beech). *Carpinus caroliniana* (American hornbeam) is often present as a small tree, along with *Acer saccharum* (sugar maple) and *Acer negundo* (boxelder). *Lindera benzoin* (northern spicebush) is the most common shrub; *Asimina triloba* (pawpaw) is characteristic in the southern portion of this type's range. Vines such as *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper) are frequent but usually at low cover. The herb layer usually features spring ephemerals, including *Claytonia virginica* (Virginia springbeauty), *Dicentra canadensis* (squirrel corn), and *Erythronium americanum* (dogtooth violet), followed by a mixture of ferns, forbs and graminoids. Characteristic species include *Arisaema triphyllum* (Jack in the pulpit), *Caulophyllum thalictroides* (blue cohosh), *Carex laxiculmis* (spreading sedge), *Deparia acrostichoides* (silver false spleenwort), *Elymus virginicus* (Virginia wildrye), *Elymus riparius* (riverbank wildrye), *Galium aparine* (stickywilly), *Onoclea sensibilis* (sensitive fern), and *Podophyllum peltatum* (mayapple). *Matteuccia struthiopteris* (ostrich fern) may form local dominance patches in this type along the Potomac River in Maryland and Virginia. Exotic species, such as *Microstegium vimineum* (Nepalese browntop), *Glechoma hederacea* (ground ivy), and *Alliaria petiolata* (garlic mustard), may be abundant, especially in disturbed areas.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana* (white ash)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer saccharum* (sugar maple)
Herb (field)	Graminoid	*Microstegium vimineum* (Nepalese browntop)

Characteristic Species: *Acer saccharum* (sugar maple), *Arisaema triphyllum* (Jack in the pulpit), *Fraxinus americana* (white ash), *Lindera benzoin* (northern spicebush), *Onoclea sensibilis* (sensitive fern), *Podophyllum peltatum* (mayapple).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is known from the mid-Atlantic states from Pennsylvania and New Jersey south to the James River in Virginia.
States/Provinces: MD, NJ:S2S3, NY, PA, VA.
Federal Lands: NPS (C&O Canal, Delaware Water Gap, George Washington Parkway, Upper Delaware); USFS (Jefferson).

CONSERVATION STATUS

Rank: G3? (5-Oct-2006).
Reasons: This type is fairly widely distributed in the mid-Atlantic states, but it occurs in small patches in restricted environmental settings that are typically cleared for agriculture, and intact examples are not well-documented.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: This community has been drastically reduced from its original extent, as it makes excellent fertile farmland. Originally it was probably a large-patch type.

Similar Associations:

- *Acer saccharum - Fraxinus* spp. - *Tilia americana / Matteuccia struthiopteris - Ageratina altissima* Forest (CEGL006114).
- *Acer saccharum - Juglans cinerea / Carpinus caroliniana / Matteuccia struthiopteris* Forest (CEGL006430).
- *Liriodendron tulipifera - Fraxinus* spp. / *Lindera benzoin - Viburnum prunifolium / Podophyllum peltatum* Forest (CEGL006314).
- *Tilia americana - Acer saccharum - Acer nigrum / Laportea canadensis* Forest (CEGL006405).

Related Concepts:

- Palustrine Broad-leaved Deciduous Forested Wetland, Seasonally Flooded (PFO1C) (Cowardin et al. 1979) ?
- Sugar Maple - Basswood: 26 (Eyre 1980) B

SOURCES

Description Authors: S. C. Gawler; mod. G. P. Fleming.

References: Cowardin et al. 1979, Eastern Ecology Working Group n.d., Eyre 1980, Harrison 2004, Harrison and Stango 2003, Lea 2000, Perles et al. 2007, Thomson et al. 1999.



Figure E21. Sugar Maple Floodplain Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.470). September 2006. NAD 1983 / UTM easting 495628, northing 4620972.

COMMON NAME (PARK-SPECIFIC): BITTERNUT HICKORY LOWLAND FOREST

SYNONYMS
USNVC English Name: **Bitternut Hickory - Black Cherry / White Snakeroot Forest**
USNVC Scientific Name: ***Carya cordiformis - Prunus serotina / Ageratina altissima* Forest**
USNVC Identifier: **CEGL006445**

LOCAL INFORMATION

Environmental Description: This forest association typically occurs on low to mid-level floodplain terraces adjacent to the Upper Delaware River or its major tributaries. Soils are derived from alluvial deposits and consist of well-drained, somewhat moist, fine sandy loams and silt. While definitive flood frequency is unknown, the association is likely to be flooded to some degree seasonally and less frequently than American sycamore (*Platanus occidentalis*)-dominated floodplain forests, which occur on lower, fringing terraces.

Vegetation Description: The somewhat open canopy of this floodplain forest is dominated by bitternut hickory (*Carya cordiformis*), which constitutes at least 25% relative cover in the canopy. Associates in the canopy and subcanopy are black cherry (*Prunus serotina*), sugar maple (*Acer saccharum*), black oak (*Quercus velutina*), American basswood (*Tilia americana*), and white ash (*Fraxinus pennsylvanica*). American sycamore (*Platanus occidentalis*) can occur sporadically but is more common on lower terrace steps, closer to the river. The most common tall shrubs, which can form dense patches, are American hornbeam (*Carpinus caroliniana*), hawthorn (*Crataegus* sp.), and slippery elm (*Ulmus rubra*). Japanese barberry (*Berberis thunbergii*) is a very common short-shrub invasive in this community and can form a nearly impenetrable understory. Ostrich fern (*Matteuccia struthiopteris*) is a characteristic herb that grows in association with a mix of graminoids and ferns that vary according to microtopographic setting. Garlic mustard (*Alliaria petiolata*) is also a common invasive species.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya cordiformis* (bitternut hickory)
Tall shrub/sapling	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam)
Short shrub/sapling	Broad-leaved deciduous shrub	*Berberis thunbergii* (Japanese barberry)
Herb (field)	Forb	*Alliaria petiolata* (garlic mustard), *Polygonum virginianum* (jumpseed)
Herb (field)	Fern or fern ally	*Matteuccia struthiopteris* (ostrich fern)

Characteristic Species: *Acer saccharum* (sugar maple), *Carpinus caroliniana* (American hornbeam), *Carya cordiformis* (bitternut hickory), *Prunus serotina* (black cherry).

Other Noteworthy Species:

Species	GRank	Type	Note
Alliaria petiolata (garlic mustard)		plant	very common invasive exotic
Berberis thunbergii (Japanese barberry)		plant	very common invasive exotic

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Floodplain Forest	Edinger et al. 2002
PA	S3		[not crosswalked]	

Local Range: Potentially occurs throughout Upper Delaware Scenic and Recreational River on channel islands and floodplain terraces.

Classification Comments: A mid- to low terrace floodplain forest dominated by bitternut hickory.

Other Comments: Common invasives: *Berberis thunbergii* (Japanese barberry), *Alliaria petiolata* (garlic mustard), *Microstegium vimineum* (Nepalese browntop).
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.22, UPDE.222.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Acer saccharum - Carya cordiformis* Temporarily Flooded Forest Alliance (A.302)
Alliance (English name)	Sugar Maple - Bitternut Hickory Temporarily Flooded Forest Alliance
Association	*Carya cordiformis - Prunus serotina / Ageratina altissima* Forest
Association (English name)	Bitternut Hickory - Black Cherry / White Snakeroot Forest
Ecological System(s):	Central Appalachian River Floodplain (CES202.608).

GLOBAL DESCRIPTION

Concept Summary: This association is characterized by the dominance or codominance of *Carya cordiformis* (bitternut hickory) on mid to high floodplain terraces. Soils are derived from alluvial deposits and consist of fine sandy loams and loamy fine sand. Codominant or associate canopy species include *Quercus rubra* (northern red oak), *Juglans cinerea* (butternut), *Prunus serotina* (black cherry), *Ulmus americana* (American elm), *Fraxinus americana* (white ash), and *Acer saccharinum* (silver maple). The canopy is usually somewhat open, occasionally closed, and about 20 m in height. The subcanopy cover is usually 20 to 30%. Composition of the subcanopy is similar to the canopy layer and may also include *Acer rubrum* (red maple) and *Acer saccharum* (sugar maple). The tall-shrub and short-shrub layers are usually sparse and include occasional saplings of canopy and subcanopy species, as well as scattered individuals of *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Berberis thunbergii* (Japanese barberry), *Rubus occidentalis* (black raspberry), and *Rubus flagellaris* (northern dewberry). The herbaceous layer is weedy, with invasive exotic species common or dominant, including *Microstegium vimineum* (Nepalese browntop), *Alliaria petiolata* (garlic mustard), and *Glechoma hederacea* (ground ivy). Common native species include *Ageratina altissima* var. *altissima* (white snakeroot), *Hydrophyllum virginianum* (Shawnee salad), and *Carex* (sedge) spp.
Environmental Description: This association occurs on mid to high floodplain terraces of mid- to large-sized rivers. It is currently documented from the Delaware and Upper Delaware, and Cheat rivers and probably occurs on other rivers within the region. Flood frequency is unknown, but it is likely flooded less often than *Platanus occidentalis* (American sycamore) and *Acer saccharinum* (silver maple) forests found on lower floodplain terraces. Soils on these stabilized terraces are derived from alluvial deposits and consist of fine sandy loams and loamy fine sand.
Vegetation Description: This association is characterized by the dominance or codominance of *Carya cordiformis* (bitternut hickory). Codominant or associate canopy species include *Quercus rubra* (northern red oak), *Juglans cinerea* (butternut), *Prunus serotina* (black cherry), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Fraxinus americana* (white ash), and occasionally *Acer saccharinum* (silver maple). The canopy is usually somewhat open, occasionally closed, and about 20 m in height. The subcanopy cover is usually 20 to 30%.

Composition of the subcanopy is similar to the canopy layer and may also include *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), and *Carpinus caroliniana* (American hornbeam). The tall-shrub and short-shrub layers are usually sparse and include occasional saplings of canopy and subcanopy species, as well as scattered individuals of *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Berberis thunbergii* (Japanese barberry), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Rubus occidentalis* (black raspberry), and *Rubus flagellaris* (northern dewberry). The herbaceous layer is weedy, with invasive exotic species common or dominant, including *Microstegium vimineum* (Nepalese browntop), *Alliaria petiolata* (garlic mustard), and *Glechoma hederacea* (ground ivy). Common native species include *Ageratina altissima* var. *altissima* (white snakeroot), *Hydrophyllum virginianum* (Shawnee salad), *Matteuccia struthiopteris* (ostrich fern), *Polygonum virginianum* (jumpseed), *Claytonia virginica* (Virginia springbeauty), and *Carex* (sedge) spp.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya cordiformis* (bitternut hickory), *Prunus serotina* (black cherry)
Tree subcanopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple), *Ulmus americana* (American elm)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Carya cordiformis* (bitternut hickory), *Lonicera morrowii* (Morrow's honeysuckle), *Prunus serotina* (black cherry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose)
Herb (field)	Forb	*Ageratina altissima* var. *altissima* (white snakeroot), *Alliaria petiolata* (garlic mustard), *Glechoma hederacea* (ground ivy), *Hydrophyllum virginianum* (Shawnee salad)
Herb (field)	Graminoid	*Microstegium vimineum* (Nepalese browntop)

Characteristic Species: *Acer saccharum* (sugar maple), *Ageratina altissima* var. *altissima* (white snakeroot), *Carya cordiformis* (bitternut hickory), *Hydrophyllum virginianum* (Shawnee salad), *Prunus serotina* (black cherry), *Ulmus americana* (American elm).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This type is currently documented from northern New Jersey, New York, and Pennsylvania, south to northern West Virginia.
States/Provinces: NJ, NY, PA:S3, WV.
Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS
Rank: GNR (7-Feb-2006).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts:
- Successional floodplain forest, aka Terrace floodplain forest (Vanderhorst 2001a) =

SOURCES

Description Authors: S. C. Gawler, mod. E. Largay and S. C. Gawler.

References: Eastern Ecology Working Group n.d., Vanderhorst 2001a, Vanderhorst and Streets 2006.



Figure E22. Bitternut Hickory Lowland Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.22). August 2005. NAD 1983 / UTM easting 491606, northing 4624247.



Figure E23. Bitternut Hickory Lowland Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.222). September 2005. NAD 1983 / UTM easting 496719, northing 4602038.

COMMON NAME (PARK-SPECIFIC): RIVER BIRCH LOW FLOODPLAIN FOREST

SYNONYMS
USNVC English Name: **River Birch - American Sycamore / Orange Jewelweed Forest**
USNVC Scientific Name: ***Betula nigra - Platanus occidentalis / Impatiens capensis* Forest**
USNVC Identifier: **CEGL006184**

LOCAL INFORMATION

Environmental Description: This riparian woodland association typically occurs on low terrace floodplains of major tributaries to the Upper Delaware River. It also can occur on islands, bars, and low terrace shorelines of the Upper Delaware itself. The low terraces are usually immediately adjacent to the river channel and subject to frequent flooding. The substrate is typically moderately well-drained, stony, recent alluvium consisting of sand, silt and/or gravel.
Vegetation Description: The open woodland canopy of this community is characterized by river birch (*Betula nigra*) dominance (this species is important in all woody strata) with American sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), black walnut (*Juglans nigra*), bitternut hickory (*Carya cordiformis*), and green ash (*Fraxinus pennsylvanica*) as occasional associates. Boxelder (*Acer negundo*) is somewhat common in the subcanopy and tall-shrub strata. Dogwoods, including redosier dogwood (*Cornus sericea)*, gray dogwood (*Cornus racemosa*), and silky dogwood (*Cornus amomum*), blackberries, such as Allegheny blackberry (*Rubus allegheniensis*) and dwarf red blackberry (*Rubus pubescens*), and multiflora rose (*Rosa multiflora*) make up the short-shrub layer. Eastern poison ivy (*Toxicodendron radicans*) and Virginia creeper (*Parthenocissus quinquefolia*) are common woody vines. There can be a dense herbaceous layer dominated by graminoids; the most common species are rough bluegrass (*Poa trivialis*), Wiegand's wildrye (*Elymus wiegandii*), and reed canarygrass (*Phalaris arundinacea*).
Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Betula nigra* (river birch)
Short shrub/sapling	Broad-leaved deciduous shrub	*Cornus sericea* (redosier dogwood)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Graminoid	*Elymus wiegandii* (Wiegand's wildrye), *Phalaris arundinacea* (reed canarygrass), *Poa trivialis* (rough bluegrass)

Characteristic Species: *Betula nigra* (river birch), *Phalaris arundinacea* (reed canarygrass).
Other Noteworthy Species:

Species	GRank	Type	Note
Elymus wiegandii (Wiegand's wildrye)		plant	
Phalaris arundinacea (reed canarygrass)		plant	
Poa trivialis (rough bluegrass)		plant	exotic
Toxicodendron radicans (eastern poison ivy)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Floodplain Forest	Edinger et al. 2002
PA	S4*	3	Sycamore - (River Birch) - Box-Elder Floodplain Forest	Fike 1999

Local Range: This type can occur throughout Upper Delaware Scenic and Recreational River on low terrace floodplains and island heads adjacent to the river or its tributaries. The only examples of this association observed during this study were near the southern end of the park.
Classification Comments: A floodplain woodland strongly dominated by river birch.

Other Comments: Information not available.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.124, UPDE.143, UPDE.AA.32, UPDE.AA. 48, UPDE.AA.202, UPDE.AA.514.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	*Betula nigra - (Platanus occidentalis)* Temporarily Flooded Forest Alliance (A.280)
Alliance (English name)	River Birch - (American Sycamore) Temporarily Flooded Forest Alliance
Association	*Betula nigra - Platanus occidentalis / Impatiens capensis* Forest
Association (English name)	River Birch - American Sycamore / Orange Jewelweed Forest
Ecological System(s):	Central Appalachian River Floodplain (CES202.608). Northern Atlantic Coastal Plain Stream and River (CES203.070).

GLOBAL DESCRIPTION

Concept Summary: This Mid-Atlantic floodplain forest of large and moderately large rivers occurs on sandy, gravelly, well-drained soils of levees, gravel bars, braided channels and other areas of frequent flooding. The tree canopy is well-developed and dominated by *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore), with associates including *Acer negundo* (boxelder) and occasionally *Acer saccharinum* (silver maple) and *Fraxinus pennsylvanica* (green ash). The shrub layer can include *Cornus amomum* (silky dogwood), *Cornus sericea* (red-osier dogwood), and *Lindera benzoin* (northern spicebush). The vine and herb layers are lush and diverse and may include *Boehmeria cylindrica* (small-spike false nettle), *Elymus hystrix* (eastern bottlebrush grass), *Stellaria pubera* (star chickweed), *Impatiens capensis* (jewelweed), *Impatiens pallida* (pale touch-me-not), *Laportea canadensis* (Canadian woodnettle), *Pilea pumila* (Canadian clearweed), *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis rotundifolia* (muscadine) or *Vitis riparia* (riverbank grape), *Chasmanthium latifolium* (Indian woodoats), *Podophyllum peltatum* (mayapple), *Polygonum virginianum* (jumpseed), *Apocynum cannabinum* (Indianhemp), and *Urtica* (nettle) sp. Exotic species are typical and may include *Lysimachia* (yellow loosestrife) sp., *Microstegium vimineum* (Nepalese browntop), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Polygonum cuspidatum* (Japanese knotweed), *Phalaris arundinacea* (reed canarygrass), and *Alliaria petiolata* (garlic mustard).
Environmental Description: This Mid-Atlantic floodplain forest of large and moderately large rivers occurs on sandy, gravelly, well-drained soils of levees, gravel bars, braided channels and other areas of frequent flooding.
Vegetation Description: The tree canopy is well-developed and dominated by *Betula nigra* (river birch) and *Platanus occidentalis* (American sycamore), with associates including *Acer negundo* (boxelder) and occasionally *Acer saccharinum* (silver maple) and *Fraxinus pennsylvanica* (green ash). The shrub layer can include *Cornus amomum* (silky dogwood), *Cornus sericea* (red-osier dogwood), and *Lindera benzoin* (northern spicebush). The vine and herb layers are lush and diverse and may include *Boehmeria cylindrica* (small-spike false nettle), *Elymus hystrix* (eastern bottlebrush grass), *Stellaria pubera* (star chickweed), *Impatiens capensis*

(jewelweed), *Impatiens pallida* (pale touch-me-not), *Laportea canadensis* (Canadian woodnettle), *Pilea pumila* (Canadian clearweed), *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis rotundifolia* (muscadine) or *Vitis riparia* (riverbank grape), *Chasmanthium latifolium* (Indian woodoats), *Podophyllum peltatum* (mayapple), *Polygonum virginianum* (jumpseed), *Apocynum cannabinum* (Indianhemp), and *Urtica* (nettle) sp. Exotic species are typical and may include *Lysimachia* (yellow loosestrife) sp., *Microstegium vimineum* (Nepalese browntop), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Polygonum cuspidatum* (Japanese knotweed), *Phalaris arundinacea* (reed canarygrass), and *Alliaria petiolata* (garlic mustard).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula nigra* (river birch), *Platanus occidentalis* (American sycamore)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus amomum* (silky dogwood), *Toxicodendron radicans* (eastern poison-ivy)
Shrub/sapling (tall & short)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Vitis rotundifolia* (muscadine)
Herb (field)	Forb	*Boehmeria cylindrica* (small-spike false nettle), *Impatiens capensis* (jewelweed)

Characteristic Species: *Betula nigra* (river birch), *Impatiens capensis* (jewelweed), *Platanus occidentalis* (American sycamore).

Other Noteworthy Species:

Species	GRank	Type	Note
Alliaria petiolata (garlic mustard)		plant	exotic
Lonicera japonica (Japanese honeysuckle)		plant	exotic
Lonicera morrowii (Morrow's honeysuckle)		plant	exotic
Microstegium vimineum (Nepalese browntop)		plant	exotic
Phalaris arundinacea (reed canarygrass)		plant	exotic
Polygonum cuspidatum (Japanese knotweed)		plant	exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community is common in the Mid-Atlantic states.
States/Provinces: DE, MD, NJ, NY, PA, WV?
Federal Lands: NPS (Upper Delaware).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.

Similar Associations:

- *Betula nigra - Acer rubrum - (Liquidambar styraciflua, Platanus occidentalis)* Successional Forest (CEGL006976).
- *Betula nigra - Platanus occidentalis* Forest (CEGL002086).
- *Platanus occidentalis - (Liquidambar styraciflua, Liriodendron tulipifera) / Asimina triloba* Forest (CEGL006603)
- *Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra)* Woodland (CEGL003896)--on more exposed, heavily scoured shores that support stunted *Betula nigra* and *Platanus occidentalis*.
- *Platanus occidentalis - Fraxinus pennsylvanica* Forest (CEGL006036)--represented by more northern species.

Related Concepts:

- *Platanus occidentalis - Acer negundo / Asarum canadense* Forest (Bartgis 1986) B
- Sycamore-river birch-jewelweed floodplain forest (CAP pers. comm. 1998) ?

SOURCES

Description Authors: L. A. Sneddon, mod. E. Largay.

References: Bartgis 1986, Bowman 2000, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Harrison 2004, Podniesinski and Wagner 2002, Thomson et al. 1999.



Figure E24. River Birch Low Floodplain Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.514). September 2006. NAD 1983 / UTM easting 518947, northing 4586030.

COMMON NAME (PARK-SPECIFIC): SYCAMORE - MIXED HARDWOOD FLOODPLAIN FOREST

SYNONYMS
USNVC English Name: **American Sycamore - Green Ash Forest**
USNVC Scientific Name: ***Platanus occidentalis - Fraxinus pennsylvanica* Forest**
USNVC Identifier: **CEGL006036**

LOCAL INFORMATION

Environmental Description: This association typically occurs on low terrace floodplains of major tributaries to the Upper Delaware River. It also can occur on islands, bars, and low terrace shorelines of the Upper Delaware itself. The low terraces are usually immediately adjacent to the river channel and subject to frequent flooding. The substrate is typically moderately well-drained, very stony, recent alluvium consisting of sand, silt and/or gravel.
Vegetation Description: The somewhat open to closed tree canopy layer of this successional floodplain forest type is diagnostically dominated by American sycamore (*Platanus occidentalis*). Birches, such as sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), and river birch (*Betula nigra*), black willow (*Salix nigra*), northern red oak (*Quercus rubra*), green ash (*Fraxinus pennsylvanica*), and white ash (*Fraxinus americana*) can be associates, as can sugar maple (*Acer saccharum*) and American basswood (*Tilia americana*) on richer sites. At some sites, eastern white pine (*Pinus strobus*) can be common in the canopy. The subcanopy and tall-shrub layers can be variable, too, according to site conditions. Typical subcanopy and tall-shrub species, in addition to those in the canopy, are American hornbeam (*Carpinus caroliniana*), common ninebark (*Physocarpus opulifolius*), American elm (*Ulmus americana*), slippery elm (*Ulmus rubra*), American witchhazel (*Hamamelis virginiana*), and common winterberry (*Ilex verticillata*). Many of the same species also appear, in lower abundance, as short shrubs. On disturbed sites, black locust (*Robinia pseudoacacia*), black cherry (*Prunus serotina*), and black walnut (*Juglans nigra*) can be common in the canopy or subcanopy, and species such as white ash, American hornbeam, and elm may be more abundant than in higher quality, intact stands. Vines make up an important part of the flora and are codominated by Virginia creeper (*Parthenocissus quinquefolia*) and eastern poison ivy (*Toxicodendron radicans*). Ground flora consists of a mix of disturbance-tolerant species, such as Nepalese browntop (*Microstegium vimineum*), Japanese knotweed (*Polygonum cuspidatum*), and garlic mustard (*Alliaria petiolata*), and typical woodland or floodplain herbs, including fringed loosestrife (*Lysimachia ciliata*), Indianhemp (*Apocynum cannabinum*), deertongue (*Dichanthelium clandestinum*), feathery false lily of the valley (*Maianthemum racemosum*), upright sedge (*Carex stricta*), common ladyfern (*Athyrium filix-femina*), spotted ladysthumb (*Polygonum persicaria*), swamp smartweed (*Polygonum hydropiperoides*), and big bluestem (*Andropogon gerardii*).
Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous shrub	*Physocarpus opulifolius* (common ninebark)
Tree canopy	Broad-leaved deciduous tree	*Platanus occidentalis* (American sycamore)
Tree subcanopy	Broad-leaved deciduous tree	*Carpinus caroliniana* (American hornbeam)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Toxicodendron radicans* (eastern poison ivy)

Stratum	Lifeform	Species
Herb (field)	Forb	*Apocynum cannabinum* (Indianhemp), *Lysimachia ciliata* (fringed loosestrife)
Herb (field)	Graminoid	*Microstegium vimineum* (Nepalese browntop)

Characteristic Species: *Acer saccharum* (sugar maple), *Carpinus caroliniana* (American hornbeam), *Parthenocissus quinquefolia* (Virginia creeper), *Physocarpus opulifolius* (common ninebark), *Platanus occidentalis* (American sycamore), *Toxicodendron radicans* (eastern poison-ivy).

Other Noteworthy Species:

Species	GRank	Type	Note
Alliaria petiolata (garlic mustard)		plant	common invasive
Microstegium vimineum (Nepalese browntop)		plant	common invasive
Polygonum cuspidatum (Japanese knotweed)		plant	common invasive

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Floodplain Forest	Edinger et al. 2002
PA	S4*	3	Sycamore - (River Birch) - Box-Elder Floodplain Forest	Fike 1999

Local Range: This association is common along the entire length of the Upper Delaware River in the park.

Classification Comments: This association is distinguished from other floodplain forests by the dominance of *Platanus occidentalis* (American sycamore).

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.134, UPDE.140.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
Alliance	Platanus occidentalis - (*Fraxinus pennsylvanica, Celtis laevigata, Acer saccharinum*) Temporarily Flooded Forest Alliance (A.288)
Alliance (English name)	American Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest Alliance
Association	*Platanus occidentalis - Fraxinus pennsylvanica* Forest
Association (English name)	American Sycamore - Green Ash Forest
Ecological System(s):	Central Appalachian River Floodplain (CES202.608).

GLOBAL DESCRIPTION

Concept Summary: This floodplain forest of the northeastern United States, primarily in the northern Piedmont, is a broadly defined successional or young version of medium-gradient river floodplain forest occurring on coarse alluvial substrates. The canopy is closed to somewhat open and usually dominated by *Platanus occidentalis* (American sycamore). *Populus deltoides* (eastern cottonwood), *Acer saccharinum* (silver maple), and *Ulmus americana* (American elm) are usually present but not common; occasional associates include *Acer negundo* (boxelder), *Fraxinus pennsylvanica* (green ash), *Juglans cinerea* (butternut), *Carya cordiformis* (bitternut hickory), *Celtis occidentalis* (common hackberry), *Acer saccharum* (sugar maple), and *Acer*

rubrum (red maple). Shrubs or subcanopy are variable depending on geography and can include *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Salix nigra* (black willow), *Lindera benzoin* (northern spicebush), or *Alnus serrulata* (hazel alder), plus exotic invasives such as *Rosa multiflora* (multiflora rose), *Berberis thunbergii* (Japanese barberry), and *Lonicera morrowii* (Morrow's honeysuckle). The herbaceous layer tends to be sparse to locally abundant and can include *Matteuccia struthiopteris* (ostrich fern), *Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Geum canadense* (white avens), *Impatiens pallida* (pale touch-me-not), *Boehmeria cylindrica* (small-spike false nettle), *Urtica dioica* (stinging nettle), *Solidago rugosa* (wrinkleleaf goldenrod), *Hydrophyllum virginianum* (Shawnee salad), *Carex bromoides* (bromelike sedge), *Ageratina altissima* (white snakeroot), plus vine species *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). There is typically a very high component of disturbance-tolerant exotic species such as *Lysimachia nummularia* (creeping jenny), *Glechoma hederacea* (ground ivy), *Microstegium vimineum* (Nepalese browntop), *Hesperis matronalis* (dames rocket), *Aegopodium podagraria* (bishop's goutweed), *Polygonum cuspidatum* (Japanese knotweed), and *Alliaria petiolata* (garlic mustard).

Environmental Description: Early- to-mid successional forest occurs on cobble or sand substrates of floodplain islands or cobble shores of moderate- to high-energy rivers.

Vegetation Description: The canopy is closed to somewhat open and usually dominated by *Platanus occidentalis* (American sycamore). *Populus deltoides* (eastern cottonwood), *Acer saccharinum* (silver maple), and *Ulmus americana* (American elm) are usually present but not common; occasional associates include *Acer negundo* (boxelder), *Fraxinus pennsylvanica* (green ash), *Juglans cinerea* (butternut), *Carya cordiformis* (bitternut hickory), *Celtis occidentalis* (common hackberry), *Acer saccharum* (sugar maple), and *Acer rubrum* (red maple). Shrubs or subcanopy are variable depending on geography and can include *Betula nigra* (river birch), *Carpinus caroliniana* (American hornbeam), *Salix nigra* (black willow), *Lindera benzoin* (northern spicebush), or *Alnus serrulata* (hazel alder), plus exotic invasives such as *Rosa multiflora* (multiflora rose), *Berberis thunbergii* (Japanese barberry), and *Lonicera morrowii* (Morrow's honeysuckle). The herbaceous layer tends to be sparse to locally abundant and can include *Matteuccia struthiopteris* (ostrich fern), *Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Geum canadense* (white avens), *Impatiens pallida* (pale touch-me-not), *Boehmeria cylindrica* (small-spike false nettle), *Urtica dioica* (stinging nettle), *Solidago rugosa* (wrinkleleaf goldenrod), *Hydrophyllum virginianum* (Shawnee salad), *Carex bromoides* (bromelike sedge), *Ageratina altissima* (white snakeroot), plus vine species *Toxicodendron radicans* (eastern poison-ivy) and *Parthenocissus quinquefolia* (Virginia creeper). There is typically a very high component of disturbance-tolerant exotic species such as *Lysimachia nummularia* (creeping jenny), *Glechoma hederacea* (ground ivy), *Microstegium vimineum* (Nepalese browntop), *Hesperis matronalis* (dames rocket), *Aegopodium podagraria* (bishop's goutweed), *Polygonum cuspidatum* (Japanese knotweed), and *Alliaria petiolata* (garlic mustard).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Platanus occidentalis* (American sycamore)
Short shrub/sapling	Broad-leaved deciduous shrub	*Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Boehmeria cylindrica* (small-spike false nettle)
Herb (field)	Fern or fern ally	*Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern)

Characteristic Species: *Acer saccharinum* (silver maple), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's nightshade), *Elymus virginicus* (Virginia wildrye), *Onoclea sensibilis* (sensitive fern), *Osmunda cinnamomea* (cinnamon fern), *Parthenocissus quinquefolia* (Virginia creeper), *Platanus occidentalis* (American sycamore), *Polygonum sagittatum* (arrowleaf tearthumb), *Populus deltoides* (eastern cottonwood), *Ulmus americana* (American elm).

Other Noteworthy Species:

Species	GRank	Type	Note
Aegopodium podagraria (bishop's goutweed)		plant	exotic
Alliaria petiolata (garlic mustard)		plant	exotic
Glechoma hederacea (ground ivy)		plant	exotic
Hesperis matronalis (dames rocket)		plant	exotic
Lysimachia nummularia (creeping jenny)		plant	exotic
Microstegium vimineum (Nepalese browntop)		plant	exotic
Polygonum cuspidatum (Japanese knotweed)		plant	exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association ranges from New England south to Pennsylvania.
States/Provinces: CT, DC, DE:S3S4, MA, NH, NJ, NY, PA, RI, VA?, VT.
Federal Lands: NPS (Delaware Water Gap, Rock Creek, Upper Delaware, Valley Forge).

CONSERVATION STATUS

Rank: G4? (20-Jun-2006).
Reasons: Total acreage (rangewide) is limited. Good-quality examples are uncommon. Threats include development and filling, alteration in flooding regimes, excessive beaver activity, and encroachment by aggressive nonnative plant species. Further data are needed to define the rank.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: This type is not tracked as a separate floodplain element in Vermont.
Similar Associations:

- *Acer saccharinum - (Populus deltoides) / Matteuccia struthiopteris - Laportea canadensis* Forest (CEGL006147)--is characterized by a stronger dominance of both *Acer saccharinum* and *Matteuccia struthiopteris* and has fewer early-successional species.
- *Betula nigra - Platanus occidentalis / Impatiens capensis* Forest (CEGL006184)--southern species present, plus canopy with *Betula nigra*.

Related Concepts: Information not available.

SOURCES

Description Authors: S. L. Neid, mod. S. C. Gawler.
References: Clancy 1996, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Frye and Quinn 1979, Kearsley 1999b, Metzler and Barrett 2001, Newbold 1994, Newbold et al. 1988, Nichols et al. 2001, Overlease 1978, Overlease 1987, Russell and Schuyler 1988, Sperduto 2000a, Sperduto 2000b, Swain and Kearsley 2000, Thompson and Sorenson 2000, WPC and TNC 2002, Wistendahl 1958.



Figure E25. Sycamore - Mixed Hardwood Floodplain Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.134). June 2005. NAD 1983 / UTM easting 520227, northing 4585882.

COMMON NAME (PARK-SPECIFIC): SOUTHERN NEW ENGLAND RED MAPLE SEEPAGE SWAMP

SYNONYMS

USNVC English Name: **Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest**

USNVC Scientific Name: ***Acer rubrum - Fraxinus (pennsylvanica, americana) / Lindera benzoin / Symplocarpus foetidus* Forest**

USNVC Identifier: **CEGL006406**

LOCAL INFORMATION

Environmental Description: This association can occur in a variety of palustrine settings, including small upland depressions, impounded drainages, poorly drained floodplains of small creeks, or within larger wetland complexes. It usually occurs on somewhat poorly to very poorly drained inorganic soil and is typically temporarily to permanently flooded.

Vegetation Description: This forested, mineral-soil wetland is typically characterized by an open canopy (25-95% relative cover) of red maple (*Acer rubrum*) and sweet birch (*Betula lenta*). There may be a few emergent stems of eastern white pine (*Pinus strobus*) and oaks, such as swamp white oak (*Quercus bicolor*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), and chestnut oak (*Quercus prinus*), can be common associates in both the canopy and subcanopy. American witchhazel (*Hamamelis virginiana*), highbush blueberry (*Vaccinium corymbosum*), and common winterberry (*Ilex verticillata*) are regularly occurring tall shrubs; short shrubs include maleberry (*Lyonia ligustrina*), silky dogwood (*Cornus amomum*), white meadowsweet (*Spiraea alba*), Blue Ridge blueberry (*Vaccinium pallidum*), and bristly dewberry (*Rubus hispidus*). Characteristic herbaceous species can include cinnamon fern (*Osmunda cinnamomea*), upright sedge (*Carex stricta*), and eastern marsh fern (*Thelypteris palustris*). Ground layer associates are eastern hayscented fern (*Dennstaedtia punctilobula*), smallspike false nettle (*Boehmeria cylindrica*), swamp smartweed (*Polygonum hydropiperoides*), crested woodfern (*Dryopteris cristata*), spinulose woodfern (*Dryopteris carthusiana*), northern bugleweed (*Lycopus uniflorus*), and royal fern (*Osmunda regalis*). Torrey's sphagnum (*Sphagnum torreyanum*) is the most common moss.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tree canopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Tall shrub/sapling	Needle-leaved shrub	*Pinus strobus* (eastern white pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Lyonia ligustrina* (maleberry)
Herb (field)	Graminoid	*Carex stricta* (upright sedge)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern), *Osmunda cinnamomea* (cinnamon fern)

Characteristic Species: *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carex stricta* (upright sedge), *Lyonia ligustrina* (maleberry), *Osmunda cinnamomea* (cinnamon fern).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4S5*	1	Red Maple-Hardwood Swamp	Edinger et al. 2002
PA	S3S4*	2	Red Maple - Black-Gum Palustrine Forest	Fike 1999

Local Range: This association is probably widespread throughout Upper Delaware Scenic and Recreational River.
Classification Comments: A swamp strongly dominated by red maple.
Other Comments: Information not available.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.226, UPDE.228.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Saturated cold-deciduous forest (I.B.2.N.g.)
Alliance	*Acer rubrum - Fraxinus pennsylvanica* Saturated Forest Alliance (A.3035)
Alliance (English name)	Red Maple - Green Ash Saturated Forest Alliance
Association	*Acer rubrum - Fraxinus (pennsylvanica, americana) / Lindera benzoin / Symplocarpus foetidus* Forest
Association (English name)	Red Maple - (Green Ash, White Ash) / Northern Spicebush / Skunk-cabbage Forest
Ecological System(s):	North-Central Appalachian Acidic Swamp (CES202.604). Central Appalachian Stream and Riparian (CES202.609). Northern Atlantic Coastal Plain Stream and River (CES203.070).

GLOBAL DESCRIPTION

Concept Summary: This association is a seepage swamp dominated by *Acer rubrum* (red maple) and ranging from southern New England to Virginia. It generally occurs in saturated situations on slightly sloping hillsides, along small streams, or in basins that receive overland flooding in addition to groundwater influence. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweet-pepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Alnus serrulata* (hazel alder), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison-sumac), *Viburnum dentatum* (southern arrow-wood), and *Viburnum nudum* var. *cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk-cabbage) and *Osmunda cinnamomea* (cinnamon fern) are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern),

Thelypteris palustris (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. Microtopography is generally pronounced, resulting from tip-ups. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* (calliergon moss) spp. Invasive shrubs and herbs, including *Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

Environmental Description: This association is a seepage swamp dominated by *Acer rubrum* (red maple) and ranging from southern New England to Virginia. It generally occurs in saturated soils on slightly sloping hillsides, along small headwater streams, or in depressions at the edges of floodplains that receive overland flooding in addition to groundwater inputs. In general, these swamps are moderately acidic to moderately basic and have some seepage indicators but are not particularly species-rich. Soils are shallow to moderately deep mucks over mineral soils. Microtopography is generally pronounced, resulting from tip-ups and the braided character of the drainage. Soil samples collected from 18 Maryland and Virginia plot samples are "intermediate" in chemistry, i.e., mean pH = 5.2, mean Ca = 1071 ppm, mean Mg = 195 ppm, mean total base saturation = 57%, but are more "basic" than "acidic" in their calcium and magnesium content.

Vegetation Description: *Acer rubrum* (red maple) dominates the canopy; *Fraxinus pennsylvanica* (green ash) or *Fraxinus americana* (white ash) are usually also found in the canopy. *Fraxinus nigra* (black ash) is not generally associated with this type and, if present, occurs only as scattered individuals. Other canopy or subcanopy associates may include *Liriodendron tulipifera* (tuliptree), *Quercus bicolor* (swamp white oak), *Quercus palustris* (pin oak), *Prunus serotina* (black cherry), *Fagus grandifolia* (American beech), *Betula lenta* (sweet birch), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Conifers such as *Tsuga canadensis* (eastern hemlock) or *Pinus strobus* (eastern white pine) are generally absent or occur in very low abundance. The shrub layer may be fairly open to quite dense, depending on the amount of canopy closure. Shrub species commonly include *Ilex verticillata* (common winterberry), *Rhododendron viscosum* (swamp azalea), *Clethra alnifolia* (coastal sweet-pepperbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), *Alnus serrulata* (hazel alder), *Carpinus caroliniana* (American hornbeam), and less commonly *Vaccinium corymbosum* (highbush blueberry), *Lyonia ligustrina* (maleberry), *Ilex montana* (mountain holly), *Toxicodendron vernix* (poison-sumac), *Viburnum dentatum* (southern arrow-wood), and *Viburnum nudum* var. *cassinoides* (withe-rod). The herbaceous layer is variable in cover; *Symplocarpus foetidus* (skunk-cabbage) and *Osmunda cinnamomea* (cinnamon fern) are nearly always present. In some areas, tall ferns (*Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Thelypteris noveboracensis* (New York fern)) form an herbaceous canopy within which other species are scattered. These other herbaceous species include *Impatiens capensis* (jewelweed), *Galium aparine* (stickywilly), *Geum canadense* (white avens), *Arisaema triphyllum* (Jack in the pulpit), *Carex stricta* (upright sedge), *Carex gracillima* (graceful sedge), *Carex intumescens* (greater bladder sedge), *Carex radiata* (eastern star sedge), *Carex laevivaginata* (smoothsheath sedge), *Veratrum viride* (green false hellebore), *Boehmeria cylindrica* (small-spike false nettle), *Chelone glabra* (white turtlehead), *Cardamine pensylvanica* (Pennsylvania bittercress), *Pilea pumila* (Canadian clearweed), and *Glyceria* (mannagrass) spp. At the southern

end of the range in Maryland and Virginia, *Symplocarpus foetidus* (skunk-cabbage) is usually greatly dominant (>50% cover) early in the growing season, with *Saururus cernuus* (lizard's-tail) frequently assuming patch-dominance during the summer. Tree seedlings and *Sphagnum* (sphagnum) mosses are common on hummocks but do not in general form extensive carpets. Additional nonvascular species can include *Plagiomnium cuspidatum* (toothed plagiomnium moss) and *Calliergon* (calliergon moss) spp. Invasive shrubs and herbs, including *Berberis thunbergii* (Japanese barberry), *Rosa multiflora* (multiflora rose), *Lonicera morrowii* (Morrow's honeysuckle), *Alliaria petiolata* (garlic mustard), and *Microstegium vimineum* (Nepalese browntop), may be abundant.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ilex verticillata* (common winterberry), *Lindera benzoin* (northern spicebush)
Herb (field)	Forb	*Symplocarpus foetidus* (skunk-cabbage)
Herb (field)	Fern or fern ally	*Osmunda cinnamomea* (cinnamon fern)

Characteristic Species: *Acer rubrum* (red maple), *Clethra alnifolia* (coastal sweet-pepperbush), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Lindera benzoin* (northern spicebush), *Osmunda cinnamomea* (cinnamon fern), *Rhododendron viscosum* (swamp azalea), *Symplocarpus foetidus* (skunk-cabbage).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This vegetation occurs in southern New England south through the mid-Atlantic states to Virginia.

States/Provinces: CT, DC, DE, MA, MD, NH, NJ:S3S5, NY, PA, RI, VA, VT.

Federal Lands: NPS (Appomattox Court House, C&O Canal, Delaware Water Gap, Fort Necessity, Gateway, George Washington Parkway, Minute Man, Morristown, National Capital-East?, Prince William, Rock Creek, Saratoga, Upper Delaware, Weir Farm, Wolf Trap); USFWS (Great Meadows?, Iroquois, Montezuma).

CONSERVATION STATUS

Rank: G4G5 (30-Jan-2007).

Reasons: Although this is a small-patch community, its environmental requirements are quite general, and it occurs where acidic groundwater seepage emerges on the headwaters of stream drainages. The range extent crosses several ecoregions and 10 states. The major threat to this community is housing development, with disruption of groundwater source a lesser threat.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 1 - Strong.

Comments: Classification of this type at the southern end of the range is supported by analysis of a 1250-plot regional dataset compiled for the NCR and Mid-Atlantic national parks vegetation mapping project. In that analysis, this association was represented a group of 18 Maryland and Virginia plots.

Similar Associations:

- *Acer rubrum - Betula alleghaniensis / Lindera benzoin* Forest (CEGL006936).
- *Acer rubrum - Fraxinus nigra - (Tsuga canadensis) / Tiarella cordifolia* Forest (CEGL006502).
- *Acer rubrum / Nemopanthus mucronatus - Vaccinium corymbosum* Forest (CEGL006220).
- *Acer rubrum / Rhododendron viscosum - Clethra alnifolia* Forest (CEGL006156).

Related Concepts:

- Inland Red Maple Swamp (Breden 1989) B
- Palustrine Broad-leaved Deciduous Forested Wetlands (PFO1) (Cowardin et al. 1979) ?
- Red or Silver Maple-Green Ash Swamp (Thompson 1996) ?
- Southern New England stream bottom forest (Rawinski 1984) ?

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler and G. P. Fleming.

References: Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Enser 1993, Golet et al. 1993, Harrison 2004, Metzler and Barrett 2001, NRCS 2001b, NRCS 2004, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E26. Southern New England Red Maple Seepage Swamp in Upper Delaware Scenic and Recreational River (Plot UPDE.226). September 2005. NAD 1983 / UTM easting 498142, northing 4601123.

COMMON NAME (PARK-SPECIFIC): WHITE PINE - OAK FOREST

SYNONYMS

USNVC English Name: **Eastern White Pine - (Northern Red Oak, Black Oak) - American Beech Forest**

USNVC Scientific Name: ***Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest**

USNVC Identifier: **CEGL006293**

LOCAL INFORMATION

Environmental Description: This association commonly occurs in flat to moderately sloping settings, typically with an eastern aspect. Documented examples in the Upper Delaware River valley are located at elevations ranging from 166-414 m (545-1360 feet). The higher elevation stands are located on stony, well-drained, sandy soils; those at lower elevations are found on sand or silt loam.

Vegetation Description: The canopy of this dry oak-pine forest is codominated by eastern white pine (*Pinus strobus*) and dry oak species, including white oak (*Quercus alba*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), northern red oak (*Quercus rubra*), and scarlet oak (*Quercus coccinea*), with sweet birch (*Betula lenta*), red maple (*Acer rubrum*), and pitch pine (*Pinus rigida*) present as associates. Subcanopy and tall-shrub species, which are present in variable abundance, are sassafras (*Sassafras albidum*), striped maple (*Acer pensylvanicum*), flowering dogwood (*Cornus florida*), American witchhazel (*Hamamelis virginiana*), eastern hemlock (*Tsuga canadensis*), and American chestnut (*Castanea dentata*). The potentially dense short-shrub layer (20-90% cover) can be dominated by ericaceous species, including black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*), and sheep laurel (*Kalmia angustifolia*). Important associates are mapleleaf viburnum (*Viburnum acerifolium*) and highbush blueberry (*Vaccinium corymbosum*); pink azalea (*Rhododendron periclymenoides*) is commonly present in low abundance. Japanese barberry (*Berberis thunbergii*) can be somewhat common in disturbed settings. Herbaceous cover can range from sparse to moderate and includes eastern teaberry (*Gaultheria procumbens*), eastern hayscented fern (*Dennstaedtia punctilobula*), wild sarsaparilla (*Aralia nudicaulis*), and marginal woodfern (*Dryopteris marginalis*). Less abundant associated species can be white snakeroot (*Ageratina altissima* var. *altissima*), Pennsylvania sedge (*Carex pensylvanica*), intermediate woodfern (*Dryopteris intermedia*), striped prince's pine (*Chimaphila maculata*), big bluestem (*Andropogon gerardii*), and Indiangrass (*Sorghastrum nutans*). Leucobryum moss (*Leucobryum glaucum*) is the most common species in the very sparse moss layer.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Tall shrub/sapling	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry)

Stratum	Lifeform	Species
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Gaultheria procumbens* (eastern teaberry)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Pinus strobus* (eastern white pine), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus velutina* (black oak).

Other Noteworthy Species:

Species	GRank	Type	Note
Gaylussacia baccata (black huckleberry)		plant	
Rhododendron periclymenoides (pink azalea)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Appalachian Oak-Pine Forest	Edinger et al. 2002
PA	S4*	1	Dry White Pine (Hemlock) - Oak Forest	Fike 1999

Local Range: This community can occur throughout Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.15, UPDE.23, UPDE.104, UPDE.118, UPDE.120, UPDE.142.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Pinus strobus - Quercus (alba, rubra, velutina)* Forest Alliance (A.401)
Alliance (English name)	Eastern White Pine - (White Oak, Northern Red Oak, Black Oak) Forest Alliance
Association	*Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest
Association (English name)	Eastern White Pine - (Northern Red Oak, Black Oak) - American Beech Forest
Ecological System(s):	Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563). Northeastern Interior Dry-Mesic Oak Forest (CES202.592). Central Appalachian Dry Oak-Pine Forest (CES202.591).

GLOBAL DESCRIPTION

Concept Summary: This mixed white pine - oak forest of the northeastern U.S. occurs on dry-mesic to mesic, acidic, nutrient-poor, sandy loam to sandy soils. In the northern glaciated portion of the range, the forest occurs on outwash plains or moraines, as well as along mid and lower slopes and within protected ravines, and on protected ridges or upper slopes of shale, sandstone or other sedimentary rock, occasionally underlain by metamorphic or igneous rock. Along the unglaciated plateau, this community occurs on rolling topography underlain by sandstone. It occurs at elevations below 915 m (3000 feet) throughout the range. The tree canopy is dominated by a mixture of *Pinus strobus* (eastern white pine) and oaks, including *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak) (usually in minor amounts), and primarily in the southern portions of the range, *Quercus*

coccinea (scarlet oak). Oak species drop out at the northern extreme of the type's range, leaving only *Quercus rubra* (northern red oak). *Fagus grandifolia* (American beech) is characteristic over much of the range of this type but is absent in some areas. Other less frequent canopy associates may include *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), *Pinus rigida* (pitch pine), *Populus tremuloides* (quaking aspen), *Fraxinus americana* (white ash), *Ulmus americana* (American elm), *Tsuga canadensis* (eastern hemlock), and at the northern range limit may include *Betula papyrifera* (paper birch) and *Populus grandidentata* (bigtooth aspen). The variable subcanopy may include *Hamamelis virginiana* (American witch-hazel) or *Prunus serotina* (black cherry); other species such as *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), and *Nyssa sylvatica* (blackgum) may be present in the central and southern portions of the range. It has a sparse to well-developed, generally ericaceous shrub layer. The herb layer ranges from sparse to moderately dense cover. In disturbed settings, *Rhamnus cathartica* (common buckthorn) may be an abundant shrub. The bryophyte layer is not well-documented. This association is differentiated from mixed oak-pine forests to the south by *Fagus grandifolia* (American beech) and the absence of southern-ranging species *Liriodendron tulipifera* (tuliptree), *Galax urceolata* (beetleweed), *Trillium catesbaei* (bashful wakerobin), *Halesia tetraptera* (mountain silverbell), and others. The absence of *Ilex glabra* (inkberry) and the unimportance of *Quercus alba* (white oak) differentiate this type from a closely related association of northeastern coastal areas, *Pinus strobus - Quercus alba / Ilex glabra* Forest (CEGL006382). Earlier successional versions in New England have less pine (usually) and more *Betula* (birch) spp. and *Acer rubrum* (red maple) and are separated as *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* (eastern white pine) Forest (CEGL006506).

Environmental Description: This mixed white pine - oak forest occurs on dry-mesic to mesic, acidic, nutrient-poor, sandy loam to sandy soils along mid and lower slopes, and along the unglaciated plateau on rolling topography underlain by sandstone. In the northern glaciated portion of the range, the forest occurs on outwash plains or moraines, as well as along mid and lower slopes and within protected ravines, and on protected ridges of shale, sandstone, or other sedimentary rock, occasionally underlain by metamorphic or igneous rock. Along the unglaciated plateau, this community occurs on rolling topography underlain by sandstone. It occurs at elevations below 915 m (3000 feet) throughout the range.

Vegetation Description: The tree canopy is dominated by a mixture of *Pinus strobus* (eastern white pine) and oaks, including *Quercus velutina* (black oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Quercus prinus* (chestnut oak) (usually in minor amounts), and primarily in the southern portions of the range, *Quercus coccinea* (scarlet oak). Oak species drop out at the northern extreme of the type's range, leaving only *Quercus rubra* (northern red oak). *Fagus grandifolia* (American beech) is characteristic but not always present. Other less frequent canopy associates may include *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), *Populus tremuloides* (quaking aspen), *Fraxinus americana* (white ash), *Ulmus americana* (American elm), *Tsuga canadensis* (eastern hemlock), and at the northern range limit may include *Betula papyrifera* (paper birch) and *Populus grandidentata* (bigtooth aspen). The variable subcanopy may include *Hamamelis virginiana* (American witch-hazel) or *Prunus serotina* (black cherry); other species such as *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), and *Nyssa sylvatica* (blackgum) may be present in the central and southern portions of the range. The sparse to well-developed, generally ericaceous shrub layer includes *Gaylussacia* (huckleberry) spp. (usually *Gaylussacia baccata)*,

Kalmia latifolia (mountain laurel), *Vaccinium* (blueberry) spp. (typically *Vaccinium pallidum* (Blue Ridge blueberry) and/or *Vaccinium angustifolium),* and sometimes *Kalmia angustifolia* (sheep laurel), as well as *Rubus* (blackberry) spp., *Corylus americana* (American hazelnut), *Rhododendron periclymenoides* (pink azalea), *Gaultheria procumbens* (eastern teaberry), *Sassafras albidum* (sassafras), and *Viburnum prunifolium* (blackhaw). The herb layer ranges from sparse to moderately dense cover, with species including *Aralia nudicaulis* (wild sarsaparilla), *Ageratina altissima* (white snakeroot), *Amphicarpaea bracteata* (American hogpeanut), *Brachyelytrum erectum* (bearded shorthusk), *Carex communis* (fibrousroot sedge), *Carex woodii* (pretty sedge), *Carex pensylvanica* (Pennsylvania sedge), *Carex lucorum* (Blue Ridge sedge), *Carex debilis* (white edge sedge), *Melampyrum lineare* (narrowleaf cowwheat), *Pteridium aquilinum* (western brackenfern), *Trientalis borealis* (starflower), *Gaultheria procumbens* (eastern teaberry), *Chimaphila maculata* (striped prince's pine), *Desmodium nudiflorum* (nakedflower ticktrefoil), *Galium latifolium* (purple bedstraw), *Goodyera pubescens* (downy rattlesnake plantain), *Hieracium venosum* (rattlesnakeweed), *Houstonia purpurea* (Venus' pride), *Maianthemum racemosum* (feathery false lily of the valley), *Maianthemum canadense* (Canada mayflower), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Monotropa uniflora* (Indianpipe), *Poa cuspidata* (early bluegrass), *Polygonatum biflorum* (smooth Solomon's seal), *Polystichum acrostichoides* (Christmas fern), and/or *Viola hastata* (halberdleaf yellow violet). In disturbed settings, *Rhamnus cathartica* (common buckthorn) may be an abundant shrub. The bryophyte layer is not well-documented but supports *Leucobryum glaucum* (leucobryum moss) and *Polytrichum commune* (polytrichum moss) in occurrences in the northern portion of the range (Acadia National Park).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree canopy	Broad-leaved deciduous tree	*Quercus alba* (white oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus velutina* (black oak)
Tree subcanopy	Broad-leaved deciduous tree	*Prunus serotina* (black cherry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witch-hazel)
Short shrub/sapling	Broad-leaved evergreen shrub	*Kalmia latifolia* (mountain laurel)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

Characteristic Species: *Fagus grandifolia* (American beech), *Pinus strobus* (eastern white pine), *Quercus rubra* (northern red oak).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community occurs in New England south and west to Pennsylvania and West Virginia and possibly New Jersey. Total acreage for all subsections is approximately 230,000 square km.

States/Provinces: MA, ME, NH, NJ?, NY, PA, RI, VT:S3, WV.

Federal Lands: NPS (Acadia, Delaware Water Gap, Minute Man, Saratoga, Upper Delaware); USFS (Finger Lakes); USFWS (Assabet River, Great Meadows, Oxbow).

CONSERVATION STATUS

Rank: G5 (31-Jan-2007).

Reasons: This vegetation occurs as large patches of the matrix forest type and ranges across most northeastern states. Pristine or old-growth examples are few, but in general this forest type has recovered to mid- to late-successional stages following large-scale clearing by European settlers.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: In the northern part of this type's range, it can be similar to *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088), which is distinguished by having *Tsuga canadensis* (eastern hemlock) as the principal canopy conifer. However, examples of both types may have *Pinus strobus* (eastern white pine) and *Tsuga canadensis* (eastern hemlock) present. In the southern part of this type's range, drier expressions overlap conceptually with *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539) to the south, and the overlap between those two needs clarification.

Similar Associations:

- *Pinus strobus - (Pinus resinosa) - Quercus rubra* Forest (CEGL002480).
- *Pinus strobus - Quercus alba - Quercus prinus / Vaccinium stamineum* Forest (CEGL008539).
- *Pinus strobus - Quercus alba / Ilex glabra* Forest (CEGL006382).
- *Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest (CEGL006336)--has less pine, more hickory, and little or no beech, but can intergrade to this type.
- *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest (CEGL006506).
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173).
- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088).

Related Concepts:

- Eastern White Pine: 21 (Eyre 1980) B
- Mesic Pine-Oak Forest (Thompson 1996) ?
- Pine-Oak-Heath Sandplain Forest (Thompson 1996) ?
- SNE dry central hardwood forest on acidic bedrock or till (Rawinski 1984) B
- SNE dry oak/pine forests on acidic bedrock or till (Rawinski 1984) B
- SNE mesic oak/pine forest on sandy/gravelly soil (Rawinski 1984) B
- White Pine - Northern Red Oak - Red Maple: 20 (Eyre 1980) B
- White pine-oak-beech dry forest (large patch to matrix) (CAP pers. comm. 1998) ?

SOURCES

Description Authors: L. A. Sneddon, mod. E. Largay and S. C. Gawler.

References: Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1993, Eyre 1980, Fike 1999, Gawler 2002, Kuchler 1956, Lundgren 2001, Moore and Taylor 1927, NRCS 2004, Rawinski 1984, Sperduto 2000a, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Jenkins 1992, Thompson and Sorenson 2000.



Figure E27. White Pine - Oak Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.15). August 2005. NAD 1983 / UTM easting 486783, northing 4633892.

COMMON NAME (PARK-SPECIFIC): HEMLOCK - NORTHERN HARDWOOD FOREST

SYNONYMS

USNVC English Name: **Eastern Hemlock - Yellow Birch - Sugar Maple / Intermediate Woodfern Forest**

USNVC Scientific Name: ***Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest**

USNVC Identifier: **CEGL006109**

LOCAL INFORMATION

Environmental Description: This community occurs on rocky, moist, north-facing slopes at low to mid-elevations as well as in well-drained but seepy depressions and protected coves. Slope varies from nearly level to, more typically, somewhat steep (30-40 degrees); aspect is variable but largely north-facing (northwest- to northeast-facing). Soils are well-drained, exceedingly stony, moist to somewhat moist loams and silty loams underlain by Devonian-age shale, sandstone, and siltstone.

Vegetation Description: The tree canopy of this semi-rich, mixed-canopy forest is dominated by eastern hemlock (*Tsuga canadensis*) with associated (diagnostic) enrichment indicators, including sugar maple (*Acer saccharum*) and American basswood (*Tilia americana*). Additional northern hardwoods that appear in the potentially diverse canopy and subcanopy are yellow birch (*Betula alleghaniensis*), sweet birch (*Betula lenta*), red maple (*Acer rubrum*), white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), tuliptree (*Liriodendron tulipifera*), blackgum (*Nyssa sylvatica*), and hophornbeam (*Ostrya virginiana*). White oak (*Quercus alba*), northern red oak (*Quercus rubra*), and eastern white pine (*Pinus strobus*) are present only in low abundance. American beech sprouts are important in the tall- and short-shrub layers. In addition to those found in the canopy and subcanopy, species in the tall- and short-shrub strata include American witchhazel (*Hamamelis virginiana*), great laurel (*Rhododendron maximum*), common serviceberry (*Amelanchier arborea*), American hornbeam (*Carpinus caroliniana*), striped maple (*Acer pensylvanicum*), American chestnut (*Castanea dentata*), sassafras (*Sassafras albidum*), mountain holly (*Ilex montana*), red elderberry (*Sambucus racemosa*), beaked hazelnut (*Corylus cornuta*), northern spicebush (*Lindera benzoin*), mapleleaf viburnum (*Viburnum acerifolium*), purple-flowering raspberry (*Rubus odoratus*), and lowbush blueberry (*Vaccinium angustifolium*). Wild hydrangea (*Hydrangea arborescens*), hobblebush (*Viburnum lantanoides*), and great laurel can be present sporadically. The somewhat sparse to moderately dense herbaceous layer typically contains a diverse number of species, each present in low abundance. Enrichment indicators can include northern maidenhair (*Adiantum pedatum*), Canadian wildginger (*Asarum canadense*), Robert geranium (*Geranium robertianum*), broadleaf sedge (*Carex platyphylla*), maidenhair spleenwort (*Asplenium trichomanes*), broad beechfern (*Phegopteris hexagonoptera*), long beechfern (*Phegopteris connectilis*), and white baneberry (*Actaea pachypoda*). Additional ground layer species include intermediate woodfern (*Dryopteris intermedia*), marginal woodfern (*Dryopteris marginalis*), eastern hayscented fern (*Dennstaedtia punctilobula*), New York fern (*Thelypteris noveboracensis*), common ladyfern (*Athyrium filix-femina*), Christmas fern (*Polystichum acrostichoides*), interrupted fern (*Osmunda claytoniana*), cinnamon fern (*Osmunda cinnamomea*), rock polypody (*Polypodium virginianum*), mountain woodsorrel (*Oxalis montana*), wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*),

white wood aster (*Eurybia divaricata*), Shawnee salad (*Hydrophyllum virginianum*), white snakeroot (*Ageratina altissima* var. *altissima*), mayapple (*Podophyllum peltatum*), heartleaf foamflower (*Tiarella cordifolia*), and threeleaf goldthread (*Coptis trifolia*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Fagus grandifolia* (American beech), *Hamamelis virginiana* (American witchhazel)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern)

Characteristic Species: *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species:

Species	GRank	Type	Note
Fagus grandifolia (American beech)		plant	
Ostrya virginiana (hophornbeam)		plant	
Tilia americana (American basswood)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Hemlock-Northern Hardwood Forest	Edinger et al. 2002
PA	S4*	2	Hemlock (White Pine) - Northern Hardwood Forest	Fike 1999

Local Range: This community is common throughout Upper Delaware Scenic and Recreational River.

Classification Comments: *Tsuga canadensis* (eastern hemlock) with mesic northern hardwood species and some enrichment indicators

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.3, UPDE.4, UPDE.5, UPDE.8, UPDE.9, UPDE.11, UPDE.14, UPDE.19, UPDE.37, UPDE.40, UPDE.45, UPDE.57, UPDE.59, UPDE.64, UPDE.67, UPDE.71, UPDE.80, UPDE.89, UPDE.176, UPDE.188, UPDE.189.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Tsuga canadensis - Betula alleghaniensis* Forest Alliance (A.412)
Alliance (English name)	Eastern Hemlock - Yellow Birch Forest Alliance
Association	*Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest
Association (English name)	Eastern Hemlock - Yellow Birch - Sugar Maple / Intermediate Woodfern Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593).

GLOBAL DESCRIPTION

Concept Summary: This association comprises hemlock - northern hardwood forests of the northeastern United States. This forest is associated with cool, dry-mesic to mesic sites and acidic soils, often on rocky, north-facing slopes. Soils can have a thick, poorly decomposed duff layer over sandy loams. *Tsuga canadensis* (eastern hemlock) is characteristic and usually dominant in the coniferous to mixed canopy. While hemlock generally forms at least 50% of the canopy, in some cases it may be as low as 25% relative dominance. Hardwood codominants include *Betula alleghaniensis* (yellow birch) or *Acer saccharum* (sugar maple), with *Fagus grandifolia* (American beech) common but not usually abundant in all but the very southern portion of the range of this type. *Betula lenta* (sweet birch) may replace *Betula alleghaniensis* (yellow birch) in some areas. *Ostrya virginiana* (hophornbeam) may be present as a small tree. *Quercus* (oak) spp. and *Pinus strobus* (eastern white pine) tend to be absent or, if present, only occur with low abundance. The shrub layer may be dense to fairly open and often includes *Viburnum acerifolium* (mapleleaf viburnum) and *Acer pensylvanicum* (striped maple) in addition to *Tsuga canadensis* (eastern hemlock) regeneration. Herbs may be sparse, particularly in dense shade, but include *Dryopteris intermedia* (intermediate woodfern), *Medeola virginiana* (Indian cucumber), *Oxalis montana* (mountain woodsorrel), *Mitchella repens* (partridgeberry), *Maianthemum canadense* (Canada mayflower), *Uvularia sessilifolia* (sessileleaf bellwort), *Polystichum acrostichoides* (Christmas fern), *Trientalis borealis* (starflower), *Huperzia lucidula* (shining clubmoss), *Eurybia divaricata* (white wood aster), *Oclemena acuminata* (whorled wood aster), *Dennstaedtia punctilobula* (eastern hayscented fern), and *Thelypteris noveboracensis* (New York fern). Nonvascular plants may be well-developed, often characterized by the liverwort *Bazzania trilobata*. Diagnostic characteristics of this forest are the presence of *Betula alleghaniensis* (yellow birch) and *Acer saccharum* (sugar maple) and a lack of abundant *Quercus* (oak) spp., *Pinus strobus* (eastern white pine), or *Betula lenta* (sweet birch).

Environmental Description: This forest is associated with cool, dry-mesic to mesic sites and acidic soils, often on rocky, north-facing slopes. Soils can have a thick, poorly decomposed duff layer over sandy loams. In the southern part of the range, stands often occur in deep, sheltered ravines and along high-gradient mountain streams.

Vegetation Description: *Tsuga canadensis* (eastern hemlock) is dominant and forms at least 50% of the canopy. *Betula alleghaniensis* (yellow birch) can be codominant, with *Fagus grandifolia* (American beech) and *Acer saccharum* (sugar maple) common but not usually abundant in all but the very southern portion of the range for this type. At the southern end of the range (in Virginia and Maryland), *Liriodendron tulipifera* (tuliptree) may be an important overstory associate. The shrub layer may be dense to fairly open and often includes *Viburnum acerifolium* (mapleleaf viburnum) and *Acer pensylvanicum* (striped maple) in addition to *Tsuga canadensis* (eastern hemlock) regeneration. Herbs may be sparse, particularly in dense shade, but often include *Dryopteris intermedia* (intermediate woodfern), *Medeola virginiana* (Indian cucumber), *Oxalis montana* (mountain woodsorrel), *Mitchella repens* (partridgeberry), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Huperzia lucidula* (shining clubmoss), *Eurybia divaricata* (white wood aster), and *Thelypteris noveboracensis* (New York fern). Nonvascular plants may be well-developed, often characterized by the liverwort *Bazzania trilobata*. Diagnostic characteristics of this forest are the presence of *Betula alleghaniensis* (yellow birch) and *Acer saccharum* (sugar maple) and a lack of abundant *Quercus* (oak) spp., *Pinus strobus* (eastern white pine), or *Betula lenta* (sweet birch).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Viburnum acerifolium* (mapleleaf viburnum)
Herb (field)	Forb	*Maianthemum canadense* (Canada mayflower)

Characteristic Species: *Betula alleghaniensis* (yellow birch), *Carex albicans* (whitetinge sedge), *Dryopteris intermedia* (intermediate woodfern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Medeola virginiana* (Indian cucumber), *Mitchella repens* (partridgeberry), *Oclemena acuminata* (whorled wood aster), *Thelypteris noveboracensis* (New York fern), *Tsuga canadensis* (eastern hemlock).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community is generally distributed in large patches from New Hampshire south through Pennsylvania, becoming more local in the north Atlantic Piedmont and restricted to local patches at higher elevations of the Central Appalachians in Maryland, West Virginia, and Virginia. In Virginia it is restricted to the northwestern part of the state, where occurrences are rather local but sometimes extensive.
States/Provinces: CT, MA, MD, NH, NJ:S3, NY, PA, RI, VA:S3, VT, WV?
Federal Lands: NPS (Catoctin Mountain?, Delaware Water Gap, Johnstown Flood, Marsh-Billings-Rockefeller, Saratoga, Shenandoah, Upper Delaware); USFS (Finger Lakes, George Washington, Green Mountain); USFWS (Erie, Iroquois).

CONSERVATION STATUS

Rank: G4? (31-Dec-1997).
Reasons: This association has a very large geographic distribution and occurs in large patches in the northern part of its range. All stands of this community are now highly threatened by the exotic insect pest hemlock woolly adelgid (*Adelges tsugae*), which causes decline and eventual mortality in *Tsuga canadensis* (eastern hemlock).

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: Many stands of this vegetation type in the national forests and Shenandoah National Park have been devastated during the past decade by adelgid-caused tree mortality. In some cases, 100% of the canopy hemlocks have been killed, littering the forest floor with downed wood and stimulating massive increases in understory growth, particularly of *Betula* (birch) spp. and *Acer pensylvanicum* (striped maple). Since there is no practical treatment for the adelgid on a landscape level, one can only hope that natural pathogens will emerge to keep the adelgid in check before all of our examples of this community are severely degraded or lost.
Similar Associations:

- *Betula alleghaniensis - (Tsuga canadensis) / Rhododendron maximum / (Leucothoe fontanesiana)* Forest (CEGL007861).
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173).
- *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129).
- *Tsuga canadensis - (Betula alleghaniensis, Quercus rubra) / Ilex montana / Rhododendron catawbiense* Forest (CEGL008513).
- *Tsuga canadensis - Fagus grandifolia - Quercus (prinus, alba)* Forest (CEGL006474).

- *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088).

Related Concepts:

- *Betula alleghaniensis - Tsuga canadensis / Dryopteris intermedia - Huperzia lucidula* Forest (Coulling and Rawinski 1999) F
- *Tsuga canadensis - Betula (alleghaniensis, lenta) / Dryopteris intermedia* Forest (Fleming and Coulling 2001) =
- *Tsuga canadensis - Betula lenta - Betula alleghaniensis* Association (Fleming and Moorhead 1996) F
- *Tsuga canadensis / Dryopteris intermedia / Bazzania trilobata* Association (Rawinski et al. 1994) F
- CNE dry transitional forest on sandy / gravelly soils (Rawinski 1984) ?
- CNE mesic conifer [transition] forest on acidic bedrock/till (Rawinski 1984) B
- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B
- Eastern Hemlock: 23 (Eyre 1980) B
- Hemlock - Yellow Birch: 24 (Eyre 1980) B
- Hemlock Forest (Thompson 1996) B
- Mesic Hemlock-Hardwood Forest (Breden 1989) B

SOURCES

Description Authors: S. L. Neid, mod. S. C. Gawler and G. P. Fleming.

References: Breden 1989, Breden et al. 2001, Coulling and Rawinski 1999, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1993, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Gawler 2002, Harrison 2004, Metzler and Barrett 2001, NAP pers. comm. 1998, NRCS 2004, Rawinski 1984, Rawinski et al. 1994, Smith 1983, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, VDNH 2003, Young et al. 2006.



Figure E28. Hemlock - Northern Hardwood Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.176). July 2005. NAD 1983 / UTM easting 517236, northing 4585171.

COMMON NAME (PARK-SPECIFIC): HEMLOCK - BEECH - OAK FOREST

SYNONYMS

USNVC English Name:	**Eastern Hemlock - American Beech - Northern Red Oak Forest**
USNVC Scientific Name:	***Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest**
USNVC Identifier:	**CEGL006088**

LOCAL INFORMATION

Environmental Description: This association occurs on dry, nutrient-poor, well-drained soils over acidic bedrock. Most often, it occurs on moderate-gradient midslopes with a west/northwest- to northeast-facing aspect, but slope and aspect are variable. Documented examples of this community in the Upper Delaware River basin occur at elevations ranging from 161-457 m (530-1500 feet) with an average elevation of 287 m (943 feet). Underlying bedrock is Devonian-age sandstone, siltstone, and shale; soils are most often sandy or silty loams in a stony matrix.

Vegetation Description: The canopy of this dry, mixed forest is dominated by eastern hemlock (*Tsuga canadensis*) with a strong component of American beech (*Fagus grandifolia*), sweet birch (*Betula lenta*), and dry oak species, especially chestnut oak (*Quercus prinus*), northern red oak (*Quercus rubra*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), and black oak (*Quercus velutina*). Eastern white pine (*Pinus strobus*) and red maple (*Acer rubrum*) can also be compositionally important. Sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*) can be present but are rare. When stands of this forest type are harvested, the resulting stand can be heavily dominated by American beech with oaks as associates. Eastern hemlock is no longer dominant in these settings. American beech sprouts can form dense thickets in the tall- and short-shrub layers, which are often diagnostic of this type after silvicultural activity. Great laurel (*Rhododendron maximum*) can be an important species in the tall-shrub layer and co-occurs with American witchhazel (*Hamamelis virginiana*), striped maple (*Acer pensylvanicum*), and mountain holly (*Ilex montana*). Lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*), black huckleberry (*Gaylussacia baccata*), and deerberry (*Vaccinium stamineum*) can be locally important; mapleleaf viburnum (*Viburnum acerifolium*) is a common associated low shrub. The herbaceous layer, while commonly sparse, is very species-rich, potentially containing eastern hayscented fern (*Dennstaedtia punctilobula*), intermediate woodfern (*Dryopteris intermedia*), marginal woodfern (*Dryopteris marginalis*), wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), cinnamon fern (*Osmunda cinnamomea*), New York fern (*Thelypteris noveboracensis*), Christmas fern (*Polystichum acrostichoides*), white wood aster (*Eurybia divaricata*), starflower (*Trientalis borealis*), rock polypody (*Polypodium virginianum*), partridgeberry (*Mitchella repens*), Indian cucumber (*Medeola virginiana*), wavy hairgrass (*Deschampsia flexuosa*), mountain woodsorrel (*Oxalis montana*), western brackenfern (*Pteridium aquilinum*), small enchanter's nightshade (*Circaea alpina*), whorled wood aster (*Oclemena acuminata*), northern long sedge (*Carex folliculata*), common ladyfern (*Athyrium filix-femina*), threeleaf goldthread (*Coptis trifolia*), eastern teaberry (*Gaultheria procumbens*), blackseed ricegrass (*Piptatherum racemosum*), threeseeded sedge (*Carex trisperma*), Pennsylvania sedge (*Carex pensylvanica*), graceful sedge (*Carex gracillima*), white edge sedge (*Carex debilis*), and many others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak)
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Rhododendron maximum* (great laurel)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern), *Dryopteris intermedia* (intermediate woodfern)

Characteristic Species: *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species:

Species	GRank	Type	Note
Rhododendron maximum (great laurel)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Hemlock-Northern Hardwood Forest	Edinger et al. 2002
PA	S4*		Hemlock (White Pine) - Northern Hardwood Forest	Fike 1999

Local Range: This association is very common throughout Upper Delaware Scenic and Recreational River.

Classification Comments: Characterized by *Tsuga canadensis* (eastern hemlock), *Fagus grandifolia* (American beech), and *Betula lenta* (sweet birch) with dry oak species.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.12, UPDE.13, UPDE.31, UPDE.47, UPDE.49, UPDE.53, UPDE.54, UPDE.69, UPDE.70, UPDE.71, UPDE.74, UPDE.78, UPDE.82, UPDE.86, UPDE.87, UPDE.101, UPDE.106, UPDE.109, UPDE.112, UPDE.114, UPDE.119, UPDE.138, UPDE.141, UPDE.161, UPDE.163, UPDE.164, UPDE.173, UPDE.205, UPDE.208, UPDE.214, UPDE.223, UPDE.227.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Tsuga canadensis - Betula alleghaniensis* Forest Alliance (A.412)
Alliance (English name)	Eastern Hemlock - Yellow Birch Forest Alliance
Association	*Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest
Association (English name)	Eastern Hemlock - American Beech - Northern Red Oak Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593). Laurentian-Acadian Pine-Hemlock-Hardwood Forest (CES201.563).

GLOBAL DESCRIPTION

Concept Summary: This association comprises dry-mesic hemlock-mixed hardwood forests of the northeastern United States. It occurs on dry to dry-mesic, nutrient-poor, well-drained, often stony sandy loams or loamy sands over acidic bedrock. The canopy is a mixture of *Tsuga canadensis* (eastern hemlock), with *Fagus grandifolia* (American beech) and/or *Quercus rubra* (northern red oak) in variable proportions depending on soil (site) and disturbance characteristics. The overstory can range from mostly coniferous to mostly deciduous; drier sites tend to have more abundant beech or oak, and cooler sites tend to have more abundant hemlock. Associated tree species include *Betula lenta* (sweet birch) (sometimes replaced by *Betula papyrifera* (paper birch) at the northern end of this type's range), *Pinus strobus* (eastern white pine), and *Acer rubrum* (red maple). Shrubs are often sparse but locally abundant and, in addition to saplings of canopy species, include *Hamamelis virginiana* (American witch-hazel), *Acer pensylvanicum* (striped maple), *Viburnum acerifolium* (mapleleaf viburnum), *Kalmia latifolia* (mountain laurel), and in the south *Ilex montana* (mountain holly). Though heaths may be present, they are rarely prominent. The herb layer is generally sparse but usually includes several of the following: *Mitchella repens* (partridgeberry), *Lycopodium digitatum* (fan clubmoss), *Lycopodium obscurum* (rare clubmoss), *Lycopodium annotinum* (stiff clubmoss), *Epifagus virginiana* (beechdrops), *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Medeola virginiana* (Indian cucumber), *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessileleaf bellwort), *Pteridium aquilinum* (western brackenfern), *Dryopteris intermedia* (intermediate woodfern), *Monotropa uniflora* (Indianpipe), and occasionally *Lycopodium dendroideum* (tree groundpine), *Coptis trifolia* (threeleaf goldthread), and *Dennstaedtia punctilobula* (eastern hayscented fern).

Environmental Description: This forest occurs on dry to dry-mesic, nutrient-poor, well-drained, often stony sandy loams or loamy sands. Underlying bedrock is acidic. In Virginia, it occupies extremely acidic (mean pH = 3.8), infertile silt loams on mesic to submesic valley sideslopes and broad, convex ridges at elevations from 1000-1200 m. In New England, it is a common forest type found on dry-mesic acidic soils on various landscape settings.

Vegetation Description: The canopy is a mixture of *Tsuga canadensis* (eastern hemlock) with *Fagus grandifolia* (American beech) and/or *Quercus rubra* (northern red oak) in variable proportions depending on soil (site) and disturbance characteristics; drier sites tend to have more abundant beech or oak and cooler sites tend to have more abundant hemlock. Associated tree species include *Betula lenta* (sweet birch) (sometimes replaced by *Betula papyrifera* (paper birch) at the northern end of this type's range), *Pinus strobus* (eastern white pine), and *Acer rubrum* (red maple). Shrubs are often sparse but locally abundant and, in addition to saplings of canopy species, include *Hamamelis virginiana* (American witch-hazel), *Acer pensylvanicum* (striped maple), *Viburnum acerifolium* (mapleleaf viburnum), *Kalmia latifolia* (mountain laurel), and in the south *Ilex montana* (mountain holly). Though heaths may be present, they are rarely prominent. The herb layer is generally sparse but usually includes several of the following: *Mitchella repens* (partridgeberry), *Lycopodium digitatum* (fan clubmoss), *Lycopodium obscurum* (rare clubmoss), *Lycopodium annotinum* (stiff clubmoss), *Epifagus virginiana* (beechdrops), *Gaultheria procumbens* (eastern teaberry), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Medeola virginiana* (Indian cucumber), *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessileleaf bellwort), *Dryopteris intermedia* (intermediate woodfern), *Monotropa uniflora* (Indianpipe), and occasionally *Lycopodium dendroideum* (tree

groundpine), *Coptis trifolia* (threeleaf goldthread), and *Dennstaedtia punctilobula* (eastern hayscented fern).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple), *Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple), *Hamamelis virginiana* (American witch-hazel), *Viburnum acerifolium* (mapleleaf viburnum)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Kalmia latifolia* (mountain laurel)
Herb (field)	Forb	*Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower)

Characteristic Species: *Betula lenta* (sweet birch), *Dryopteris intermedia* (intermediate woodfern), *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association is widespread in southern New England and ranges south locally in the northern Piedmont and high Allegheny Mountains to Virginia and West Virginia. In Virginia, the type is confined to the Allegheny Mountain / Laurel Fork area in northwestern Highland County.

States/Provinces: CT, MA, ME, NH, NY, PA, RI, VA:S1, VT.

Federal Lands: NPS (Marsh-Billings-Rockefeller, Saint-Gaudens, Saratoga, Upper Delaware); USFS (George Washington).

CONSERVATION STATUS

Rank: G4G5 (26-Jun-1998).

Reasons: This community type is widely distributed in the northern part of its range. Its long-term viability is threatened by pathogens associated with its two dominant canopy trees.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: At least in the southern portion of this type's range, the *Tsuga canadensis* (eastern hemlock) component of this community type appears to have been heavily reduced by past disturbances because of this species' commercial timber value and its vulnerability to fire.

Similar Associations:

- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293).
- *Quercus rubra - Acer saccharum - Fagus grandifolia / Viburnum acerifolium* Forest (CEGL006173).
- *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest (CEGL006129).
- *Tsuga canadensis - Betula alleghaniensis - Acer saccharum / Dryopteris intermedia* Forest (CEGL006109).
- *Tsuga canadensis - Fagus grandifolia - (Acer saccharum)* Great Lakes Forest (CEGL005042).
- *Tsuga canadensis - Fagus grandifolia - Quercus (prinus, alba)* Forest (CEGL006474).

Related Concepts:

- *Fagus grandifolia - Tsuga canadensis / Dryopteris intermedia* Forest (Fleming and Coulling 2001) =
- *Fagus grandifolia / Dryopteris intermedia* Association (Fleming and Moorhead 1996) =
- CNE dry transitional forest on sandy / gravelly soils (Rawinski 1984) ?

- CNE mesic conifer [transition] forest on acidic bedrock/till (Rawinski 1984) B
- CNE mesic hardwood forest on acidic bedrock/till (Rawinski 1984) B
- Central New England mesic conifer forest on acidic bedrock / till (Rawinski 1984) B
- Eastern Hemlock: 23 (Eyre 1980) B
- Hemlock Forest (Thompson 1996) B

SOURCES

Description Authors: G. Fleming and P. Coulling, mod. S. L. Neid and S. C. Gawler.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Gawler 2002, Metzler and Barrett 2001, NRCS 2004, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, VDNH 2003.



Figure E29. Hemlock - Beech - Oak Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.12). July 2005. NAD 1983 / UTM easting 486410, northing 4633526.



Figure E30. Hemlock - Beech - Oak Forest in Upper Delaware Scenic and Recreational River (Plot UPDE.13). August 2005. NAD 1983 / UTM easting 486425, northing 4633953.

COMMON NAME (PARK-SPECIFIC): PITCH PINE ROCKY SUMMIT

SYNONYMS

USNVC English Name: **Pitch Pine / (Bear Oak) / Black Chokeberry / Wavy Hairgrass Woodland**

USNVC Scientific Name: ***Pinus rigida* / (*Quercus ilicifolia*) / *Photinia melanocarpa* / *Deschampsia flexuosa* Woodland**

USNVC Identifier: **CEGL006116**

LOCAL INFORMATION

Environmental Description: This woodland association is restricted to high elevations (over 365 m [1200 feet]) on level, lichen-covered bedrock outcrops and large boulders. The soil, if present, is extremely thin, well-drained, and very stony. Exposure of the underlying bedrock, sandstone of the Long Run and Walcksville members of the Catskill Formation, drives development of the community, which occurs patchily in a matrix of dry forest dominated by oak or pine species.

Vegetation Description: The vegetation of this woodland association can be sparse or patchy with numerous rock outcrops. Trees and shrubs can cover from 10-50% of the area. The short tree canopy (rarely exceeding 8 m tall) is dominated by stunted pitch pine (*Pinus rigida*), chestnut oak (*Quercus prinus*), and eastern white pine (*Pinus strobus*). Pitch pine is the most common subcanopy and tall-shrub species as well. Low shrubs are generally quite stunted, too, and consist largely of lowbush blueberry (*Vaccinium angustifolium*), black huckleberry (*Gaylussacia baccata*), and Blue Ridge blueberry (*Vaccinium pallidum*). Herbaceous and nonvascular vegetation is dominated by wavy hairgrass (*Deschampsia flexuosa*) and greygreen reindeer lichen (*Cladina rangiferina*), with Pennsylvania sedge (*Carex pensylvanica*), little bluestem (*Schizachyrium scoparium*), juniper polytrichum moss (*Polytrichum juniperinum*), and narrowleaf cowwheat (*Melampyrum lineare*) present in lower abundance.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Pinus rigida* (pitch pine)
Tall shrub/sapling	Needle-leaved shrub	*Pinus rigida* (pitch pine)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass)

Characteristic Species: *Deschampsia flexuosa* (wavy hairgrass), *Pinus rigida* (pitch pine), *Vaccinium angustifolium* (lowbush blueberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Cladina rangiferina (greygreen reindeer lichen)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S3S4*	1	Pitch Pine-Oak-Heath Rocky Summit	Edinger et al. 2002
PA	S2S3*	2	Pitch Pine - Mixed Hardwood Woodland	Fike 1999

Local Range: This association was only seen in southern portion of Upper Delaware Scenic and Recreational River.

Classification Comments: Can be distinguished from Ridgetop Scrub Oak Barrens by dominance of stunted *Pinus rigida* (pitch pine), not *Quercus ilicifolia* (bear oak). Traprock Ridge [Hickory - Eastern Redcedar Rocky Woodland (CEGL006002)] is a woodland dominated by Pinus strobus (eastern white pine).

Other Comments: None.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.182.
Upper Delaware Scenic and Recreational River Inventory Notes: None.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Evergreen woodland (II.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
Formation	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
Alliance	*Pinus rigida* Woodland Alliance (A.524)
Alliance (English name)	Pitch Pine Woodland Alliance
Association	*Pinus rigida / (Quercus ilicifolia) / Photinia melanocarpa / Deschampsia flexuosa* Woodland
Association (English name)	Pitch Pine / (Bear Oak) / Black Chokeberry / Wavy Hairgrass Woodland
Ecological System(s):	Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: This northeastern pitch pine community occurs on dry rocky ridges and summits of low to moderate elevations. Soils are derived from acidic bedrock and are typically shallow, well- to excessively drained, coarse sands or gravels that develop in pockets of the exposed bedrock expanses. The canopy is open and trees are often stunted, usually less than 15 m in height and may be under 10 m. Tall shrubs are scattered and not abundant. The dwarf-shrub layer is moderately to well-developed (>20% cover, often more dense). Herbs are sparse. The bryoid layer is of variable cover, with lichens prominent. The ground cover is bare rock and deciduous and coniferous litter. The canopy is dominated by *Pinus rigida* (pitch pine) with a variable mixture of associates, such as *Betula populifolia* (gray birch), *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Carya glabra* (pignut hickory), *Pinus strobus* (eastern white pine), *Pinus resinosa* (red pine), *Betula lenta* (sweet birch), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry). The tall-shrub layer is comprised of scattered *Quercus ilicifolia* (bear oak), *Quercus prinoides* (dwarf chinkapin oak), or less commonly *Nemopanthus mucronatus* (catberry). The shrub layer is dominated by heaths, such as *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaylussacia baccata* (black huckleberry), as well as other shrubs, such as *Comptonia peregrina* (sweet fern) and *Photinia melanocarpa* (black chokeberry). The herbaceous layer typically includes *Pteridium aquilinum* (western brackenfern), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Carex pensylvanica* (Pennsylvania sedge) and/or *Carex lucorum* (Blue Ridge sedge), *Maianthemum canadense* (Canada mayflower), *Aralia nudicaulis* (wild sarsaparilla), *Melampyrum lineare* (narrowleaf cowwheat), *Fragaria virginiana* (Virginia strawberry), *Rumex acetosella* (common sheep sorrel), *Erechtites hieraciifolia* (American burnweed), *Corydalis sempervirens* (rock harlequin), *Trientalis borealis* (starflower), and *Cypripedium acaule* (moccasin flower). In the northern Appalachian Mountains, this community generally occurs at elevations from near sea level to 520 m (1700 feet) and may include species of northern affinity,

such as *Viburnum nudum* (possumhaw), *Kalmia angustifolia* (sheep laurel), *Betula papyrifera* (paper birch), *Picea rubens* (red spruce), and *Rhododendron canadense* (rhodora), while in the Central Appalachians, this community occurs at elevations up to 1340 m (4400 feet), with occasional associates including *Pinus pungens* (Table Mountain pine), *Pinus virginiana* (Virginia pine), and *Ilex montana* (mountain holly). Periodic fires are probably necessary for persistence of this type, except at the most extreme sites. This association is differentiated from *Pinus rigida / Corema conradii* Woodland (CEGL006154) by the absence of *Corema* (corema), and from other *Pinus rigida* (pitch pine)-dominated woodlands of rocky habitats by the absence or very low cover of the scrub oak *Quercus ilicifolia* (bear oak).

Environmental Description: This northeastern pitch pine community occurs on dry rocky ridges and summits of low to moderate elevations. Soils are derived from acidic bedrock and are typically shallow, well- to excessively drained, coarse sands or gravels that develop in pockets of the exposed bedrock expanses. In the northern Appalachian Mountains, this community generally occurs at elevations from near sea level to 520 m (1700 feet),while in the Central Appalachians, this community occurs at elevations up to 1340 (4400 feet).

Vegetation Description: The canopy is open and trees are often stunted, usually less than 15 m in height and may be under 10 m. Tall shrubs are scattered and not abundant. The dwarf-shrub layer is moderately to well-developed (>20% cover, often more dense). Herbs are sparse. The bryoid layer is of variable cover, with lichens prominent. The ground cover is bare rock and deciduous and coniferous litter. The canopy is dominated by *Pinus rigida* (pitch pine) with a variable mixture of associates, such as *Betula populifolia* (gray birch), *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Carya glabra* (pignut hickory), *Pinus strobus* (eastern white pine), *Pinus resinosa* (red pine), *Betula lenta* (sweet birch), *Acer rubrum* (red maple), and *Prunus serotina* (black cherry). The tall-shrub layer is comprised of scattered *Quercus ilicifolia* (bear oak), *Quercus prinoides* (dwarf chinkapin oak), or less commonly *Nemopanthus mucronatus* (catberry). The shrub layer is dominated by heaths, such as *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaylussacia baccata* (black huckleberry), as well as other shrubs, such as *Comptonia peregrina* (sweet fern) and *Photinia melanocarpa* (black chokeberry). The herbaceous layer typically includes *Pteridium aquilinum* (western brackenfern), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Carex pensylvanica* (Pennsylvania sedge) and/or *Carex lucorum* (Blue Ridge sedge), *Maianthemum canadense* (Canada mayflower), *Aralia nudicaulis* (wild sarsaparilla), *Melampyrum lineare* (narrowleaf cowwheat), *Fragaria virginiana* (Virginia strawberry), *Rumex acetosella* (common sheep sorrel), *Erechtites hieraciifolia* (American burnweed), *Corydalis sempervirens* (rock harlequin), *Trientalis borealis* (starflower), and *Cypripedium acaule* (moccasin flower). In the northern Appalachian Mountains, this community may include species of northern affinity, such as *Viburnum nudum* (possumhaw), *Kalmia angustifolia* (sheep laurel), *Betula papyrifera* (paper birch), *Picea rubens* (red spruce), and *Rhododendron canadense* (rhodora), while in the Central Appalachians, this community occurs with occasional associates including *Pinus pungens* (Table Mountain pine), *Pinus virginiana* (Virginia pine), and *Ilex montana* (mountain holly).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus rigida* (pitch pine)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Quercus ilicifolia* (bear oak)
Tall shrub/sapling	Needle-leaved shrub	*Pinus rigida* (pitch pine)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Amelanchier arborea* (common serviceberry)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Forb	*Corydalis sempervirens* (rock harlequin), *Erechtites hieraciifolia* (American burnweed), *Rumex acetosella* (common sheep sorrel)
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Betula lenta* (sweet birch), *Betula populifolia* (gray birch), *Gaylussacia baccata* (black huckleberry), *Pinus rigida* (pitch pine), *Quercus ilicifolia* (bear oak), *Quercus prinus* (chestnut oak), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Dendroica discolor (prairie warbler)		animal	
Rumex acetosella (common sheep sorrel)		plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs in the northeastern United States from central New England south to Maryland and possibly to Virginia.
States/Provinces: CT, MA, MD, ME, NH, NJ:S1, NY, PA, RI, VA?, VT:S1, WV.
Federal Lands: NPS (Acadia, Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.

Similar Associations:

- *Pinus (pungens, rigida) - Quercus prinus / (Quercus ilicifolia) / Gaylussacia baccata* Woodland (CEGL004996).
- *Pinus rigida / Corema conradii* Woodland (CEGL006154).

Related Concepts:

- Pitch Pine-Oak-Heath Rocky Summit (Thompson 1996) ?
- Pitch Pine: 45 (Eyre 1980) B
- Pitch pine/black chokeberry low-mid elevation ridgetop (CAP pers. comm. 1998) ?
- Ridgetop Pitch Pine-Scrub Oak Forest (Breden 1989) B
- SNE Acidic Rocky Summit/Rock Outcrop Community (Rawinski 1984) ?

SOURCES

Description Authors: S. C. Gawler.

References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fike 1999, Fleming 1985, Gawler 2002, Harrison 2004, Hunt 1999, Kuchler 1956, Lundgren 1999a, Metzler and Barrett 2001, Moore and Taylor 1927, Rawinski 1984, Sperduto 1997a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E31. Pitch Pine Rocky Summit in Upper Delaware Scenic and Recreational River (Plot UPDE.182). July 2005. NAD 1983 / UTM easting 515932, northing 4585424.

COMMON NAME (PARK-SPECIFIC): HICKORY - EASTERN REDCEDAR ROCKY WOODLAND

SYNONYMS

USNVC English Name: **Eastern Red-cedar - White Ash / Poverty Oatgrass / Canada Bluegrass Woodland**

USNVC Scientific Name: ***Juniperus virginiana - Fraxinus americana / Danthonia spicata - Poa compressa* Woodland**

USNVC Identifier: **CEGL006002**

LOCAL INFORMATION

Environmental Description: This association occurs on steep, typically southwest-facing high slopes and at the top of sandstone and shale bedrock outcrops, cliffs, and bluffs. The bedrock substrate is coarse, Devonian-age sandstone boulders and bedrock outcrops of the Sonyea Group, Lower Walton Formation, and soils are extremely stony and moderately well-drained. A documented example of this type in the Upper Delaware River drainage occurs at an elevation of 290 m (950 feet) with a slope of about 42%. Although well-drained and potentially droughty, this association may not burn often due to a low fuel load and abundance of bare rocky substrate.

Vegetation Description: The vegetation of this xeric woodland is dominated by eastern white pine (*Pinus strobus*) and pignut hickory (*Carya glabra*) with associated eastern redcedar (*Juniperus virginiana*) and chestnut oak (*Quercus prinus*). Additional species in the subcanopy are hophornbeam (*Ostrya virginiana*) and northern red oak (*Quercus rubra*); eastern hemlock (*Tsuga canadensis*) and sweet birch (*Betula lenta*) occur in the tall-shrub layer with canopy and subcanopy species. Many of the same species are found in the sparse, patchy short-shrub layer with scattered Blue Ridge blueberry (*Vaccinium pallidum*) and northern bush honeysuckle (*Diervilla lonicera*). Herbaceous cover can be moderately well-developed, if patchy, and is dominated by longbranch frostweed (*Helianthemum canadense*) with rock polypody (*Polypodium virginianum*), poverty oatgrass (*Danthonia spicata*), gray goldenrod (*Solidago nemoralis*), downy goldenrod (*Solidago puberula*), Pennsylvania sedge (*Carex pensylvanica*), flaxleaf whitetop aster (*Ionactis linariifolius*), Allegheny hawkweed (*Hieracium paniculatum*), woman's tobacco (*Antennaria plantaginifolia*), and horseflyweed (*Baptisia tinctoria*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine)
Tree subcanopy	Broad-leaved deciduous tree	*Carya glabra* (pignut hickory), *Ostrya virginiana* (hophornbeam)
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern redcedar)
Short shrub/sapling	Broad-leaved deciduous shrub	*Betula lenta* (sweet birch), *Quercus rubra* (northern red oak)
Herb (field)	Forb	*Helianthemum canadense* (longbranch frostweed)
Herb (field)	Fern or fern ally	*Polypodium virginianum* (rock polypody)

Characteristic Species: *Carya glabra* (pignut hickory), *Helianthemum canadense* (longbranch frostweed), *Ostrya virginiana* (hophornbeam), *Pinus strobus* (eastern white pine).

Other Noteworthy Species:

Species	GRank	Type	Note
Juniperus virginiana (eastern redcedar)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S3*	1	Red Cedar Rocky Summit	Edinger et al. 2002
PA	S2*	1	Red Cedar - Prickly Pear Shale Shrubland	Fike 1999

Local Range: This association is seen in the southern portion of Upper Delaware Scenic and Recreational River.

Classification Comments: Can be distinguished from Ridgetop Scrub Oak Barrens by the dominance of *Pinus strobus* (eastern white pine), not *Quercus ilicifolia* (bear oak). Pitch Pine Rocky Summit is a woodland dominated by stunted *Pinus rigida* (pitch pine).

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.108.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Evergreen woodland (II.A.)
Physiognomic Group	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
Formation	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b.)
Alliance	*Juniperus virginiana* Woodland Alliance (A.545)
Alliance (English name)	Eastern Red-cedar Woodland Alliance
Association	*Juniperus virginiana - Fraxinus americana / Danthonia spicata - Poa compressa* Woodland
Association (English name)	Eastern Red-cedar - White Ash / Poverty Oatgrass / Canada Bluegrass Woodland
Ecological System(s):	Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: This traprock ridge open woodland is known from mountainous sites in New England, New Jersey, and Pennsylvania, and may occur in southeastern New York. The vegetation occurs primarily on exposed outcrops of basaltic rock in the Connecticut Valley of New England and the Piedmont physiographic province in New Jersey. While most sites are on igneous rock, along the Kittatinny Ridge in Pennsylvania and New Jersey, it occurs on conglomerates of the Shawangunk Formation. Sites supporting this community are upper slopes of basalt, diorite, or conglomerate ridges from 365-1050 m elevation, characteristically south- or west-facing and range in slope from 5-30 degrees. Most sites have minimal soil development. Tree cover is sparse, ranging from 5-30% cover (average 20%) with *Juniperus virginiana* (eastern red-cedar) being the most constant canopy tree. Other woody species sometimes present include *Fraxinus americana* (white ash), *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Ostrya virginiana* (hophornbeam), and *Carya glabra* (pignut hickory). The actual canopy composition reflects, to some extent, the surrounding forest. The scattered shrub layer often includes *Rosa carolina* (Carolina rose), *Quercus prinus* (chestnut oak), *Quercus ilicifolia* (bear oak), *Rhus typhina* (staghorn sumac), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium angustifolium* (lowbush blueberry), *Viburnum rafinesquianum* (downy arrow-wood), and *Prunus virginiana* (chokecherry). The herbaceous layer usually covers 12-50% of the ground and is dominated by *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy

hairgrass), and *Danthonia spicata* (poverty oatgrass), with their relative abundance varying from site to site. Numerous other herbaceous species occur in this community type, including *Carex pensylvanica* (Pennsylvania sedge), *Anthoxanthum odoratum* (sweet vernalgrass), *Hypericum gentianoides* (orangegrass), *Antennaria plantaginifolia* (woman's tobacco), *Corydalis sempervirens* (rock harlequin), *Solidago nemoralis* (gray goldenrod), *Poa compressa* (Canada bluegrass), *Maianthemum racemosum* (feathery false lily of the valley), *Uvularia perfoliata* (perfoliate bellwort), *Aquilegia canadensis* (red columbine), *Asclepias verticillata* (whorled milkweed), *Polygonum scandens* (climbing false buckwheat), *Krigia virginica* (Virginia dwarfdandelion), and *Houstonia longifolia* (longleaf summer bluet). No species is restricted to this community, but the assemblage listed above is very characteristic.

Environmental Description: This sparse woodland occurs primarily on exposed outcrops of basaltic rock in the Connecticut Valley of New England and the Piedmont physiographic province in New Jersey and adjacent Pennsylvania. While most sites are on igneous rock, along the Kittatinny Ridge in Pennsylvania and New Jersey, it occurs on conglomerates of the Shawangunk Formation. Sites supporting this community are upper slopes of basalt, diorite, or conglomerate ridges from 365-1050 m elevation. The ridges are characteristically south- or west-facing and range in slope from 5-30 degrees. Most sites have minimal soil development.

Vegetation Description: This community occurs as exposed, mainly herbaceous openings on ridgetops of resistant mafic rock. Occurrences are generally less than 0.1 ha in size. Tree cover is sparse, ranging from 5-30% cover (average 20%) with *Juniperus virginiana* (eastern red-cedar) being the most constant canopy tree. Other woody species sometimes present include *Fraxinus americana* (white ash), *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Ostrya virginiana* (hophornbeam), and *Carya glabra* (pignut hickory). The actual canopy composition reflects, to some extent, the surrounding forest. The scattered shrub layer often includes *Rosa carolina* (Carolina rose), *Quercus prinus* (chestnut oak), *Quercus ilicifolia* (bear oak), *Rhus typhina* (staghorn sumac), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium angustifolium* (lowbush blueberry), *Viburnum rafinesquianum* (downy arrow-wood), and *Prunus virginiana* (chokecherry). The herbaceous layer usually covers 12-50% of the ground and is dominated by *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (wavy hairgrass), and *Danthonia spicata* (poverty oatgrass), with their relative abundance varying from site to site. Numerous other herbaceous species occur in this community type, including *Carex pensylvanica* (Pennsylvania sedge), *Anthoxanthum odoratum* (sweet vernalgrass), *Hypericum gentianoides* (orangegrass), *Antennaria plantaginifolia* (woman's tobacco), *Corydalis sempervirens* (rock harlequin), *Solidago nemoralis* (gray goldenrod), *Poa compressa* (Canada bluegrass), *Maianthemum racemosum* (feathery false lily of the valley), *Uvularia perfoliata* (perfoliate bellwort), *Aquilegia canadensis* (red columbine), *Asclepias verticillata* (whorled milkweed), *Polygonum scandens* (climbing false buckwheat), *Krigia virginica* (Virginia dwarfdandelion), and *Houstonia longifolia* (longleaf summer bluet). No species is restricted to this community, but the assemblage listed above is very characteristic.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Juniperus virginiana* (eastern red-cedar)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Helianthemum bicknellii* (hoary frostweed), *Isanthus brachiatus* (fluxweed), *Poa compressa* (Canada bluegrass), *Rosa carolina* (Carolina rose), *Solidago nemoralis* (gray goldenrod).

Other Noteworthy Species:

Species	GRank	Type	Note
Arabis missouriensis (green rockcress)		plant	
Houstonia longifolia (longleaf summer bluet)		plant	
Muhlenbergia capillaris (hairawn muhly)		plant	
Polygonum tenue (pleatleaf knotweed)		plant	
Pycnanthemum clinopodioides (basil mountainmint)	G2	plant	
Pycnanthemum torrei (Torrey's mountainmint)	G2	plant	
Scutellaria parvula var. *missouriensis* (Leonard's skullcap)		plant	
Selaginella rupestris (northern selaginella)		plant	

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community has been described from mountainous sites in New England states: Fall Mountain in New Hampshire; Bare Mountain, East Mountain, Mount Tom and Mount Norwottuck in Massachusetts; Onion Mountain, Sugarloaf, Sleeping Giant and West Mountain in Connecticut. It has also been documented at sites in the Watchung Mountains in New Jersey, Kittatinny Ridge in New Jersey and Pennsylvania, and in southeastern New York.
States/Provinces: CT, MA, ME?, NH, NJ:S1S2, NY, ON?, PA, VT.
Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS

Rank: G2G3 (16-Nov-1997).
Reasons: There are probably 30-60 occurrences of this community rangewide. At least 19 occurrences have been documented from Connecticut, Massachusetts, Pennsylvania and New Jersey, with outliers in New Hampshire and southeastern New York. This community is restricted to exposed outcrops of basaltic rock in the Connecticut River valley of New England and the Piedmont and High Allegheny Plateau physiographic province of New Jersey and adjacent Pennsylvania. Most occurrences are small; total acreage is probably less than 500 acres rangewide.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: In general, this community is similar to a number of other sparse woodland ridgetop communities. New Jersey occurrences are floristically related to ridgetop sparse woodlands in Virginia (e.g., greenstone glades) but appear to share more species with the northern occurrences with which they have been grouped here. However, further research may indicate that the New Jersey occurrences represent a unique vegetation assemblage. In Massachusetts, this community typically occurs as herbaceous (and probably successional) patches within a hickory-hop hornbeam forest. New York contains some examples of this community which they classify under the name "red cedar rocky summit community."
Similar Associations:

- *Juniperus virginiana - Ostrya virginiana / Carex eburnea* Woodland (CEGL006180).

Related Concepts:

- Eastern Redcedar: 46 (Eyre 1980) B
- Red Cedar Woodland (Thompson 1996) ?
- SNE circumneutral rocky summit/rock outcrop community (Rawinski 1984) ?

SOURCES

Description Authors: M. Anderson, mod. S. C. Gawler.

References: Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Grossman et al. 1994, Lee 1985, Livingston and Lund 1982, Metzler and Barrett 1992, Metzler and Barrett 2001, Motzkin 1993, Nichols 1914, Perles et al. 2007, Rawinski 1984, Roberts 1914, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, Walz 1996.



Figure E32. Hickory - Eastern Redcedar Rocky Woodland in Upper Delaware Scenic and Recreational River (Plot UPDE.108). July 2005. NAD 1983 / UTM easting 516359, northing 4587952.

COMMON NAME (PARK-SPECIFIC): RED OAK - HEATH WOODLAND / ROCKY SUMMIT

SYNONYMS

USNVC English Name: **Northern Red Oak - (Chestnut Oak) / Blueberry species / Wavy Hairgrass Woodland**

USNVC Scientific Name: ***Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland**

USNVC Identifier: **CEGL006134**

LOCAL INFORMATION

Environmental Description: This woodland association occurs on high-elevation, typically level, knob tops. Documented examples of the community in the Upper Delaware drainage are typically located at elevations over 305 m (1000 feet); they range from 213-341 m (700-1120 feet). Soils are well-drained and stony, and underlying bedrock is Devonian sandstone and shale. This community tends to occur in small patches in a mosaic with Lower New England Slope Chestnut Oak Forest and is likely correlated with shallower soils and/or exposed bedrock.

Vegetation Description: This woodland's tree canopy and subcanopy are dominated by deciduous species, predominantly chestnut oak (*Quercus prinus*), northern red oak (*Quercus rubra*), and scarlet oak (*Quercus coccinea*), with lesser amounts of red maple (*Acer rubrum*), eastern white pine (*Pinus strobus*), white oak (*Quercus alba*), and sweet birch (*Betula lenta*). Tall shrubs are not common or abundant but can consist of pignut hickory (*Carya glabra*), mountain laurel (*Kalmia latifolia*), and American witchhazel (*Hamamelis virginiana*). Typical low shrubs, often occurring at high abundance, include black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium angustifolium*), and Blue Ridge blueberry (*Vaccinium pallidum*), with deerberry (*Vaccinium stamineum*), mountain laurel, sweet fern (*Comptonia peregrina*), and pink azalea (*Rhododendron periclymenoides*) sometimes present in lower abundance. Pennsylvania sedge (*Carex pensylvanica*) and wavy hairgrass (*Deschampsia flexuosa*) are common, characteristic herbs. Associated species are eastern hayscented fern (*Dennstaedtia punctilobula*), Canada mayflower (*Maianthemum canadense*), western brackenfern (*Pteridium aquilinum*), poverty oatgrass (*Danthonia spicata*), eastern teaberry (*Gaultheria procumbens*), partridgeberry (*Mitchella repens*), wild sarsaparilla (*Aralia nudicaulis*), and Swan's sedge (*Carex swanii*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak)
Tree subcanopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Deschampsia flexuosa* (wavy hairgrass)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Gaylussacia baccata* (black huckleberry), *Quercus prinus* (chestnut oak), *Vaccinium angustifolium* (lowbush blueberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Carex pensylvanica (Pennsylvania sedge)		plant	
Quercus rubra (northern red oak)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Chestnut Oak Forest	Edinger et al. 2002
PA	SNR*	1	Dry Oak - Heath Woodland	Fike 1999

Local Range: This association seems to be most common in central Upper Delaware Scenic and Recreational River.

Classification Comments: A woodland association dominated by chestnut oak.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.76, UPDE.77, UPDE.83, UPDE.88, UPDE.139.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Deciduous woodland (II.B.)
Physiognomic Group	Cold-deciduous woodland (II.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
Formation	Cold-deciduous woodland (II.B.2.N.a.)
Alliance	*Quercus rubra - Quercus prinus* Woodland Alliance (A.624)
Alliance (English name)	Northern Red Oak - Chestnut Oak Woodland Alliance
Association	*Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland
Association (English name)	Northern Red Oak - (Chestnut Oak) / Blueberry species / Wavy Hairgrass Woodland
Ecological System(s):	Northern Appalachian-Acadian Rocky Heath Outcrop (CES201.571). Central and Southern Appalachian Montane Oak Forest (CES202.596). Central Appalachian Dry Oak-Pine Forest (CES202.591). Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: This dry, acidic oak woodland occurs on rocky upper slopes and summits from New England south to the highest peaks in West Virginia. Typical settings are low- to mid-elevation summits and south-facing, upper slopes. Elevations of known occurrences range from near sea level to about 610 m (0-2000 feet) in New England, and to 1370 m (4500 ft) in West Virginia. Soils are shallow, well-drained, acidic, nutrient-poor gravels and coarse sands, often with prominent exposed bedrock. Canopy cover is variable, ranging from open and patchy to closed, depending on site conditions. It overtops a dwarf-shrub layer that is frequently extensive and a sparse tall-shrub layer. Herb cover is patchy and variable. Bryoid cover is minor, scattered patches on the rocky substrate. The canopy is dominated by scattered, often stunted *Quercus rubra* (northern red oak) with minor associates depending on geography and often including *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Betula populifolia* (gray birch), *Betula papyrifera* (paper birch), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple) or *Quercus coccinea* (scarlet oak) in more coastal regions. *Quercus rubra* (northern red oak) tends to be the only oak at the northern end of the range. *Pinus strobus* (eastern white pine), *Pinus rigida* (pitch pine), or other conifers may be present, but only in minor amounts. The dwarf-shrub layer is strongly dominated by heaths, especially *Vaccinium angustifolium* (lowbush

blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaylussacia baccata* (black huckleberry) with *Gaylussacia frondosa* (blue huckleberry), *Comptonia peregrina* (sweet fern), and *Kalmia angustifolia* (sheep laurel) also common. Tall shrubs may include *Quercus ilicifolia* (bear oak), *Hamamelis virginiana* (American witch-hazel), *Amelanchier* (serviceberry) spp., and *Prunus pensylvanica* (pin cherry). The herbaceous layer is comprised of *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Carex lucorum* (Blue Ridge sedge), *Pteridium aquilinum* (western brackenfern), *Comandra umbellata* (bastard toadflax), *Melampyrum lineare* (narrowleaf cowwheat), *Polygala paucifolia* (gaywings), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (eastern teaberry), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer includes *Polytrichum commune* (polytrichum moss), *Leucobryum glaucum* (leucobryum moss), and others.

Environmental Description: This red oak woodland occurs on rocky upper slopes and summits from New England south to the highest peaks in West Virginia. Typical settings are low- to mid-elevation summits and south-facing, upper slopes. Elevations of known occurrences range from near sea level to about 610 m (0-2000 feet) in New England, and to 1370 m (4500 feet) in West Virginia. Soils are shallow, well-drained, acidic, nutrient-poor gravels and coarse sands, often with prominent exposed bedrock.

Vegetation Description: The open and patchy canopy overtops a sparse tall-shrub layer, and dwarf-shrub layer is frequently extensive. Herb cover is patchy and variable. Bryoid cover is minor, scattered patches on the rocky substrate. The canopy is dominated by scattered, often stunted *Quercus rubra* (northern red oak) with minor associates depending on geography and often including *Quercus velutina* (black oak), *Quercus prinus* (chestnut oak), *Betula populifolia* (gray birch), *Betula papyrifera* (paper birch), *Betula lenta* (sweet birch), and *Acer rubrum* (red maple) with *Quercus coccinea* (scarlet oak) in more coastal regions. *Pinus strobus* (eastern white pine), *Pinus rigida* (pitch pine), or other conifers may be present, but only in minor amounts. The dwarf-shrub layer is strongly dominated by heaths, especially *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), and *Gaylussacia baccata* (black huckleberry) with *Gaylussacia frondosa* (blue huckleberry), *Comptonia peregrina* (sweet fern), and *Kalmia angustifolia* (sheep laurel) also common. Tall shrubs may include *Quercus ilicifolia* (bear oak), *Hamamelis virginiana* (American witch-hazel), *Amelanchier* (serviceberry) spp., and *Prunus pensylvanica* (pin cherry). The herbaceous layer is comprised of *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Carex lucorum* (Blue Ridge sedge), *Pteridium aquilinum* (western brackenfern), *Comandra umbellata* (bastard toadflax), *Melampyrum lineare* (narrowleaf cowwheat), *Polygala paucifolia* (gaywings), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (eastern teaberry), and *Aralia nudicaulis* (wild sarsaparilla). The bryophyte layer includes *Polytrichum commune* (polytrichum moss), *Leucobryum glaucum* (leucobryum moss), and others.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Quercus rubra* (northern red oak)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Quercus ilicifolia* (bear oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry)

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass)
Herb (field)	Fern or fern ally	*Pteridium aquilinum* (western brackenfern)

Characteristic Species: *Deschampsia flexuosa* (wavy hairgrass), *Quercus rubra* (northern red oak), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This red oak woodland occurs on low- to mid-elevation summits and south-facing, steep upper slopes from New England south to the highest peaks in West Virginia.
States/Provinces: CT, MA, ME, NH, NJ, NY, PA, VA?, VT, WV.
Federal Lands: NPS (Acadia, Upper Delaware).

CONSERVATION STATUS
Rank: G3G5 (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.
Similar Associations:
- *Pinus strobus, Quercus rubra*) / *Danthonia spicata* Acidic Bedrock Wooded Herbaceous Vegetation (CEGL005101).
- *Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland (CEGL006320).
- *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest (CEGL006506).

Related Concepts:
- Dry Oak Woodland (Thompson 1996) B
- Northern Red Oak: 55 (Eyre 1980) B
- Red oak woodlands (NAP pers. comm. 1998) ?
- Red oak-chestnut oak acid mid-high elevation, rocky slopes (CAP pers. comm. 1998) ?
- SNE circumneutral rocky summit/rock outcrop community (Rawinski 1984) ?

SOURCES
Description Authors: S. C. Gawler, mod. S. L. Neid and E. Largay.
References: Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Fike 1999, Fleming 1985, Gawler 2002, Lundgren 1999a, Metzler and Barrett 2003, NAP pers. comm. 1998, Northern Appalachian Ecology Working Group 2000, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E33. Red Oak - Heath Woodland / Rocky Summit in Upper Delaware Scenic and Recreational River (Plot UPDE.76). September 2005. NAD 1983 / UTM easting 493571, northing 4605369.

COMMON NAME (PARK-SPECIFIC): BIRCH - WILLOW RIVERBANK SHRUBLAND

SYNONYMS

USNVC English Name: **American Sycamore - River Birch - (Carolina Willow, Black Willow) Woodland**

USNVC Scientific Name: ***Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra)* Woodland**

USNVC Identifier: **CEGL003896**

LOCAL INFORMATION

Environmental Description: This riverine shrubland typically occurs in the floodplain of the Delaware River on islands, shorelines, gravel/cobble bars, or riverbeds. Vegetation structure and composition are influenced by frequent river flooding and scour.

Vegetation Description: This community is characterized by a dense tall-shrub layer dominated by American sycamore (*Platanus occidentalis*) 2-5 m in height. While sycamore can form nearly a monoculture, river birch (*Betula nigra*) or silver maple (*Acer saccharinum*) can also be codominant in the tall-shrub layer. Individual sycamores may also be scattered in a sparse tree canopy that is 5-10 m in height. Black willow (*Salix nigra*), American sycamore, and river birch are dominant in the sparse short-shrub layer, along with silver maple and black ash (*Fraxinus nigra*). The herbaceous layer ranges from sparse to moderately dense and can contain a wide variety of typical wetland and prairie species. Common species include big bluestem (*Andropogon gerardii*), marshpepper knotweed (*Polygonum hydropiper*), reed canarygrass (*Phalaris arundinacea*), switchgrass (*Panicum virgatum*), whitegrass (*Leersia virginica*), Pennsylvania smartweed (*Polygonum pensylvanicum*), deertongue (*Dichanthelium clandestinum*), upland bentgrass (*Agrostis perennans*), swamp milkweed (*Asclepias incarnata*), smallspike false nettle (*Boehmeria cylindrica*), sensitive fern (*Onoclea sensibilis*), Canada clearweed (*Pilea pumila*), and swamp smartweed (*Polygonum hydropiperoides*). This association is highly susceptible to colonization by purple loosestrife (*Lythrum salicaria*), Japanese knotweed (*Polygonum cuspidatum*), multiflora rose (*Rosa multiflora*), purple crown-vetch (*Coronilla varia*), and other invasive plants. Vines such as riverbank grape (*Vitis riparia*) and eastern poison ivy (*Toxicodendron radicans*) are often found throughout this tall sycamore-dominated shrubland.

Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous tree	*Platanus occidentalis* (American sycamore)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem)

Characteristic Species: *Andropogon gerardii* (big bluestem), *Platanus occidentalis* (American sycamore).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Floodplain Forest	Edinger et al. 2002
PA	S4	1	River Birch - Sycamore Floodplain Scrub	Fike 1999

Local Range: This vegetation type is common on the Delaware River floodplain within the park.

Classification Comments: This association is distinguished from other riparian types by being dominated by a tall-shrub layer of *Platanus occidentalis* (American sycamore) (2-5 m in height)

with or without *Betula nigra* (river birch). The dominance of shrubs (2-5 m tall) differentiates this type from River Birch Low Floodplain Forest, which is a woodland type dominated by a tall (>5 m), sparse (>25% cover) canopy of *Betula nigra* (river birch). The Willow River-Bar Shrubland is different from this association in that its dwarf-shrubs are typically <2 m in height due to frequent flooding.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.158 (Perles et al. 2007).

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Deciduous woodland (II.B.)
Physiognomic Group	Cold-deciduous woodland (II.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
Formation	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)
Alliance	*Platanus occidentalis - (Betula nigra, Salix* spp.) Temporarily Flooded Woodland Alliance (A.633)
Alliance (English name)	American Sycamore - (River Birch, Willow species) Temporarily Flooded Woodland Alliance
Association	*Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra)* Woodland
Association (English name)	American Sycamore - River Birch - (Carolina Willow, Black Willow) Woodland
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609). South-Central Interior Small Stream and Riparian (CES202.706).

GLOBAL DESCRIPTION

Concept Summary: This early-successional shrub community of coarse-textured (cobbly / bouldery) to fine-textured (silty or muddy) depositional bars and islands occurs along rivers and large streams in the High Allegheny Plateau, Central Appalachians, and Lower New England ecoregions. It is subject to relatively frequent and powerful flooding and ice-scouring and has a highly variable physiognomy. It is dominated by stunted, usually battered and flood-trained trees (varying from less than 5 m tall to >10 m tall) of *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). *Salix caroliniana* (coastal plain willow) and *Salix nigra* (black willow) are dominant or codominant in a minority of stands. Other floodplain trees, particularly *Acer saccharinum* and *Fraxinus pennsylvanica* (green ash), may occur as minor associates. Shrub associates include *Cornus amomum* (silky dogwood), *Salix sericea* (silky willow), *Alnus serrulata* (hazel alder), and sometimes *Cephalanthus occidentalis* (common buttonbush) or *Physocarpus opulifolius* (common ninebark). The herbaceous layer ranges from sparse to moderately dense. Characteristic herbs include *Apocynum cannabinum* (Indianhemp), *Polygonum virginianum* (jumpseed), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Eupatorium serotinum* (lateflowering thoroughwort), *Asclepias incarnata* (swamp milkweed), *Pilea pumila* (Canadian clearweed), *Hypericum* (St. Johnswort) spp., *Bidens* (beggarticks) spp., *Phalaris arundinacea* (reed canarygrass), *Dichanthelium clandestinum* (deertongue), *Leersia virginica* (whitegrass), *Panicum virgatum* (switchgrass), and *Justicia americana* (American water-willow). Vines such as *Vitis riparia* (riverbank grape) and

Toxicodendron radicans (eastern poison-ivy) are often found throughout this association. Exotics such as *Lythrum salicaria* (purple loosestrife), *Microstegium vimineum* (Nepalese browntop), *Polygonum cuspidatum* (Japanese knotweed), *Coronilla varia* (purple crownvetch), and *Rosa multiflora* (multiflora rose) are frequent invaders.

Environmental Description: This is an early-successional community of coarse-textured or fine-textured depositional bars and islands subject to frequent flooding. Two environmental / floristic variants of this type have been recognized across the upper Potomac River drainage: one occurring on cobbly and bouldery depositional bars and islands along high-gradient river stretches subject to frequent, high-energy flooding and ice-scouring; the other occurring on low, frequently flooded, muddy depositional bars and shorelines in relatively low-gradient (alluvial process control) river reaches. In the high-gradient variant, soils are usually sandy, periodically droughty when exposed, and tightly packed in a matrix of cobbles or boulders. In the low-gradient variant, soils have a significant silt component and are poorly drained even after long periods of exposure. Soils collected from plots of both variants were circumneutral (pH 7.0 to 7.2), with high calcium levels and 100% total base saturation.

Vegetation Description: The physiognomy of this community is extremely variable, with recently disturbed stands often having the stature of shrublands, and older stands attaining more of a woodland form. The vegetation is dominated by stunted and often battered and flood-trained trees (varying from less than 5 m tall to >10 m tall) of *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). *Salix caroliniana* (coastal plain willow) and *Salix nigra* (black willow) are dominant or codominant in a minority of stands. Other floodplain trees, particularly *Acer saccharinum* (silver maple) and *Fraxinus pennsylvanica* (green ash), may occur as minor associates. Shrub associates include *Cornus amomum* (silky dogwood), *Salix sericea* (silky willow), *Alnus serrulata* (hazel alder), and sometimes *Cephalanthus occidentalis* (common buttonbush) or *Physocarpus opulifolius* (common ninebark). The herbaceous layer ranges from sparse to moderately dense. Characteristic herbs include *Apocynum cannabinum* (Indianhemp), *Polygonum virginianum* (jumpseed), *Polygonum* (knotweed) *hydropiper*, *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum hydropiperoides* (swamp smartweed), *Polygonum sagittatum*, *Polygonum pensylvanicum* (Pennsylvania smartweed), *Asclepias incarnata* (swamp milkweed), *Eupatorium serotinum* (lateflowering thoroughwort), *Hypericum* (St. Johnswort) spp., *Bidens* (beggarticks) spp., *Artemisia annua* (sweet sagewort), *Cyperus* (flatsedge) spp., *Boehmeria cylindrica* (small-spike false nettle), *Phyla lanceolata* (lanceleaf fogfruit), *Hibiscus laevis* (halberdleaf rosemallow), *Ipomoea lacunosa* (whitestar), *Acalypha rhomboidea* (Virginia threeseed mercury), *Phalaris arundinacea* (reed canarygrass), *Dichanthelium clandestinum* (deertongue), *Leersia virginica* (whitegrass), *Panicum virgatum* (switchgrass), *Pilea pumila* (Canadian clearweed), and *Justicia americana* (American water-willow). Vines such as *Vitis riparia* (riverbank grape) and *Toxicodendron radicans* (eastern poison-ivy) are often found throughout this association. Exotics such as *Microstegium vimineum* (Nepalese browntop), *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Lythrum salicaria* (purple loosestrife) and *Polygonum cuspidatum* (Japanese knotweed) are a frequent problem.

The two variants of this type in the Potomac drainage [see Environment] are similar in total floristic composition but may differ considerably in herbaceous density and the relative abundances of individual species. The high-gradient variant tends to have a sparse herb layer of somewhat stunted ruderal species, including *Apocynum cannabinum* (Indianhemp), *Cyperus*

strigosus (strawcolored flatsedge), *Acalypha rhomboidea* (Virginia threeseed mercury), and *Eupatorium serotinum* (lateflowering thoroughwort). The low-gradient variant has a variable herb layer that includes flood-tolerant species such as *Pilea pumila* (Canadian clearweed), *Leersia virginica* (whitegrass), *Leersia oryzoides* (rice cutgrass), *Scrophularia marilandica* (carpenter's square), annual species of *Polygonum* (knotweed) (*Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Polygonum punctatum* (dotted smartweed), *Polygonum sagittatum* (arrowleaf tearthumb)), *Mimulus alatus* (sharpwing monkeyflower), *Mimulus ringens* (Allegheny monkeyflower), *Carex lurida* (shallow sedge), *Carex frankii* (Frank's sedge), *Carex tribuloides* (blunt broom sedge), *Eupatorium perfoliatum* (common boneset), *Paspalum fluitans* (horsetail paspalum), *Verbena hastata* (swamp verbena), and *Scutellaria lateriflora* (blue skullcap). Exotics are common in both variants.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Betula nigra* (river birch), *Platanus occidentalis* (American sycamore)
Herb (field)	Vine/Liana	*Vitis riparia* (riverbank grape)
Herb (field)	Forb	*Lythrum salicaria* (purple loosestrife), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum pensylvanicum* (Pennsylvania smartweed)
Herb (field)	Graminoid	*Leersia virginica* (whitegrass), *Panicum virgatum* (switchgrass), *Phalaris arundinacea* (reed canarygrass)

Characteristic Species: *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Leersia virginica* (whitegrass), *Panicum virgatum* (switchgrass), *Phalaris arundinacea* (reed canarygrass), *Platanus occidentalis* (American sycamore), *Polygonum hydropiper* (marshpepper knotweed), *Salix nigra* (black willow).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association is found in the High Allegheny, Central Appalachian, Piedmont, and Lower New England ecoregions from West Virginia, Virginia, and Maryland north to New York. It is also attributed to the Western Allegheny Plateau. The low-gradient variant is widespread along major streams of the Piedmont Mesozoic Basins in northern Virginia and Maryland, and scattered along lower-gradient stretches of rivers and large streams in the Ridge and Valley province. It has been documented by plot data from the Potomac and Monocacy rivers and Antietam Creek in Maryland and Bull Run in Virginia. Its distribution is very likely much wider than existing data indicate.
States/Provinces: MD, NJ, NY, PA:S4, VA, WV.
Federal Lands: NPS (Antietam, C&O Canal, Delaware Water Gap, George Washington Parkway, Harpers Ferry, Manassas, Monocacy, Upper Delaware).

CONSERVATION STATUS

Rank: G4G5 (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.

Comments: Classification of this type was refined through analysis of data from 40 plots from the Potomac River across several physiographic provinces. *Salix interior* (sandbar willow), a former nominal in the type, is listed as "rare" in Maryland and Virginia (Kartesz 1999).

Similar Associations:

- *Betula nigra - Platanus occidentalis / Impatiens capensis* Forest (CEGL006184).
- *Platanus occidentalis - Acer saccharinum - Betula nigra - Fraxinus pennsylvanica / Boehmeria cylindrica - Carex emoryi* Woodland (CEGL006476)--is more restricted in its range, documented only from relatively stable, bedrock and high channel shelves along high-gradient stretches of the Potomac River in DC, MD, VA. It typically has a higher species richness, a higher percentage of perennial species and a more layered vegetation structure.
- *Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland (CEGL003725).

Related Concepts:

- *Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra) / Apocynum cannabinum* Wooded Herbaceous Vegetation (Lea 2003) =
- *Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra) / Apocynum sibiricum* Woodland (Fleming et al. 2004) =
- Black willow - mixed hardwood riverine shrubland (Perles et al. 2004) ?
- Mixed hardwood riverine shrubland (Perles et al. 2004) ?
- River birch (sycamore) - mixed hardwood riverine shrubland (Perles et al. 2004) ?
- River birch-willow thickets (CAP pers. comm. 1998) ?
- Silver maple (river birch) - mixed hardwood riverine shrubland (Perles et al. 2004) ?
- Sycamore - mixed hardwood riverine shrubland (Perles et al. 2004) ?

SOURCES

Description Authors: S. L. Neid, mod. S. C. Gawler and G. P. Fleming.

References: CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Fleming et al. 2004, Harrison 2004, Kartesz 1999, Lea 2003, Perles et al. 2004, Perles et al. 2007, TNC and WPC 2004.



Figure E34. Birch - Willow Riverbank Shrubland in Upper Delaware Scenic and Recreational River (Plot UPDE.158). September 2005. NAD 1983 / UTM easting 495415, northing 4622720.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN SUCCESSIONAL SHRUBLAND

SYNONYMS

USNVC English Name: **Autumn Olive - Gray Dogwood - Multiflora Rose - Eastern Red-cedar Shrubland**

USNVC Scientific Name: ***Elaeagnus umbellata - Cornus racemosa - Rosa multiflora - Juniperus virginiana*** **Shrubland**

USNVC Identifier: **CEGL006451**

LOCAL INFORMATION

Environmental Description: This successional shrubland typically occurs on former agricultural land or after intensive timber harvest and, at Upper Delaware Scenic and Recreational River, occurs on high, gentle slopes. Soils are variable but can be silty loams that are well-drained, stony, and somewhat moist.

Vegetation Description: This terrestrial shrubland's vegetation is extremely variable depending on land-use history, but characteristically it is dominated by Allegheny blackberry (*Rubus allegheniensis*). When the shrubland is developing after a timber harvest, a few individual trees from the prior forest community may still be standing in the thicket. A variety of additional blackberries and/or raspberries (*Rubus* spp.) could occur, as could multiflora rose (*Rosa multiflora*). Herbaceous vegetation is extremely variable but is generally composed of early-successional grasses and herbs; eastern hayscented fern (*Dennstaedtia punctilobula*) can be the only herb present.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* (sugar maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus allegheniensis* (Allegheny blackberry)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Dennstaedtia punctilobula* (eastern hayscented fern), *Rubus allegheniensis* (Allegheny blackberry).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Successional Shrubland	Edinger et al. 2002
PA	SNA		[not crosswalked]	

Local Range: This association is uncommon at Upper Delaware Scenic and Recreational River and is located on a high, gently sloping ridgeline on the Pennsylvania side, near the center of the corridor.

Classification Comments: A successional prickle thicket.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.34.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temperate cold-deciduous shrubland (III.B.2.N.a.)
Alliance	*Cornus drummondii* Shrubland Alliance (A.3558)
Alliance (English name)	Roughleaf Dogwood Shrubland Alliance
Association	*Elaeagnus umbellata - Cornus racemosa - Rosa multiflora - Juniperus virginiana* Shrubland
Association (English name)	Autumn Olive - Gray Dogwood - Multiflora Rose - Eastern Red-cedar Shrubland
Ecological System(s):	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept Summary: This association comprises shrubby old fields dominated by thickets of *Elaeagnus angustifolia* (Russian olive), *Cornus racemosa* (gray dogwood), *Viburnum prunifolium* (blackhaw), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Ligustrum vulgare* (European privet), *Euonymus alatus* (winged burning bush), *Rosa multiflora* (multiflora rose), *Rhus glabra* (smooth sumac), and *Rhus typhina* (staghorn sumac), with patches of herbaceous vegetation among the shrubs. Shorter shrubs include *Berberis thunbergii* (Japanese barberry) and *Rubus* (blackberry) spp., and in some fields *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), and/or *Vaccinium angustifolium* (lowbush blueberry). Small trees are often present but form <25% cover; they include *Juniperus virginiana* (eastern red-cedar), *Betula populifolia* (gray birch), *Prunus virginiana* (chokecherry), *Cornus florida* (flowering dogwood), *Acer rubrum* (red maple), *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), and *Fraxinus americana* (white ash). The herbaceous layer is variable depending on the density of shrub cover. Typical species are those associated with old fields, grasslands, and agricultural sites. Common species include *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago nemoralis* (gray goldenrod), *Monarda fistulosa* (wild bergamot), *Anthoxanthum odoratum* (sweet vernalgrass), *Poa pratensis* (Kentucky bluegrass), *Oxalis stricta* (common yellow oxalis), *Viola sororia* (common blue violet), *Euthamia graminifolia* (flat-top goldentop), *Festuca rubra* (red fescue), *Schizachyrium scoparium* (little bluestem), *Pycnanthemum virginianum* (Virginia mountainmint), *Alliaria petiolata* (garlic mustard), *Galium mollugo* (false baby's breath), *Potentilla simplex* (common cinquefoil), *Achillea millefolium* (common yarrow), *Daucus carota* (Queen Anne's lace), *Trifolium repens* (white clover), *Bromus inermis* (smooth brome), *Agrostis gigantea* (redtop), and *Elymus repens* (quackgrass), among many others. Vines can be absent or dominant, sometimes covering the tall and short shrubs. Common vines are *Vitis aestivalis* (summer grape), *Vitis labrusca* (fox grape), *Toxicodendron radicans* (eastern poison-ivy), *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), and *Lonicera japonica* (Japanese honeysuckle).

Environmental Description: This association occurs on former agricultural lands and old fields that are no longer intensively mowed, plowed or managed. These sites contain moderately well-drained to well-drained soils. The shrublands are flat to gently sloping, often bounded by stonewalls or fencerows.

Vegetation Description: The structure of this association varies from open fields with scattered tall and short shrubs covering 25% of the field, with herbaceous vegetation in the interstices, to dense "closed-canopy" tall shrublands with sparse ground layer vegetation. Common shrubs include *Elaeagnus angustifolia* (Russian olive), *Cornus racemosa* (gray dogwood), *Viburnum prunifolium* (blackhaw), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Ligustrum vulgare* (European privet), *Euonymus alatus* (winged burning bush), *Rosa multiflora* (multiflora rose), *Rhus glabra* (smooth sumac), and *Rhus typhina* (staghorn sumac), with patches of herbaceous vegetation among the shrubs. Shorter shrubs include *Berberis thunbergii* (Japanese barberry) and *Rubus* (blackberry) spp., and in some fields *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry), and/or *Vaccinium angustifolium* (lowbush blueberry). Small trees are often present but form <25% cover; they include *Juniperus virginiana* (eastern red-cedar), *Betula populifolia* (gray birch), *Prunus virginiana* (chokecherry), *Cornus florida* (flowering dogwood), *Acer rubrum* (red maple), *Juglans nigra* (black walnut), *Prunus serotina* (black cherry), *Robinia pseudoacacia* (black locust), and *Fraxinus americana* (white ash). The herbaceous layer is variable depending on the density of shrub cover. Typical species are those associated with old fields, grasslands, and agricultural sites. Common species include *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago nemoralis* (gray goldenrod), *Monarda fistulosa* (wild bergamot), *Anthoxanthum odoratum* (sweet vernalgrass), *Poa pratensis* (Kentucky bluegrass), *Oxalis stricta* (common yellow oxalis), *Viola sororia* (common blue violet), *Euthamia graminifolia* (flat-top goldentop), *Festuca rubra* (red fescue), *Schizachyrium scoparium* (little bluestem), *Pycnanthemum virginianum* (Virginia mountainmint), *Alliaria petiolata* (garlic mustard), *Galium mollugo* (false baby's breath), *Potentilla simplex* (common cinquefoil), *Achillea millefolium* (common yarrow), *Daucus carota* (Queen Anne's lace), *Trifolium repens* (white clover), *Bromus inermis* (smooth brome), *Agrostis gigantea* (redtop), and *Elymus repens* (quackgrass), among many others. Vines can be absent or dominant, sometimes covering the tall and short shrubs. Common vines are *Vitis aestivalis* (summer grape), *Vitis labrusca* (fox grape), *Toxicodendron radicans* (eastern poison-ivy), *Celastrus orbiculata* (Asian bittersweet), *Parthenocissus quinquefolia* (Virginia creeper), and *Lonicera japonica* (Japanese honeysuckle).

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Cornus racemosa* (gray dogwood), *Elaeagnus umbellata* (autumn olive), *Rhus glabra* (smooth sumac), *Rosa multiflora* (multiflora rose)
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Herb (field)	Vine/Liana	*Celastrus orbiculata* (Asian bittersweet), *Vitis aestivalis* (summer grape), *Vitis labrusca* (fox grape)
Herb (field)	Forb	*Monarda fistulosa* (wild bergamot), *Solidago canadensis* var. *scabra* (tall goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Graminoid	*Anthoxanthum odoratum* (sweet vernalgrass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Anthoxanthum odoratum* (sweet vernalgrass), *Celastrus orbiculata* (Asian bittersweet), *Cornus racemosa* (gray dogwood), *Elaeagnus umbellata* (autumn olive), *Juniperus virginiana* (eastern red-cedar), *Monarda fistulosa* (wild bergamot), *Rhus glabra* (smooth sumac), *Rhus typhina* (staghorn sumac), *Rosa multiflora* (multiflora rose), *Solidago*

canadensis var. *scabra* (tall goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Vitis aestivalis* (summer grape).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This community is common in former agricultural areas in the northeastern U.S.
States/Provinces: CT, DE, MA, NJ, NY, PA.
Federal Lands: NPS (Delaware Water Gap, Gateway, Saratoga, Upper Delaware, Valley Forge); USFWS (Iroquois, Montezuma, Prime Hook).

CONSERVATION STATUS
Rank: GNA (ruderal) (23-Jun-2006).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: This is a broadly defined type intended for shrubby vegetation on abandoned cropland or pasture.
Similar Associations:
- *Cornus (amomum, sericea)* - *Viburnum dentatum* - *Rosa multiflora* Shrubland (CEGL006576).

Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler.
References: Eastern Ecology Working Group n.d., Keever 1979, NRCS 2001b, NRCS 2004, Newbold et al. 1988, Overlease 1987.



Figure E35. Northeastern Successional Shrubland in Upper Delaware Scenic and Recreational River (Plot UPDE.34). September 2005. NAD 1983 / UTM easting 488059, northing 4632348.

COMMON NAME (PARK-SPECIFIC): RIDGETOP SCRUB OAK BARRENS

SYNONYMS
USNVC English Name: **Bear Oak - Sand Cherry Shrubland**
USNVC Scientific Name: ***Quercus ilicifolia - Prunus pumila* Shrubland**
USNVC Identifier: **CEGL006121**

LOCAL INFORMATION

Environmental Description: At Upper Delaware Scenic and Recreational River, this association is restricted to rocky, thin, extremely well-drained soil on high-elevation ridgetops. This association is influenced by the extremely thin soils over acidic bedrock, with fire as a secondary influence.

Vegetation Description: This association is dominated by bear oak (*Quercus ilicifolia*), with heath species such as black huckleberry (*Gaylussacia baccata*) and blueberries (*Vaccinium* spp.) as characteristic associates. Common graminoids include wavy hairgrass (*Deschampsia flexuosa*), Pennsylvania sedge (*Carex pensylvanica*), and little bluestem (*Schizachyrium scoparium*).

Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Quercus ilicifolia* (bear oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry)
Herb (field)	Graminoid	*Deschampsia flexuosa* (wavy hairgrass)

Characteristic Species: *Deschampsia flexuosa* (wavy hairgrass), *Gaylussacia baccata* (black huckleberry), *Quercus ilicifolia* (bear oak).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S3S4*	1	Pitch Pine-Oak-Heath Rocky Summit	Edinger et al. 2002
PA	S3*	1	Scrub Oak Shrubland	Fike 1999

Local Range: This association is located on a high ridgetop in the southern portion of the park.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: None.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temperate cold-deciduous shrubland (III.B.2.N.a.)
Alliance	*Quercus ilicifolia* Shrubland Alliance (A.906)
Alliance (English name)	Bear Oak Shrubland Alliance
Association	*Quercus ilicifolia - Prunus pumila* Shrubland
Association (English name)	Bear Oak - Sand Cherry Shrubland
Ecological System(s):	Central Appalachian Pine-Oak Rocky Woodland (CES202.600). Central Appalachian Dry Oak-Pine Forest (CES202.591).

GLOBAL DESCRIPTION

Concept Summary: This *Quercus ilicifolia* (bear oak) shrubland occurs on ridgetops, summits and rock outcrops in the northeastern United States. It occurs on extremely shallow, stable acidic soils over bedrock. Open bedrock is common. This shrubland is dominated by *Quercus ilicifolia* (bear oak), which occurs with variable cover depending on site conditions. Associated shrubs include *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Comptonia peregrina* (sweet fern), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), *Photinia melanocarpa* (black chokeberry), *Quercus prinoides* (dwarf chinkapin oak), and *Prunus pumila* (sandcherry). The herbaceous layer varies from sparse to well-developed depending on the density of shrub cover. Typical herbs include *Deschampsia flexuosa* (wavy hairgrass), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), *Pteridium aquilinum* (western brackenfern), *Gaultheria procumbens* (eastern teaberry), *Comandra umbellata* (bastard toadflax), *Melampyrum lineare* (narrowleaf cowwheat), *Hypericum gentianoides* (orangegrass), *Corydalis sempervirens* (rock harlequin), *Sibbaldiopsis tridentata* (shrubby fivefingers), plus *Andropogon gerardii* (big bluestem) or *Polygonatum biflorum* (smooth Solomon's seal) at some sites. Scattered and stunted trees are common and include species from the surrounding ridgetop forests, such as *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Pinus rigida* (pitch pine), *Populus tremuloides* (quaking aspen), *Betula populifolia* (gray birch), and *Carya glabra* (pignut hickory).

Environmental Description: This shrubland occurs on extremely shallow, stable acidic soils over bedrock, typically on ridges. Open bedrock is common. Fire is a secondary influence.

Vegetation Description: This shrubland is dominated by *Quercus ilicifolia* (bear oak), which occurs with variable cover depending on site conditions. Associated shrubs include *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Comptonia peregrina* (sweet fern), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), *Photinia melanocarpa* (black chokeberry), *Quercus prinoides* (dwarf chinkapin oak), and *Prunus pumila* (sandcherry). The herbaceous layer varies from sparse to well-developed depending on the density of shrub cover. Typical herbs include *Deschampsia flexuosa* (wavy hairgrass), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), *Pteridium aquilinum* (western brackenfern), *Gaultheria procumbens* (eastern teaberry), *Comandra umbellata* (bastard toadflax), *Melampyrum lineare* (narrowleaf cowwheat), *Hypericum gentianoides* (orangegrass), *Corydalis sempervirens* (rock harlequin), *Sibbaldiopsis tridentata* (shrubby fivefingers), plus *Andropogon gerardii* (big bluestem) or *Polygonatum biflorum* (smooth Solomon's seal) at some sites. Scattered and stunted trees are common and include species from the surrounding ridgetop forests, such as *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Quercus alba* (white oak), *Pinus rigida* (pitch pine), *Populus tremuloides* (quaking aspen), *Betula populifolia* (gray birch), and *Carya glabra* (pignut hickory).

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Quercus ilicifolia* (bear oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Amelanchier arborea* (common serviceberry), *Comandra umbellata* (bastard toadflax), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Melampyrum lineare* (narrowleaf cowwheat), *Prunus pumila* (sandcherry), *Pteridium aquilinum* (western brackenfern), *Quercus ilicifolia* (bear oak), *Quercus prinus* (chestnut oak), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This association is known from ridgelines from southern New England south to interior New Jersey and Pennsylvania.
States/Provinces: CT, MA, NJ, NY, PA.
Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS
Rank: GNR (10-May-2002).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: Information not available.
Similar Associations:
- *Quercus ilicifolia* - *Quercus prinoides* Shrubland (CEGL006111).

Related Concepts: Information not available.

SOURCES
Description Authors: E. Largay, mod. S. C. Gawler.
References: Eastern Ecology Working Group n.d., Fike 1999, Metzler and Barrett 2001, Swain and Kearsley 2000.

No photo available.

COMMON NAME (PARK-SPECIFIC): WILLOW RIVER-BAR SHRUBLAND

SYNONYMS

USNVC English Name: **Black Willow / Reed Canarygrass - Indian-hemp Temporarily Flooded Shrubland**

USNVC Scientific Name: ***Salix nigra / Phalaris arundinacea - Apocynum cannabinum* Temporarily Flooded Shrubland**

USNVC Identifier: **CEGL006065**

LOCAL INFORMATION

Environmental Description: Most occurrences of this association are located on low bars attached to riverbanks of the Delaware River; however, the type can occur on island heads as well. The substrate is predominantly cobbles along with sand and gravel. Due to flooding, high stream velocity and ice-scour to which these areas are frequently exposed, the majority of the shrubs remain short-statured (<2 m in height). This community occurs between the Northeastern Temperate Cobble Scour Rivershore and the tall shrubland or floodplain forest farther away from the water's edge.

Vegetation Description: This association is characterized by a moderately dense to dense short-shrub layer less than 2 m in height. The species composition of the short-shrub layer is mixed and varied, with no one species consistently dominating. Stunted individuals of black willow (*Salix nigra*) may be codominant, along with one or more other species of Missouri River willow (*Salix eriocephala*), silky willow (*Salix sericea*), or American sycamore (*Platanus occidentalis*). Other typical woody species are silver maple (*Acer saccharinum*), eastern cottonwood (*Populus deltoides*), river birch (*Betula nigra*), and red maple (*Acer rubrum*). Individual tall shrubs (2-5 m in height) of the same species may be scattered throughout the shrubland. The herbaceous layer can be sparse to dense and contains a wide diversity of herbaceous and graminoid species. Some common species are reed canarygrass (*Phalaris arundinacea*), Indianhemp (*Apocynum cannabinum*), American water-willow (*Justicia americana*), deertongue (*Dichanthelium clandestinum*), marshpepper knotweed (*Polygonum hydropiper*), big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), wingstem (*Verbesina alternifolia*), upland bentgrass (*Agrostis perennans*), and Virginia wildrye (*Elymus virginicus*). This community is also frequently colonized by purple loosestrife (*Lythrum salicaria*).

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Platanus occidentalis* (American sycamore)
Herb (field)	Forb	*Apocynum cannabinum* (Indianhemp), *Lythrum salicaria* (purple loosestrife), *Polygonum hydropiper* (marshpepper knotweed)
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

Characteristic Species: *Phalaris arundinacea* (reed canarygrass), *Platanus occidentalis* (American sycamore).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2S3*	1	Riverside Sand/Gravel Bar	Edinger et al. 2002
PA	S4*	1	Black Willow Scrub/Shrub Wetland	Fike 1999

Local Range: This vegetation type occurs throughout the Delaware River.

Classification Comments: This association is identified by the presence of a substantial short-shrub layer of *Salix* (willow) spp. and/or *Platanus occidentalis* (American sycamore). The height of the shrubs (<2 m in height) differentiates this type from Birch - Willow Riverbank Shrubland in which shrubs are 2-5 m in height. The shrubs in Willow River-Bar Shrubland remain stunted because they typically receive more frequent or more intense scour than the tall-shrub community.
Other Comments: Information not available.
Local Description Authors: S. J. Perles (PNHP).
Plots: UPDE.AA.464 (Fike 1999, Perles et al. 2004, Perles et al. 2007).
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d.)
Alliance	*Salix nigra* Temporarily Flooded Shrubland Alliance (A.948)
Alliance (English name)	Black Willow Temporarily Flooded Shrubland Alliance
Association	*Salix nigra / Phalaris arundinacea - Apocynum cannabinum* Temporarily Flooded Shrubland
Association (English name)	Black Willow / Reed Canarygrass - Indian-hemp Temporarily Flooded Shrubland
Ecological System(s):	Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582). Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: This community is a willow shrubland of low riverbanks along moderate- to high-energy rivers in the northeastern U.S. and High Allegheny Plateau. It occurs on cobble substrates with sand and gravel in areas that are flooded only during high-water events, but receive winter ice-scour. It occupies an intermediate position along a disturbance gradient between open, herbaceous cobble shores and higher floodplain forests. *Salix nigra* (black willow) is often dominant or codominant with other willows or dogwoods forming a dense shrub layer. Less frequent shrubs and tree saplings include *Salix eriocephala* (Missouri River willow), *Salix lucida* (shining willow), *Salix sericea* (silky willow), *Alnus incana* (gray alder), *Alnus serrulata* (hazel alder), *Cornus amomum* (silky dogwood), *Cornus sericea* (red-osier dogwood), *Spiraea alba* var. *latifolia* (white meadowsweet), *Platanus occidentalis* (American sycamore), *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), and *Populus deltoides* (eastern cottonwood). The herbaceous layer is typically sparse with variable composition, including *Carex torta* (twisted sedge), *Panicum dichotomiflorum* (fall panicgrass), *Panicum virgatum* (switchgrass), *Dichanthelium clandestinum* (deertongue), *Echinochloa crus-galli* (barnyardgrass), *Elymus virginicus* (Virginia wildrye), *Phalaris arundinacea* (reed canarygrass), *Calamagrostis canadensis* (bluejoint), *Apocynum cannabinum* (Indianhemp), *Agrostis* (bentgrass) spp., *Solidago gigantea* (giant goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Eupatorium maculatum* (spotted joepyeweed), *Rorippa islandica*, *Lysimachia terrestris* (earth loosestrife), *Polygonum* (knotweed) spp., and *Bidens* (beggarticks) spp. Invasive, exotic species can be problematic in this community, including *Polygonum cuspidatum* (Japanese knotweed),

Lythrum salicaria (purple loosestrife), *Tussilago farfara* (coltsfoot), and *Cynanchum louiseae* (Louis' swallow-wort).

Environmental Description: This community occurs on low riverbanks along moderate- to high-energy rivers on cobble substrates within a sand or gravel matrix.

Vegetation Description: *Salix nigra* (black willow) is often dominant or codominant with other willows or dogwoods forming a dense shrub layer. Less frequent shrubs and tree saplings include *Salix eriocephala* (Missouri River willow), *Salix lucida* (shining willow), *Salix sericea* (silky willow), *Alnus incana* (gray alder), *Alnus serrulata* (hazel alder), *Cornus amomum* (silky dogwood), *Cornus sericea* (red-osier dogwood), *Spiraea alba* var. *latifolia* (white meadowsweet), *Platanus occidentalis* (American sycamore), *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), and *Populus deltoides* (eastern cottonwood). The herbaceous layer is typically sparse with variable composition, including *Carex torta* (twisted sedge), *Panicum dichotomiflorum* (fall panicgrass), *Panicum virgatum* (switchgrass), *Dichanthelium clandestinum* (deertongue), *Echinochloa crus-galli* (barnyardgrass), *Elymus virginicus* (Virginia wildrye), *Phalaris arundinacea* (reed canarygrass), *Calamagrostis canadensis* (bluejoint), *Apocynum cannabinum* (Indianhemp), *Agrostis* (bentgrass) spp., *Solidago gigantea* (giant goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Eupatorium maculatum* (spotted joepyeweed), *Rorippa islandica*, *Lysimachia terrestris* (earth loosestrife), *Polygonum* (knotweed) spp., and *Bidens* (beggarticks) spp. Invasive, exotic species can be problematic in this community, including *Polygonum cuspidatum* (Japanese knotweed), *Lythrum salicaria* (purple loosestrife), *Tussilago farfara* (coltsfoot), and *Cynanchum louiseae* (Louis' swallow-wort).

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Salix nigra* (black willow)
Herb (field)	Forb	*Apocynum cannabinum* (Indianhemp), *Polygonum hydropiper* (marshpepper knotweed)
Herb (field)	Graminoid	*Phalaris arundinacea* (reed canarygrass)

Characteristic Species: *Cornus amomum* (silky dogwood), *Dichanthelium clandestinum* (deertongue), *Phalaris arundinacea* (reed canarygrass), *Platanus occidentalis* (American sycamore).

Other Noteworthy Species:

Species	GRank	Type	Note
Cynanchum louiseae (Louis' swallow-wort)		plant	invasive exotic
Echinochloa crus-galli (barnyardgrass)		plant	exotic
Lythrum salicaria (purple loosestrife)		plant	invasive exotic
Polygonum cuspidatum (Japanese knotweed)		plant	invasive exotic
Tussilago farfara (coltsfoot)		plant	invasive exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association occurs in the eastern United States from New Hampshire and Vermont south to Pennsylvania and New Jersey.

States/Provinces: CT, DE, MA, MD?, ME, NH:S3, NJ, NY, PA, VT.

Federal Lands: NPS (Delaware Water Gap, Upper Delaware); USFWS (Great Meadows).

CONSERVATION STATUS

Rank: G4? (20-Jun-2006).

Reasons: This community is not well-documented but occurs over a large range and is a frequent component of floodplain systems.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

- *Salix caroliniana* Temporarily Flooded Shrubland (CEGL003899).
- *Salix interior - Salix eriocephala* Sandbar Shrubland (CEGL005078).

Related Concepts: Information not available.

SOURCES

Description Authors: S. L. Neid, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Fike 1999, Gawler 2002, Metzler and Barrett 2001, Nichols et al. 2001, Perles et al. 2004, Perles et al. 2007, TNC and WPC 2004.



Figure E36. Willow River - Bar Shrubland in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.464). September 2006. NAD 1983 / UTM easting 521761, northing 4584552.

COMMON NAME (PARK-SPECIFIC): SPECKLED ALDER SWAMP

SYNONYMS
USNVC English Name: **Speckled Alder Swamp Shrubland**
USNVC Scientific Name: ***Alnus incana* Swamp Shrubland**
USNVC Identifier: **CEGL002381**

LOCAL INFORMATION

Environmental Description: This palustrine community is associated with the presence of standing water, saturated soil, or groundwater seepage for at least a portion of the growing season. There is either early-season standing water or a hydrological connection with the floodplains of creeks and drainages.

Vegetation Description: This association is typically dominated by speckled alder (*Alnus incana* ssp. *rugosa*) with varied associated shrub species, including redosier dogwood (*Cornus sericea*), spiraea (*Spiraea* spp.), and viburnum (*Viburnum* spp.).

Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* ssp. *rugosa* (speckled alder)

Characteristic Species: *Alnus incana* ssp. *rugosa* (speckled alder).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Shrub Swamp	Edinger et al. 2002
PA	S3S4*	2	Alder - Ninebark Wetland	Fike 1999

Local Range: This association is most common in the southern portion of Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: None.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Seasonally flooded cold-deciduous shrubland (III.B.2.N.e.)
Alliance	*Alnus incana* Seasonally Flooded Shrubland Alliance (A.986)
Alliance (English name)	Speckled Alder Seasonally Flooded Shrubland Alliance
Association	*Alnus incana* Swamp Shrubland
Association (English name)	Speckled Alder Swamp Shrubland
Ecological System(s):	Laurentian-Acadian Floodplain Forest (CES201.587). Western Great Plains Open Freshwater Depression Wetland (CES303.675). Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582). High Allegheny Wetland (CES202.069).

GLOBAL DESCRIPTION

Concept 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* (hairy sedge), *Carex prairea* (prairie sedge), *Carex trisperma* (threeseeded 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* (arborvitae).

Environmental Description: 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: 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* (hairy sedge), *Carex prairea* (prairie sedge), *Carex trisperma* (threeseeded 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* (arborvitae) (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:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Alnus incana* (gray alder)

Characteristic Species: *Alnus incana* (gray alder).

Other Noteworthy Species:

Species	GRank	Type	Note
Ilex collina (longstalk holly)	G3	plant	vulnerable

USFWS Wetland System: Palustrine.

DISTRIBUTION

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.

States/Provinces: IA:S3?, IL, IN?, MA, MB?, ME, MI:S5, MN:S5, ND:S2?, NH:S3S4, NJ?:S2S4, NY, OH, ON, PA, VT, WI:S4, WV:S3.

Federal Lands: NPS (Acadia, Apostle Islands, 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).

CONSERVATION STATUS

Rank: G5 (23-Jun-2006).

Reasons: This association is widely distributed and considered secure in many states.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

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* (arborvitae) saturated forest types, and *Fraxinus nigra - Acer rubrum* saturated forest types.

Similar Associations:

- *lnus incana - Cornus (amomum, sericea) / Clematis virginiana* Shrubland (CEGL006062).
- *Alnus incana* ssp. *rugosa - Nemopanthus mucronatus / Sphagnum* spp. Shrubland (CEGL006158).
- *Alnus serrulata* Swamp Shrubland (CEGL005082).

Related Concepts:

- *Alnus incana - Sambucus canadensis* shrub community (Darlington 1943) F
- *Alnus incana - Viburnum cassinoides* shrub community (Darlington 1943) F
- *Alnus incana* ssp. *rugosa* tall shrub thicket (Fortney et al. 2005) =
- *Alnus incana* ssp. *rugosa* shrubland (Byers et al. 2007) =
- *Alnus rugosa* shrub (Walbridge and Lang 1982) =
- *Alnus rugosa* tall shrub community (Walbridge 1982) =
- *Alnus rugosa* tall shrub community (Robinette 1966) =
- *Alnus rugosa* thicket community (Fortney 1975) =
- Alder Shrub Swamp (Anderson and Barren 1991) =
- Alder Thicket (Curtis 1959) =
- Thicket Swamp: Speckled Alder / Bluejoint Grass type , W35 (Harris et al. 1996) =

SOURCES

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

References: Anderson 1982, Anderson and Barren 1991, Breden et al. 2001, Byers et al. 2007, Chapman et al. 1989, Curtis 1959, Darlington 1943, DeMeo et al. 1998, Fortney 1975, Fortney et al. 2005, Gawler 2002, Greenall 1996, Harris et al. 1996, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., NDNHI n.d., NRCS 2004, Ohmann and Ream 1971, Rentch unpubl. data 2003, Robinette 1966, Sperduto 2000b, Swain and Kearsley 2001, Thompson and Sorenson 2000, WNHIP unpubl. data, Walbridge 1982, Walbridge and Lang 1982.

No photo available.

COMMON NAME (PARK-SPECIFIC): STEEPLEBUSH / REED CANARYGRASS SUCCESSIONAL WET MEADOW

SYNONYMS

USNVC English Name: **Steeplebush - Blackberry species / Reed Canarygrass Shrubland**

USNVC Scientific Name: ***Spiraea tomentosa* - *Rubus* spp. / *Phalaris arundinacea* Shrubland**

USNVC Identifier: **CEGL006571**

LOCAL INFORMATION

Environmental Description: This variable wetland type is associated with abandoned pastures or old agricultural fields in low-lying or seepy areas and, as such, they are often located in flat to extremely gently sloping settings. The substrate is typically mineral soil, often with a layer of muck at the surface. Soils can be stone-free or stony silt loam, clay loam, or sandy clay loam and are moderately well-drained to poorly drained. These wetlands typically flood early in the growing season and may be saturated at or near the surface at that time, but they are generally dry for much of the remainder of the year.

Vegetation Description: The vegetation of this successional wetland type is characterized by wet meadow species. There can be a sparse tree canopy/subcanopy layer with red maple (*Acer rubrum*), eastern white pine (*Pinus strobus*), black cherry (*Prunus serotina*), and common serviceberry (*Amelanchier arborea*). Low-shrub dominants are extremely variable and can include white meadowsweet (*Spiraea alba*), Allegheny blackberry (*Rubus allegheniensis*), northern dewberry (*Rubus flagellaris*), American red raspberry (*Rubus idaeus*), bristly dewberry (*Rubus hispidus*), maleberry (*Lyonia ligustrina*), and deerberry (*Vaccinium stamineum*). The herbaceous ground flora stratum is dense (90% cover) with similarly variable dominance. Generally, wrinkleleaf goldenrod (*Solidago rugosa*), eastern hayscented fern (*Dennstaedtia punctilobula*), giant goldenrod (*Solidago gigantea*), Canada goldenrod (*Solidago canadensis*), flat-top goldentop (*Euthamia graminifolia*), and parasol whitetop (*Doellingeria umbellata*) are most abundant. Broom sedge (*Carex scoparia*), soft fox sedge (*Carex conjuncta*), fringed sedge (*Carex crinita*), common rush (*Juncus effusus*), common velvetgrass (*Holcus lanatus*), little bluestem (*Schizachyrium scoparium*), arrowleaf tearthumb (*Polygonum sagittatum*), sensitive fern (*Onoclea sensibilis*), common milkweed (*Asclepias syriaca*), and bluejoint (*Calamagrostis canadensis*) are potential associates.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* (red maple)
Short shrub/sapling	Broad-leaved deciduous shrub	*Spiraea alba* (white meadowsweet)
Herb (field)	Forb	*Solidago gigantea* (giant goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Euthamia graminifolia* (flat-top goldentop), *Solidago canadensis* (Canada goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod).

Other Noteworthy Species:

Species	GRank	Type	Note
Dennstaedtia punctilobula (eastern hayscented fern)		plant	
Spiraea alba (white meadowsweet)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Shallow Emergent Marsh	Edinger et al. 2002
PA	S5*	2	Wet Meadow	Fike 1999

Local Range: This association could occur throughout Upper Delaware Scenic and Recreational River.

Classification Comments: This association occurs in wet and seepy old fields that can range, physiognomically, from herbaceous to shrubland.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.30, UPDE.38, UPDE.41, UPDE.51, UPDE.221.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Seasonally flooded cold-deciduous shrubland (III.B.2.N.e.)
Alliance	*Spiraea (alba, tomentosa)* - *Rubus* spp. Seasonally Flooded Shrubland Alliance (A.3022)
Alliance (English name)	(White Meadowsweet, Steeplebush) - Blackberry species Seasonally Flooded Shrubland Alliance
Association	*Spiraea tomentosa* - *Rubus* spp. / *Phalaris arundinacea* Shrubland
Association (English name)	Steeplebush - Blackberry species / Reed Canarygrass Shrubland
Ecological System(s):	High Allegheny Wetland (CES202.069).

GLOBAL DESCRIPTION

Concept Summary: This wet meadow vegetation of the northeastern states occurs in a variety of settings, most frequently in low-lying areas of old fields or pastures, headwater basins, or beaver-impacted wetlands. The physiognomy is complex and variable, ranging from shrub thicket to herbaceous meadow with scattered shrubs. Shrub species usually include *Spiraea tomentosa* (steeplebush), *Spiraea alba* var. *alba* (white meadowsweet), *Cornus amomum* (silky dogwood), *Rubus allegheniensis* (Allegheny blackberry), *Rubus hispidus* (bristly dewberry), *Salix* (willow) spp., and others. *Hypericum densiflorum* (bushy St. Johnswort) often occurs in the Central Appalachians. The invasive exotic shrubs *Lonicera morrowii* (Morrow's honeysuckle) and *Rosa multiflora* (multiflora rose) may be locally abundant. Associated herbaceous species are also variable in composition, depending on land-use history. Commonly seen are *Phalaris arundinacea* (reed canarygrass), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago canadensis* (Canada goldenrod), *Juncus effusus* (common rush), *Scirpus cyperinus* (woolgrass), *Scirpus expansus* (woodland bulrush), *Leersia oryzoides* (rice cutgrass), *Calamagrostis canadensis* (bluejoint), *Carex scoparia* (broom sedge), *Carex folliculata* (northern long sedge), *Carex lurida* (shallow sedge), *Carex lupulina* (hop sedge), *Carex vulpinoidea* (fox sedge), *Carex trichocarpa* (hairyfruit sedge), *Vernonia noveboracensis*

(New York ironweed), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Lycopus uniflorus* (northern bugleweed), *Impatiens capensis* (jewelweed), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), *Eleocharis* (spikerush) spp., and others. The invasive species *Microstegium vimineum* (Nepalese browntop), *Lythrum salicaria* (purple loosestrife), and *Phragmites australis* (common reed) can be abundant or form monocultures in these wetlands.

Environmental Description: This wet meadow vegetation of the northeastern states occurs in a variety of settings, most frequently in low-lying areas of old fields or pastures, headwater basins, or beaver-impacted wetlands. These wetlands typically flood early in the growing season and may be saturated to near the surface for some of the growing season, but they are generally dry for much of the year. The substrate is typically mineral soil with a layer of muck at the surface.

Vegetation Description: The physiognomy is complex and variable, ranging from shrub thicket to herbaceous meadow with scattered shrubs. Within each wetland, species may be locally abundant and often have patchy distribution. Shrub species usually include *Spiraea tomentosa* (steeplebush), *Spiraea alba* var. *alba* (white meadowsweet), *Cornus amomum* (silky dogwood), *Rubus allegheniensis* (Allegheny blackberry), *Rubus hispidus* (bristly dewberry), *Salix* (willow) spp., and others. *Hypericum densiflorum* (bushy St. Johnswort) often occurs in the Central Appalachians. The invasive exotic shrubs *Lonicera morrowii* (Morrow's honeysuckle) and *Rosa multiflora* (multiflora rose) may be locally abundant. Associated herbaceous species are also variable in composition, depending on land-use history. Commonly seen are *Phalaris arundinacea* (reed canarygrass), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago gigantea* (giant goldenrod), *Solidago canadensis* (Canada goldenrod), *Juncus effusus* (common rush), *Scirpus cyperinus* (woolgrass), *Scirpus expansus* (woodland bulrush), *Leersia oryzoides* (rice cutgrass), *Calamagrostis canadensis* (bluejoint), *Carex scoparia* (broom sedge), *Carex folliculata* (northern long sedge), *Carex lurida* (shallow sedge), *Carex lupulina* (hop sedge), *Carex vulpinoidea* (fox sedge), *Carex trichocarpa* (hairyfruit sedge), *Vernonia noveboracensis* (New York ironweed), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Lycopus uniflorus* (northern bugleweed), *Impatiens capensis* (jewelweed), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Thelypteris palustris* (eastern marsh fern), *Onoclea sensibilis* (sensitive fern), *Eleocharis* (spikerush) spp., and others. *Sphagnum* (sphagnum) spp. are often abundant along with lesser amounts of other nonvascular species. The invasive species *Microstegium vimineum* (Nepalese browntop), *Lythrum salicaria* (purple loosestrife), and *Phragmites australis* (common reed) can be abundant or form monocultures in these wetlands.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus allegheniensis* (Allegheny blackberry), *Spiraea alba* var. *alba* (white meadowsweet), *Spiraea tomentosa* (steeplebush)
Herb (field)	Forb	*Solidago canadensis* (Canada goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Graminoid	*Leersia oryzoides* (rice cutgrass), *Phalaris arundinacea* (reed canarygrass)

Characteristic Species: *Rubus allegheniensis* (Allegheny blackberry), *Spiraea tomentosa* (steeplebush).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: Although this vegetation is widespread, its range has not been evaluated. It is known from the Central Appalachian ecoregion, the High Alleghany Plateau, Western Alleghany Plateau, North Atlantic Coast, and the Lower New England / Northern Piedmont ecoregions, and is likely in others.

States/Provinces: CT, MA, ME?, NJ, NY, PA, WV:S2.

Federal Lands: NPS (Allegheny Portage Railroad, Boston Harbor Islands, Cape Cod, Delaware Water Gap, Johnstown Flood, Saratoga, Upper Delaware, Weir Farm); USFS (Monongahela); USFWS (Assabet River?, Erie, Great Meadows?, Great Swamp, Iroquois, Montezuma, Parker River?).

CONSERVATION STATUS

Rank: GNR (8-Jul-1999).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Information not available.

Similar Associations:

- *Cornus (amomum, sericea) - Viburnum dentatum - Rosa multiflora* Shrubland (CEGL006576).

Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler.

References: Byers et al. 2007, Decker 1955, Eastern Ecology Working Group n.d., Fike 1999, NRCS 2004, NatureServe and Russell 2003.



Figure E37. Steeplebush / Reed Canarygrass Succesional Wet Meadow in Upper Delaware Scenic and Recreational River (Plot UPDE.30). July 2005. NAD 1983 / UTM easting 488483, northing 4632991.

COMMON NAME (PARK-SPECIFIC): HIGHBUSH BLUEBERRY BOG THICKET

SYNONYMS
USNVC English Name: **Highbush Blueberry / Peatmoss species Shrubland**
USNVC Scientific Name: ***Vaccinium corymbosum* / *Sphagnum* spp. Shrubland**
USNVC Identifier: **CEGL006190**

LOCAL INFORMATION

Environmental Description: This interesting wetland type occurs in isolated upland depressions typically on ridgetops in Pennsylvania. In these depressions, vegetation grows on organic soil, often on a floating mat. These wetlands may be ombrotrophic (receiving nutrients from rainfall only) or influenced by groundwater.
Vegetation Description: This association is characterized by a dense tall-shrub layer (50-90% cover) dominated by highbush blueberry (*Vaccinium corymbosum*), with swamp azalea (*Rhododendron viscosum*), maleberry (*Lyonia ligustrina*), black spruce (*Picea mariana*), and red maple (*Acer rubrum*) as associates. Scattered trees may be present (<10% cover) such as black spruce, red maple, blackgum (*Nyssa sylvatica*), or pitch pine (*Pinus rigida*). Typical short shrubs include leatherleaf (*Chamaedaphne calyculata*), black huckleberry (*Gaylussacia baccata*), swamp azalea, highbush blueberry, sheep laurel (*Kalmia angustifolia*), and cranberry (*Vaccinium macrocarpon*). Sphagnum (*Sphagnum* spp.) blankets well-developed hummocks and hollows. The herbaceous and graminoid species are scattered sparsely over the sphagnum. Common ferns include cinnamon fern (*Osmunda cinnamomea*), eastern marsh fern (*Thelypteris palustris*), and Virginia chainfern (*Woodwardia virginica*).
Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Lyonia ligustrina* (maleberry), *Rhododendron viscosum* (swamp azalea), *Vaccinium corymbosum* (highbush blueberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Chamaedaphne calyculata* (leatherleaf)

Characteristic Species: *Chamaedaphne calyculata* (leatherleaf), *Lyonia ligustrina* (maleberry), *Rhododendron viscosum* (swamp azalea), *Vaccinium corymbosum* (highbush blueberry), *Woodwardia virginica* (Virginia chainfern).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S1*	1	Highbush Blueberry Bog Thicket	Edinger et al. 2002
PA	S4*	1	Highbush Blueberry - Sphagnum Wetland	Fike 1999

Local Range: Only one, very small occurrence of this association was observed during this study. This example occurs on or very near the park's western boundary. Other areas that likely support additional examples of this wetland type were observed on the aerial photography just outside the park boundary in Pennsylvania.
Classification Comments: Highbush Blueberry Bog Thicket is distinguished from Southern New England Bog by the thick tall-shrub layer (>50% cover) of typically *Vaccinium corymbosum* (highbush blueberry), with *Rhododendron viscosum* (swamp azalea) and *Lyonia ligustrina* (maleberry).
Other Comments: Information not available.
Local Description Authors: S. J. Perles (PNHP).

Plots: UPDE.AA.356 (Radis 1986, Fike 1999, Breden et al. 2001, Perles et al. 2007).
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Shrubland (III)
Physiognomic Subclass	Deciduous shrubland (III.B.)
Physiognomic Group	Cold-deciduous shrubland (III.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
Formation	Saturated cold-deciduous shrubland (III.B.2.N.g.)
Alliance	*Vaccinium corymbosum* Saturated Shrubland Alliance (A.1018)
Alliance (English name)	Highbush Blueberry Saturated Shrubland Alliance
Association	*Vaccinium corymbosum / Sphagnum* spp. Shrubland
Association (English name)	Highbush Blueberry / Peatmoss species Shrubland
Ecological System(s):	Boreal-Laurentian-Acadian Acidic Basin Fen (CES201.583). North-Central Interior and Appalachian Acidic Peatland (CES202.606). Northern Atlantic Coastal Plain Pitch Pine Lowland (CES203.374).

GLOBAL DESCRIPTION

Concept Summary: Highbush blueberry peat bog of glaciated regions in the eastern and northeastern United States. This tall-shrub bog thicket occurs on oligotrophic to weakly minerotrophic peat soils, commonly as a border thicket around more open dwarf heath shrub peatlands or within small, isolated basins. Significant seasonal water level fluctuation can occur, especially in isolated basins without inlet or outlet streams. A tall-shrub layer is characterized by abundant *Vaccinium corymbosum* (highbush blueberry) plus *Gaylussacia baccata* (black huckleberry), *Chamaedaphne calyculata* (leatherleaf), *Kalmia angustifolia* (sheep laurel), *Rhododendron canadense* (rhodora), *Lyonia ligustrina* (maleberry), and *Nemopanthus mucronatus* (catberry) in more northern or cooler microclimates, and *Ilex verticillata* (common winterberry) and *Rhododendron viscosum* (swamp azalea) in the south. In locally wetter areas, *Cephalanthus occidentalis* (common buttonbush) or *Decodon verticillatus* (swamp-loosestrife) can occur. Coastal occurrences may have additional shrub species such as *Leucothoe racemosa* (swamp doghobble), *Clethra alnifolia* (coastal sweet-pepperbush), and *Gaylussacia dumosa* (dwarf huckleberry). Sparse, scattered trees may occur, including *Acer rubrum* (red maple), *Picea mariana* (black spruce), *Larix laricina* (tamarack), *Pinus strobus* (eastern white pine), *Pinus rigida* (pitch pine), *Betula populifolia* (gray birch), or *Nyssa sylvatica* (blackgum), with species dependent on environmental setting. The herbaceous layer tends to be sparse, although can be locally abundant. Common herbs include *Osmunda cinnamomea* (cinnamon fern), *Woodwardia virginica* (Virginia chainfern), *Carex trisperma* (threeseeded sedge), *Sarracenia purpurea* (purple pitcherplant), *Thelypteris palustris* (eastern marsh fern), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Maianthemum trifolium* (threeleaf false lily of the valley). *Sphagnum* (sphagnum) mosses blanket well-developed hummocks and hollows, including *Sphagnum magellanicum* (Magellan's sphagnum), *Sphagnum centrale* (sphagnum), *Sphagnum rubellum* (sphagnum), *Sphagnum capillifolium* (sphagnum), *Sphagnum fimbriatum* (sphagnum), and *Sphagnum fuscum* (sphagnum).
Environmental Description: This tall-shrub bog thicket occurs on oligotrophic to weakly minerotrophic peat soils, commonly as a border thicket around more open dwarf heath shrub peatlands or within small, isolated basins. Significant seasonal water level fluctuation can occur, especially in isolated basins without inlet or outlet streams.

Vegetation Description: A tall-shrub layer is characterized by abundant *Vaccinium corymbosum* (highbush blueberry) plus *Gaylussacia baccata* (black huckleberry), *Chamaedaphne calyculata* (leatherleaf), *Kalmia angustifolia* (sheep laurel), *Rhododendron canadense* (rhodora), *Lyonia ligustrina* (maleberry), and *Nemopanthus mucronatus* (catberry) in more northern or cooler microclimates, and *Ilex verticillata* (common winterberry) and *Rhododendron viscosum* (swamp azalea) in the south. In locally wetter areas, *Cephalanthus occidentalis* (common buttonbush) or *Decodon verticillatus* (swamp-loosestrife) can occur. Sparse, scattered trees may occur, including *Acer rubrum* (red maple), *Picea mariana* (black spruce), *Larix laricina* (tamarack), *Pinus strobus* (eastern white pine), *Pinus rigida* (pitch pine), *Betula populifolia* (gray birch), or *Nyssa sylvatica* (blackgum), with species dependent on environmental setting. The herbaceous layer tends to be sparse, although can be locally abundant. Common herbs include *Osmunda cinnamomea* (cinnamon fern), *Woodwardia virginica* (Virginia chainfern), *Carex trisperma* (threeseeded sedge), *Sarracenia purpurea* (purple pitcherplant), *Thelypteris palustris* (eastern marsh fern), *Triadenum virginicum* (Virginia marsh St. Johnswort), and *Maianthemum trifolium* (threeleaf false lily of the valley). *Sphagnum* (sphagnum) mosses blanket well-developed hummocks and hollows, including *Sphagnum magellanicum* (Magellan's sphagnum), *Sphagnum centrale* (sphagnum), *Sphagnum rubellum* (sphagnum), *Sphagnum capillifolium* (sphagnum), *Sphagnum fimbriatum* (sphagnum), and *Sphagnum fuscum* (sphagnum).

Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Lyonia ligustrina* (maleberry), *Vaccinium corymbosum* (highbush blueberry)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Chamaedaphne calyculata* (leatherleaf)

Characteristic Species: *Chamaedaphne calyculata* (leatherleaf), *Gaylussacia baccata* (black huckleberry), *Lyonia ligustrina* (maleberry), *Osmunda cinnamomea* (cinnamon fern), *Rhododendron viscosum* (swamp azalea), *Vaccinium corymbosum* (highbush blueberry), *Woodwardia virginica* (Virginia chainfern).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: Occurs from Pennsylvania and New Jersey north to New Hampshire and Maine and possibly Vermont.

States/Provinces: CT, MA:S4, ME?, NH, NJ:S1S3, NY, PA, RI, VT.

Federal Lands: NPS (Cape Cod, Delaware Water Gap, Upper Delaware); USFWS (Assabet River?, Great Meadows?).

CONSERVATION STATUS

Rank: G3G5 (31-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: These tall heath shrub bog thickets tend to occur in wetter, more minerotrophic settings relative to dwarf heath shrub bogs.

Similar Associations:

- *Vaccinium corymbosum - Gaylussacia baccata - Photinia melanocarpa / Calla palustris* Shrubland (CEGL005085).
- *Vaccinium corymbosum - Rhododendron viscosum - Clethra alnifolia* Shrubland (CEGL006371).

Related Concepts:

- *Vaccinium corymbosum-Rhododendron viscosum* tall shrub bog and bog border association [Type A] (Kearsley 1999a) ?
- Highbush blueberry shrub swamp (CAP pers. comm. 1998) ?
- New England coastal plain pondshore (Rawinski 1984) ?
- Northern New Jersey Shrub Swamp (Breden 1989) ?
- Shrub Swamp (Lundgren et al. 2000) ?

SOURCES

Description Authors: S. L. Neid, mod. S. C. Gawler.

References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Conard 1935, Damman and French 1987, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Gawler 2002, Johnson 1981b, Karlin and Lynn 1988, Kearsley 1999a, Lundgren et al. 2000, Lynn and Karlin 1985, Metzler and Barrett 1982, Metzler and Barrett 2001, Perles et al. 2007, Radis 1986, Rawinski 1984, Rozsa and Metzler n.d., Sperduto 2000a, Sperduto and Nichols 2004, Swain and Kearsley 2000, Swain and Kearsley 2001.



Figure E38. Highbush Blueberry Bog Thicket in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.356). September 2006. NAD 1983 / UTM easting 493939, northing 4604368.

COMMON NAME (PARK-SPECIFIC): SOUTHERN NEW ENGLAND BOG

SYNONYMS

USNVC English Name: **Leatherleaf - (Dwarf Huckleberry) - Swamp-loosestrife / Virginia Chainfern Dwarf-shrubland**

USNVC Scientific Name: ***Chamaedaphne calyculata - (Gaylussacia dumosa) - Decodon verticillatus / Woodwardia virginica*** **Dwarf-shrubland**

USNVC Identifier: **CEGL006008**

LOCAL INFORMATION

Environmental Description: This interesting wetland type occurs in isolated upland depressions typically on ridgetops in Pennsylvania. In these depressions, vegetation grows on organic soil, often on a floating mat. These wetlands may be ombrotrophic (receiving nutrients from rainfall only) or influenced by groundwater.

Vegetation Description: This association is characterized by a thick layer (70-80% cover) of dwarf-shrubs such as leatherleaf (*Chamaedaphne calyculata*), black chokeberry (*Photinia melanocarpa*), bog laurel (*Kalmia polifolia*), and sheep laurel (*Kalmia angustifolia*), over a near continuous mat of sphagnum (*Sphagnum* spp.). Other short-shrub associates include black huckleberry (*Gaylussacia baccata*), swamp azalea (*Rhododendron viscosum*), highbush blueberry (*Vaccinium corymbosum*), and cranberry (*Vaccinium macrocarpon*). Scattered trees may be present (<10% cover) such as black spruce (*Picea mariana*), red maple (*Acer rubrum*), blackgum (*Nyssa sylvatica*), and eastern white pine (*Pinus strobus*). Some tall shrubs may be present, including highbush blueberry, swamp azalea, maleberry (*Lyonia ligustrina*), black spruce, and red maple. The herbaceous and graminoid species are scattered sparsely over the sphagnum. Characteristic species include purple pitcherplant (*Sarracenia purpurea*), roundleaf sundew (*Drosera rotundifolia*), swamp-loosestrife (*Decodon verticillatus*), white beaksedge (*Rhynchospora alba*), tawny cottongrass (*Eriophorum virginicum*), Virginia chainfern (*Woodwardia virginica*), northern long sedge (*Carex folliculata*), and prickly bog sedge (*Carex atlantica* ssp. *atlantica*). These species are more abundant in areas with less tall-shrub cover.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved evergreen shrub	*Chamaedaphne calyculata* (leatherleaf), *Kalmia polifolia* (bog laurel), *Photinia melanocarpa* (black chokeberry)
Herb (field)	Forb	*Decodon verticillatus* (swamp-loosestrife), *Drosera rotundifolia* (roundleaf sundew), *Sarracenia purpurea* (purple pitcherplant)
Herb (field)	Graminoid	*Eriophorum virginicum* (tawny cottongrass), *Rhynchospora alba* (white beaksedge)

Characteristic Species: *Chamaedaphne calyculata* (leatherleaf), *Decodon verticillatus* (swamp-loosestrife), *Drosera rotundifolia* (roundleaf sundew), *Eriophorum virginicum* (tawny cottongrass), *Kalmia polifolia* (bog laurel), *Photinia melanocarpa* (black chokeberry), *Rhynchospora alba* (white beaksedge), *Sarracenia purpurea* (purple pitcherplant), *Vaccinium macrocarpon* (cranberry).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S1*	1	Dwarf Shrub Bog	Edinger et al. 2002
PA	S2*	1	Leatherleaf - Bog Rosemary Peatland	Fike 1999
PA	S2S3*	1	Leatherleaf - Cranberry Peatland	Fike 1999

Local Range: Only one, very small occurrence of this association was observed during this study. This example occurs on or very near the park's western boundary. Other areas that likely support additional examples of this wetland type were observed on the aerial photography just outside the park boundary in Pennsylvania.

Classification Comments: Southern New England Bog is distinguished from Highbush Blueberry Bog Thicket by the sparse to open tall-shrub layer, the thick dwarf-shrub and moss layers, and prominence of characteristic "bog" plants *Sarracenia purpurea* (purple pitcherplant), *Drosera rotundifolia* (roundleaf sundew), *Decodon verticillatus* (swamp-loosestrife), *Rhynchospora alba* (white beaksedge), and *Eriophorum virginicum* (tawny cottongrass).

Other Comments: Information not available.

Local Description Authors: S. J. Perles (PNHP).

Plots: UPDE.AA.356 (Radis 1986, Fike 1999, Breden et al. 2001, Perles et al. 2007).

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Dwarf-shrubland (IV)
Physiognomic Subclass	Evergreen dwarf-shrubland (IV.A.)
Physiognomic Group	Needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.)
Physiognomic Subgroup	Natural/Semi-natural needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.)
Formation	Saturated needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.g.)
Alliance	*Chamaedaphne calyculata* Saturated Dwarf-shrubland Alliance (A.1092)
Alliance (English name)	Leatherleaf Saturated Dwarf-shrubland Alliance
Association	*Chamaedaphne calyculata - (Gaylussacia dumosa) - Decodon verticillatus / Woodwardia virginica* Dwarf-shrubland
Association (English name)	Leatherleaf - (Dwarf Huckleberry) - Swamp-loosestrife / Virginia Chainfern Dwarf-shrubland
Ecological System(s):	Atlantic Coastal Plain Northern Bog (CES203.893). North-Central Interior and Appalachian Acidic Peatland (CES202.606).

GLOBAL DESCRIPTION

Concept Summary: This dwarf-shrub quaking or floating bog occurs in the southern portion of the glaciated Northeast, extending west to the Western Allegheny Plateau. It occupies oligotrophic, peat-accumulating basins. *Chamaedaphne calyculata* (leatherleaf) is strongly dominant, with associate species including *Kalmia angustifolia* (sheep laurel), *Kalmia polifolia* (bog laurel), *Vaccinium oxycoccos* (small cranberry), *Vaccinium macrocarpon* (cranberry), *Gaylussacia dumosa* (dwarf huckleberry) (on the coast), and *Gaylussacia baccata* (black huckleberry). Associate shrubs generally occur with low cover, although they may be locally common. Scattered tall shrubs, such as *Vaccinium corymbosum* (highbush blueberry), *Rhododendron viscosum* (swamp azalea), *Larix laricina* (tamarack), *Picea mariana* (black spruce), and *Acer rubrum* (red maple), may occur but always with low cover. Herbaceous cover is quite low but can include *Carex trisperma* (threeseeded sedge), *Pogonia ophioglossoides* (snakemouth orchid), *Calopogon tuberosus* (tuberous grasspink), *Eriophorum virginicum* (tawny

cottongrass), *Drosera rotundifolia* (roundleaf sundew), *Drosera intermedia* (spoonleaf sundew), *Sarracenia purpurea* (purple pitcherplant), and *Woodwardia virginica* (Virginia chainfern) scattered throughout and with *Carex canescens* (silvery sedge), *Carex limosa* (mud sedge), *Glyceria canadensis* (rattlesnake mannagrass), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Utricularia cornuta* (horned bladderwort), *Rhynchospora alba* (white beaksedge), and sometimes *Scheuchzeria palustris* (rannoch-rush) occurring in wetter fen windows. Edges of floating mats tend to receive more nutrient enrichment and support such species as *Peltandra virginica* (green arrow-arum), *Decodon verticillatus* (swamp-loosestrife), and *Dulichium arundinaceum* (threeway sedge). The bryophyte layer is well-developed, dominated by *Sphagnum capillifolium* (sphagnum), *Sphagnum magellanicum* (Magellan's sphagnum), *Sphagnum rubellum* (sphagnum), and *Sphagnum fuscum* (sphagnum) with *Sphagnum bartlettianum* (Bartlett's sphagnum), *Sphagnum cuspidatum* (toothed sphagnum), *Sphagnum fallax* (sphagnum), and *Sphagnum recurvum* (recurved sphagnum) also occurring in some examples.

Environmental Description: This dwarf-shrub quaking or floating bog occupies oligotrophic, peat-accumulating basins.

Vegetation Description: *Chamaedaphne calyculata* (leatherleaf) is strongly dominant, with associate species including *Kalmia angustifolia* (sheep laurel), *Kalmia polifolia* (bog laurel), *Vaccinium oxycoccos* (small cranberry), *Vaccinium macrocarpon* (cranberry), *Gaylussacia dumosa* (dwarf huckleberry) (near the coast), and *Gaylussacia baccata* (black huckleberry). Associate shrubs generally occur with low cover, although they may be locally common. Scattered tall shrubs, such as *Vaccinium corymbosum* (highbush blueberry), *Rhododendron viscosum* (swamp azalea), *Lyonia ligustrina* (maleberry), *Larix laricina* (tamarack), *Picea mariana* (black spruce), and *Acer rubrum* (red maple), may occur but always with low cover. Herbaceous cover is quite low but can include *Carex trisperma* (threeseeded sedge), *Pogonia ophioglossoides* (snakemouth orchid), *Calopogon tuberosus* (tuberous grasspink), *Eriophorum virginicum* (tawny cottongrass), *Decodon verticillatus* (swamp-loosestrife), *Drosera rotundifolia* (roundleaf sundew), *Drosera intermedia* (spoonleaf sundew), *Sarracenia purpurea* (purple pitcherplant), and *Woodwardia virginica* (Virginia chainfern) scattered throughout and with *Carex canescens* (silvery sedge), *Carex limosa* (mud sedge), *Carex folliculata* (northern long sedge), *Carex atlantica* (prickly bog sedge), *Glyceria canadensis* (rattlesnake mannagrass), *Triadenum virginicum* (Virginia marsh St. Johnswort), *Utricularia cornuta* (horned bladderwort), *Rhynchospora alba* (white beaksedge), and sometimes *Scheuchzeria palustris* (rannoch-rush) occurring in wetter fen windows. Edges of floating mats tend to receive more nutrient enrichment and support such species as *Peltandra virginica* (green arrow-arum), *Decodon verticillatus* (swamp-loosestrife), and *Dulichium arundinaceum* (threeway sedge). The bryophyte layer is well-developed, dominated by *Sphagnum capillifolium* (sphagnum), *Sphagnum magellanicum* (Magellan's sphagnum), *Sphagnum rubellum* (sphagnum), and *Sphagnum fuscum* (sphagnum) with *Sphagnum bartlettianum* (Bartlett's sphagnum), *Sphagnum cuspidatum* (toothed sphagnum), *Sphagnum fallax* (sphagnum), and *Sphagnum recurvum* (recurved sphagnum) also occurring in some examples.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Chamaedaphne calyculata* (leatherleaf)
Herb (field)	Forb	*Drosera rotundifolia* (roundleaf sundew)

Characteristic Species: *Chamaedaphne calyculata* (leatherleaf), *Drosera rotundifolia* (roundleaf sundew), *Eriophorum virginicum* (tawny cottongrass), *Rhynchospora alba* (white beaksedge), *Sarracenia purpurea* (purple pitcherplant), *Vaccinium macrocarpon* (cranberry).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: Information not available.
States/Provinces: CT, MA, ME, NH, NJ:S1, NY, OH, ON:S3, PA, RI.
Federal Lands: NPS (Cape Cod, Delaware Water Gap?, Minute Man, Upper Delaware); USFWS (Assabet River, Nomans Land Island?).

CONSERVATION STATUS
Rank: G5 (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 1 - Strong.
Comments: Information not available.
Similar Associations:
- *Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland (CEGL006513).

Related Concepts:
- Glacial Bog (Breden 1989) ?

SOURCES
Description Authors: S. L. Neid and L. A. Sneddon, mod. S. C. Gawler.
References: Anderson 1982, Breden 1989, Breden et al. 2001, Damman and French 1987, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Gawler 2002, Lynn and Karlin 1985, Metzler and Barrett 2001, Perles et al. 2007, Radis 1986, Sperduto 2000b, Sperduto and Nichols 2004, Swain and Kearsley 2000.



Figure E39. Southern New England Bog in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.356). September 2006. NAD 1983 / UTM easting 493939, northing 4604368.

COMMON NAME (PARK-SPECIFIC): CENTRAL APPALACHIAN BLUEBERRY SHRUBLAND

SYNONYMS
USNVC English Name: **(Lowbush Blueberry, Velvetleaf Blueberry, Hillside Blueberry) Central Appalachian Dwarf-shrubland**
USNVC Scientific Name: ***Vaccinium (angustifolium, myrtilloides, pallidum)*** **Central Appalachian Dwarf-shrubland**
USNVC Identifier: **CEGL003958**

LOCAL INFORMATION

Environmental Description: This association is created and maintained by fire and is restricted to small patches on dry, high-elevation, flat to gently rolling rocky ridges and summits. Soil is typically thin, well-drained, acidic sandy loam over bedrock. Droughty soil conditions and semi-frequent burning limit tree development, and trees (when present) are stunted. Bedrock is primarily Devonian-age acidic sandstones of the Catskill Formation.
Vegetation Description: This association is characterized by a dense short-shrub layer (0.5 m in height) with very high cover that may exceed 95%. This layer is diverse and dominated by ericaceous species. Typical dominants, listed in order of abundance, include lowbush blueberry (*Vaccinium angustifolium*), white meadowsweet (*Spiraea alba* var. *latifolia*), and Blue Ridge blueberry (*Vaccinium pallidum*). Additional short shrubs, present with less than 5% abundance, include maleberry (*Lyonia ligustrina*), Allegheny blackberry (*Rubus allegheniensis*), and setose blackberry (*Rubus setosus*). Immediately after fire, the dense short-shrub layer regenerates. However, in the years following the fire, early-successional shrubs and trees establish in the low heath. Common species include hawthorn (*Crataegus* spp.), red maple (*Acer rubrum*), quaking aspen (*Populus tremuloides*), eastern white pine (*Pinus strobus*), and sweet birch (*Betula lenta*). The development and cover of these shrub and tree species can vary from 0-75%, depending on the length of time since the fire. The herbaceous layer (less than 0.5 m tall) can be sparse to moderately dense (to at least 35% cover) but has low diversity. Fan clubmoss (*Lycopodium digitatum*) and rare clubmoss (*Lycopodium obscurum*) are characteristic, and Swan's sedge (*Carex swanii*) can also be present in low abundance with other sedges below the shrub layer.
Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Spiraea alba* var. *latifolia* (white meadowsweet), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Herb (field)	Fern or fern ally	*Lycopodium digitatum* (fan clubmoss), *Lycopodium obscurum* (rare clubmoss)

Characteristic Species: *Lycopodium digitatum* (fan clubmoss), *Lycopodium obscurum* (rare clubmoss), *Spiraea alba* var. *latifolia* (white meadowsweet), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry).
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Successional Blueberry Heath	Edinger et al. 2002
PA	S2	1	Low Heath Shrubland	Fike 1999

Local Range: This association is found, at Upper Delaware Scenic and Recreational River, near the center of the corridor in a ridgetop setting. It is not known whether it is more widespread.
Classification Comments: Central Appalachian Blueberry Shrubland is similar to Ridgetop Scrub Oak Barrens; both associations are found on thin soils at high elevations. Dominance by *Quercus ilicifolia* (bear oak) characterizes Ridgetop Scrub Oak Barrens, whereas the Central Appalachian Blueberry Shrubland is heath-dominated.
Other Comments: Information not available.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.32.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Dwarf-shrubland (IV)
Physiognomic Subclass	Deciduous dwarf-shrubland (IV.B.)
Physiognomic Group	Cold-deciduous dwarf-shrubland (IV.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous dwarf-shrubland (IV.B.2.N.)
Formation	Cespitose cold-deciduous dwarf-shrubland (IV.B.2.N.a.)
Alliance	*Vaccinium (angustifolium, myrtilloides, pallidum)* Dwarf-shrubland Alliance (A.1113)
Alliance (English name)	(Lowbush Blueberry, Velvetleaf Blueberry, Hillside Blueberry) Dwarf-shrubland Alliance
Association	*Vaccinium (angustifolium, myrtilloides, pallidum)* Central Appalachian Dwarf-shrubland
Association (English name)	(Lowbush Blueberry, Velvetleaf Blueberry, Hillside Blueberry) Central Appalachian Dwarf-shrubland
Ecological System(s):	Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: This association occurs on mid- to high-elevation acidic rock outcrops or summits and is characterized by abundant dwarf *Vaccinium* (blueberry) spp. in areas with frequent fire and/or droughty soils. This community is dominated by heaths or heath-like shrubs (typically blueberries, *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium myrtilloides* (velvetleaf huckleberry), *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry)) and is commonly referred to as "heath barrens." Soils are shallow accumulations of organic material on bedrock habitats, or rapidly drained and nutrient-poor sands on outwash plains. Small trees may be present but are very sparse. The herbaceous layer is usually sparse with low diversity. In addition to *Vaccinium* (blueberry), the shrub layer typically contains other low shrubs such as *Gaylussacia baccata* (black huckleberry), *Kalmia angustifolia* (sheep laurel), *Lyonia ligustrina* (maleberry), and *Comptonia peregrina* (sweet fern), with *Kalmia latifolia* (mountain laurel) present in some areas. *Quercus ilicifolia* (bear oak) is frequently present, with variable cover, above the low heaths. Herbaceous plants scattered among the shrubs include *Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Carex argyrantha* (hay sedge), *Danthonia spicata* (poverty oatgrass), *Piptatherum pungens* (mountain ricegrass), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Rubus hispidus* (bristly dewberry), *Melampyrum lineare* (narrowleaf cowwheat), *Solidago canadensis* (Canada goldenrod), *Lycopodium dendroideum* (tree groundpine), and *Lycopodium digitatum* (fan clubmoss). Mosses (including *Polytrichum* (polytrichum moss) spp.) and lichens usually are present.

Environmental Description: These patchy communities are typically found on higher-elevation acidic rock outcrops or summits. Along with bedrock outcrops, ledges, summits of igneous or metamorphic rock, this association is sometimes found in depressions on level outwash plains or valley floor frost pockets. Soils are shallow accumulations of organic material on bedrock habitats, or rapidly drained and nutrient-poor sands on outwash plains.
Vegetation Description: This dwarf-shrubland is dominated by locally dense *Vaccinium* (blueberry) (*Vaccinium angustifolium* (lowbush blueberry), *Vaccinium stamineum* (deerberry), and/or *Vaccinium pallidum* (Blue Ridge blueberry). Scattered small individuals of *Pinus strobus* (eastern white pine), *Pinus rigida* (pitch pine), *Prunus serotina* (black cherry), *Betula papyrifera* (paper birch), and/or *Betula populifolia* (gray birch) may occur where soil has accumulated. The herbaceous layer is usually sparse with low diversity. In addition to *Vaccinium* (blueberry), the shrub layer typically contains other shrubs such as *Gaylussacia baccata* (black huckleberry), *Kalmia angustifolia* (sheep laurel), *Lyonia* (staggerbush) *ligustrina*, and *Comptonia peregrina* (sweet fern), with *Kalmia latifolia* (mountain laurel) present in some areas. *Quercus ilicifolia* (bear oak) is frequently present, with variable cover, above the low heaths. Herbaceous plants scattered among the shrubs include *Deschampsia flexuosa* (wavy hairgrass), *Schizachyrium scoparium* (little bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Carex argyrantha* (hay sedge), *Danthonia spicata* (poverty oatgrass), *Piptatherum pungens* (mountain ricegrass), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Rubus hispidus* (bristly dewberry), *Melampyrum lineare* (narrowleaf cowwheat), *Solidago canadensis* (Canada goldenrod), *Lycopodium dendroideum* (tree groundpine), and *Lycopodium digitatum* (fan clubmoss). Mosses (including *Polytrichum* (polytrichum moss) spp.) and lichens usually are present.
Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Broad-leaved deciduous shrub	*Quercus ilicifolia* (bear oak)
Short shrub/sapling	Broad-leaved deciduous shrub	*Comptonia peregrina* (sweet fern), *Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry)
Short shrub/sapling	Broad-leaved evergreen shrub	*Kalmia angustifolia* (sheep laurel)

Characteristic Species: *Comptonia peregrina* (sweet fern), *Deschampsia flexuosa* (wavy hairgrass), *Gaylussacia baccata* (black huckleberry), *Kalmia latifolia* (mountain laurel), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Melampyrum lineare* (narrowleaf cowwheat), *Quercus ilicifolia* (bear oak), *Vaccinium angustifolium* (lowbush blueberry), *Vaccinium pallidum* (Blue Ridge blueberry).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This association is known from the mid-Atlantic states of Maryland, New Jersey, Pennsylvania and West Virginia.
States/Provinces: MD, NJ, NY, PA:S2, WV.
Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS
Rank: G4G5 (21-Jun-2006).
Reasons: This association is distributed over a fairly large portion of glaciated northeastern North America. In some states where it occurs, it has a state conservation rank of S4.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type shares many species and the general environmental setting with *Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata* Dwarf-shrubland (CEGL005094), but it lacks species of more northern affinity such as *Picea* (spruce) spp., *Abies* (fir) spp., and *Sorbus* (mountain-ash) spp., and is not characterized by *Sibbaldiopsis tridentata* (shrubby fivefingers). It results from frequent fires and droughty soils, with cold climate having less effect than in CEGL005094.

Similar Associations:

- *Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata* Dwarf-shrubland (CEGL005094).

Related Concepts:

- *Vaccinium myrtilloides* Dwarf-shrubland (Walton et al. 1997) ?

SOURCES

Description Authors: E. Largay, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Fike 1999, Harrison 2004, Walton et al. 1997.



Figure E40. Central Appalachian Blueberry Shrubland in Upper Delaware Scenic and Recreational River (Plot UPDE.32). August 2005. NAD 1983 / UTM easting 488415, northing 4632369.

COMMON NAME (PARK-SPECIFIC): LITTLE BLUESTEM OLD FIELD

SYNONYMS

USNVC English Name: **Little Bluestem - (Broomsedge Bluestem) - Goldenrod species Herbaceous Vegetation**

USNVC Scientific Name: ***Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation**

USNVC Identifier: **CEGL006333**

LOCAL INFORMATION

Environmental Description: This association occurs in various settings throughout the park, often in association with disturbed or managed openings and fields. Substrates are well-drained, moderately stony and occur in flat to only slightly sloping settings.

Vegetation Description: Vegetation is dense (>80% cover) and is not associated with bedrock outcrops. Little bluestem (*Schizachyrium scoparium*) covers greater than 50% of the area. Associates are wrinkleleaf goldenrod (*Solidago rugosa*), eastern hayscented fern (*Dennstaedtia punctilobula*), flat-top goldentop (*Euthamia graminifolia*), dwarf cinquefoil (*Potentilla canadensis*), starved panicgrass (*Dichanthelium depauperatum*), deertongue (*Dichanthelium clandestinum*), and western pearly everlasting (*Anaphalis margaritacea*). Occasional low shrubs and seedlings include Allegheny blackberry (*Rubus allegheniensis*), Blue Ridge blueberry (*Vaccinium pallidum*), bear oak (*Quercus ilicifolia*), gray birch (*Betula populifolia*), and northern red oak (*Quercus rubra*).

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Rubus allegheniensis* (Allegheny blackberry)
Herb (field)	Graminoid	*Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Rubus allegheniensis* (Allegheny blackberry), *Schizachyrium scoparium* (little bluestem).

Other Noteworthy Species:

Species	GRank	Type	Note
Dennstaedtia punctilobula (eastern hayscented fern)		plant	
Euthamia graminifolia (flat-top goldentop)		plant	
Solidago rugosa (wrinkleleaf goldenrod)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Successional Old Field	Edinger et al. 2002
PA	SNA		[not crosswalked]	

Local Range: This association occurs in the southern half of Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.216.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Andropogon virginicus* Herbaceous Alliance (A.1208)
Alliance (English name)	Broomsedge Bluestem Herbaceous Alliance
Association	*Schizachyrium scoparium* - *(Andropogon virginicus)* - *Solidago* spp. Herbaceous Vegetation
Association (English name)	Little Bluestem - (Broomsedge Bluestem) - Goldenrod species Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: This broadly defined vegetation type includes old fields of well-drained soils, either sandy or shallow to bedrock. They are characterized by dominance of warm-season grasses. *Schizachyrium scoparium* (little bluestem) is characteristic and nearly always present. Species composition is variable, depending on land-use history, but in general this vegetation is quite wide-ranging in northeastern and midwestern states. In addition to the nominal species, other associates may include *Andropogon virginicus* (broomsedge bluestem), *Eragrostis spectabilis* (purple lovegrass), *Festuca rubra* (red fescue), *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Nuttallanthus canadensis* (Canada toadflax), *Rubus flagellaris* (northern dewberry), *Panicum virgatum* (switchgrass), *Dichanthelium depauperatum* (starved panicgrass), *Potentilla simplex* (common cinquefoil), *Dichanthelium meridionale* (matting rosette grass), *Dichanthelium dichotomum* (cypress panicgrass), *Solidago rugosa* (wrinkleleaf goldenrod), and *Carex pensylvanica* (Pennsylvania sedge). Scattered shrubs are often present, including *Comptonia peregrina* (sweet fern), *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), and scattered tree saplings, such as *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Juniperus virginiana* (eastern red-cedar). *Polytrichum juniperinum* (juniper polytrichum moss) and other *Polytrichum* (polytrichum moss) spp. are common bryophytes.

Environmental Description: This vegetation occurs on well-drained soils, either on sandy flats or on dry knolls with shallow soils. The vegetation arises spontaneously after soil disturbance.

Vegetation Description: *Schizachyrium scoparium* (little bluestem) is characteristic and nearly always present. Species composition is variable, depending on land-use history, but in general, this vegetation is quite wide-ranging in northeastern and midwestern states. In addition to the nominal species, other associates may include *Andropogon virginicus* (broomsedge bluestem), *Eragrostis spectabilis* (purple lovegrass), *Festuca rubra* (red fescue), *Deschampsia flexuosa* (wavy hairgrass), *Centaurea biebersteinii* (spotted knapweed), *Danthonia spicata* (poverty oatgrass), *Hypericum perforatum* (common St. Johnswort), *Nuttallanthus canadensis* (Canada toadflax), *Rubus flagellaris* (northern dewberry), *Panicum virgatum* (switchgrass), *Dichanthelium depauperatum* (starved panicgrass), *Potentilla simplex* (common cinquefoil), *Dichanthelium meridionale* (matting rosette grass), *Dichanthelium dichotomum* (cypress panicgrass), *Solidago juncea* (early goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Hieracium* (hawkweed) spp., and *Carex pensylvanica* (Pennsylvania sedge). Scattered shrubs are often present, including *Comptonia peregrina* (sweet

fern), *Morella pensylvanica* (northern bayberry), *Gaylussacia baccata* (black huckleberry), and scattered tree saplings, such as *Prunus serotina* (black cherry), *Sassafras albidum* (sassafras), and *Juniperus virginiana* (eastern red-cedar).

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Dwarf-shrub	*Rubus flagellaris* (northern dewberry)
Herb (field)	Forb	*Solidago juncea* (early goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Graminoid	*Schizachyrium scoparium* (little bluestem)

Characteristic Species: *Andropogon virginicus* (broomsedge bluestem), *Schizachyrium scoparium* (little bluestem), *Solidago juncea* (early goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is quite wide-ranging in northeastern and midwestern states, and possibly occurs at higher elevations in the southeastern states.

States/Provinces: CT, MA, ME, NH, NJ, NY, PA, RI, VT.

Federal Lands: NPS (Boston Harbor Islands, Cape Cod, Delaware Water Gap, Fire Island, Gateway, Saratoga, Upper Delaware, Weir Farm); USFWS (Great Swamp, Iroquois).

CONSERVATION STATUS

Rank: GNA (invasive) (19-Jan-2006).

Reasons: This vegetation type includes pasture and post-agricultural fields.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: This type is distinguished, in theory, from the very similar *Dactylis glomerata - Phleum pratense - Festuca* spp. - *Solidago* (goldenrod) spp. Herbaceous Vegetation (CEGL006107) by the dominance of warm-season grasses as opposed to cool-season grasses (*Phleum* (timothy), *Festuca* (fescue)) dominating CEGL006017. Additional data will be required to see how this distinction holds up and what geographic differences might accompany such a distinction.

Similar Associations:

- *Dactylis glomerata - Phleum pratense - Festuca* spp. - *Solidago* spp. Herbaceous Vegetation (CEGL006107).
- *Lolium (arundinaceum, pratense)* Herbaceous Vegetation (CEGL004048).
- *Panicum virgatum - (Andropogon virginicus)* Herbaceous Vegetation (CEGL006616).
- *Phleum pratense - Bromus pubescens - Helenium autumnale* Herbaceous Vegetation (CEGL004018).

Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Edinger et al. 2002, House 1917, NRCS 2001b, NRCS 2004, Newbold et al. 1988, Niering et al. 1970.



Figure E41. Little Bluestem Old Field in Upper Delaware Scenic and Recreational River (Plot UPDE.216). August 2005. NAD 1983 / UTM easting 497328, northing 4601728.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN OLD FIELD

SYNONYMS

USNVC English Name: **Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation**

USNVC Scientific Name: ***Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation**

USNVC Identifier: **CEGL006107**

LOCAL INFORMATION

Environmental Description: This association occurs in fields that are not plowed or planted in crops or hay grasses. These fields are mowed at least biannually if not more frequently. Without mowing, these sites will succeed to successional shrubland types as woody species colonize the field. The shrublands are flat to gently sloping, often bounded by stonewalls or fencerows. Some of these sites are old homesteads from which the houses have been removed. These sites contain moderately well-drained to well-drained soils. They may contain poorly drained swales with wet meadow vegetation.

Vegetation Description: This association is dominated by nonnative, early-successional grasses and herbs on abandoned pasture and post-agricultural fields. Dominant species can include orchardgrass (*Dactylis glomerata*), timothy (*Phleum pratense*), wrinkleleaf goldenrod (*Solidago rugosa*), and sweet vernalgrass (*Anthoxanthum odoratum*), with numerous associates.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Solidago rugosa* (wrinkleleaf goldenrod)
Herb (field)	Graminoid	*Dactylis glomerata* (orchardgrass), *Phleum pratense* (timothy)

Characteristic Species: *Dactylis glomerata* (orchardgrass), *Phleum pratense* (timothy), *Solidago rugosa* (wrinkleleaf goldenrod).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	2	Successional Old Field	Edinger et al. 2002
PA	SNA		[not crosswalked]	

Local Range: This association is widespread throughout Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: None.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Dactylis glomerata* - *Rumex acetosella* Herbaceous Alliance (A.1190)
Alliance (English name)	Orchard Grass - Common Sheep Sorrel Herbaceous Alliance
Association	*Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation
Association (English name)	Orchard Grass - Timothy - Fescue species - Goldenrod species Herbaceous Vegetation
Ecological System(s):	Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept Summary: This broadly defined vegetation type includes pastures and post-agricultural fields and is largely composed of nonnative cool-season grasses and herbs (generally of European origin) in the early stages of succession. The fields are typically mowed at least annually. Physiognomically, these grasslands are generally comprised of mid-height (1-3 feet tall) grasses and forbs, with occasional scattered shrubs. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states and at higher elevations (610-1220 m [2000-4000 feet]) in the southeastern states. Dominant grasses vary from site to site but generally feature the nominal species. Other graminoid associates may include *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* (hawkweed) spp., *Oxalis stricta* (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima*, *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* (clover) spp., and many others.

Environmental Description: This association occurs on pastures and land that has been tilled. Generally the fields are mowed at least annually.

Vegetation Description: In addition to *Dactylis glomerata* (orchardgrass) and *Phleum pratense* (timothy), these grassy fields are characterized by graminoids including *Agrostis stolonifera* (creeping bentgrass), *Agrostis hyemalis* (winter bentgrass), *Elymus repens* (quackgrass), *Bromus inermis* (smooth brome), *Bromus tectorum* (cheatgrass), *Lolium perenne* (perennial ryegrass), *Poa pratensis* (Kentucky bluegrass), *Poa compressa* (Canada bluegrass), *Schizachyrium scoparium* (little bluestem) (not in abundance), and *Anthoxanthum odoratum* (sweet vernalgrass). Forbs scattered among the grasses are varied but include *Hieracium* (hawkweed) spp., *Oxalis*

stricta (common yellow oxalis), *Achillea millefolium* (common yarrow), *Asclepias syriaca* (common milkweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago juncea* (early goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago altissima*, *Euthamia graminifolia* (flat-top goldentop), *Cerastium arvense* (field chickweed), *Oenothera biennis* (common evening-primrose), *Potentilla simplex* (common cinquefoil), *Symphyotrichum lateriflorum* (calico aster), *Symphyotrichum novae-angliae* (New England aster), *Symphyotrichum lanceolatum* (white panicle aster), *Daucus carota* (Queen Anne's lace), *Ambrosia artemisiifolia* (annual ragweed), *Vicia cracca* (bird vetch), *Trifolium* (clover) spp., and many others.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Rumex acetosella* (common sheep sorrel)
Herb (field)	Graminoid	*Dactylis glomerata* (orchardgrass), *Festuca rubra* (red fescue), *Phleum pratense* (timothy)

Characteristic Species: *Achillea millefolium* (common yarrow), *Anthoxanthum odoratum* (sweet vernalgrass), *Dactylis glomerata* (orchardgrass), *Euthamia graminifolia* (flat-top goldentop), *Phleum pratense* (timothy), *Rumex acetosella* (common sheep sorrel), *Solidago canadensis* (Canada goldenrod), *Solidago canadensis* var. *scabra* (tall goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod).

Other Noteworthy Species:

Species	GRank	Type	Note
Anthoxanthum odoratum (sweet vernalgrass)		plant	exotic
Bromus tectorum (cheatgrass)		plant	exotic
Dactylis glomerata (orchardgrass)		plant	exotic
Daucus carota (Queen Anne's lace)		plant	exotic
Elymus repens (quackgrass)		plant	exotic
Lolium perenne (perennial ryegrass)		plant	exotic
Phleum pratense (timothy)		plant	exotic
Poa compressa (Canada bluegrass)		plant	exotic

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is quite wide-ranging in northeastern and midwestern states and possibly occurs at higher elevations in the southeastern states.

States/Provinces: CT, DE, KY, MA, MD, ME, NB?, NH, NJ, NS?, NY, PA, QC?, RI, TN, VA, VT, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Appomattox Court House, Booker T. Washington, Boston Harbor Islands, Cape Cod, Colonial, Delaware Water Gap, Fire Island, Fort Necessity, Fredericksburg-Spotsylvania, Friendship Hill, Gateway, George Washington Birthplace, Gettysburg, Johnstown Flood, Marsh-Billings-Rockefeller, Minute Man, Morristown, Petersburg, Richmond, Saint-Gaudens, Saratoga, Upper Delaware, Valley Forge, Weir Farm); USFWS (Aroostook, Assabet River, Carlton Pond, Erie, Great Meadows, Iroquois, Montezuma, Moosehorn, Nulhegan Basin, Oxbow, Parker River).

CONSERVATION STATUS

Rank: GNA (modified/managed) (8-Dec-2005).

Reasons: This vegetation type includes pasture and post-agricultural fields and is largely composed of nonnative grasses and herbs (generally of European origin).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: *Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation (CEGL006333) is similar to this type but is dominated by warm-season grasses.

Similar Associations:

- *Lolium (arundinaceum, pratense)* Herbaceous Vegetation (CEGL004048).
- *Panicum virgatum - (Andropogon virginicus)* Herbaceous Vegetation (CEGL006616).
- *Phleum pratense - Bromus pubescens - Helenium autumnale* Herbaceous Vegetation (CEGL004018).
- *Schizachyrium scoparium - (Andropogon virginicus) - Solidago* spp. Herbaceous Vegetation (CEGL006333)--has a greater component of native species and occurs on drier soils.

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler.

References: Clark 1986, Dowhan and Rozsa 1989, Eastern Ecology Working Group n.d., Edinger et al. 2002, Ehrenfeld 1977, Elliman 2003, Keever 1979, NRCS 2004, Newbold et al. 1988, Perles et al. 2006a, Perles et al. 2006b, Perles et al. 2006c, Perles et al. 2007, Sneddon et al. 1995, TDNH unpubl. Data.

No photo available.

COMMON NAME (PARK-SPECIFIC): LITTLE BLUESTEM - POVERTY GRASS LOW- TO MID-ELEVATION OUTCROP OPENING

SYNONYMS

USNVC English Name: **Little Bluestem - Poverty Oatgrass - Pennsylvania Sedge / Cup Lichen species Herbaceous Vegetation**

USNVC Scientific Name: ***Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica / Cladonia* spp. Herbaceous Vegetation**

USNVC Identifier: **CEGL006544**

LOCAL INFORMATION

Environmental Description: This association occurs on ridgetop rocky summits, bedrock outcrops, and thin soils on level to occasionally sloping ground at moderately high elevations. Vegetation is rooted in crevices and in thin, well-drained, stony soil over bedrock.

Vegetation Description: Trees and shrubs cover 20% or less of the area and include white oak (*Quercus alba*) and black cherry (*Prunus serotina*) in the sparse tree canopy layer; short shrubs include sweet fern (*Comptonia peregrina*), lowbush blueberry (*Vaccinium angustifolium*), deerberry (*Vaccinium stamineum*), and Blue Ridge blueberry (*Vaccinium pallidum*). Prominent vegetation includes herbaceous and graminoid species. Characteristic species include wavy hairgrass (*Deschampsia flexuosa*), Pennsylvania sedge (*Carex pensylvanica*), poverty oatgrass (*Danthonia spicata*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), and dwarf cinquefoil (*Potentilla canadensis*). Greygreen reindeer lichen (*Cladina rangiferina*) can be common.

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Comptonia peregrina* (sweet fern), *Vaccinium angustifolium* (lowbush blueberry)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge), *Deschampsia flexuosa* (wavy hairgrass)

Characteristic Species: *Carex pensylvanica* (Pennsylvania sedge), *Comptonia peregrina* (sweet fern), *Deschampsia flexuosa* (wavy hairgrass), *Vaccinium angustifolium* (lowbush blueberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Cladina rangiferina (greygreen reindeer lichen)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S3	1	Rocky Summit Grassland	Edinger et al. 2002
PA	S2	1	Little Bluestem - Pennsylvania Sedge Opening	Fike 1999

Local Range: This association can occur throughout Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.127, UPDE.185.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
Alliance	*Schizachyrium scoparium - (Sporobolus cryptandrus)* Herbaceous Alliance (A.1224)
Alliance (English name)	Little Bluestem - (Sand Dropseed) Herbaceous Alliance
Association	*Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica / Cladonia* spp. Herbaceous Vegetation
Association (English name)	Little Bluestem - Poverty Oatgrass - Pennsylvania Sedge / Cup Lichen species Herbaceous Vegetation
Ecological System(s):	Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: These grassy openings are found on rock outcrops and summits at 365-1220 m (1200-4000 feet) elevation in the Central Appalachians and adjacent regions. Settings include flat summits, outcrops, plateaus and southwest-facing upper slopes. Bare rock (acidic sandstone and conglomerates) typically makes up a large part of the cover. *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), and *Deschampsia flexuosa* (wavy hairgrass) are all typical. Total herbaceous cover is usually 25-50%. Other associates include *Carex pensylvanica* (Pennsylvania sedge), *Piptatherum pungens* (mountain ricegrass), *Piptatherum racemosum* (blackseed ricegrass), *Prunus pumila* (sandcherry), *Rumex acetosella* (common sheep sorrel), *Rubus* (blackberry) spp., *Sibbaldiopsis tridentata* (shrubby fivefingers), *Cladonia* (cup lichen) sp., and *Umbilicaria* (navel lichen) sp. There may be small patches of shrubs within the graminoid matrix, including *Vaccinium* (blueberry) spp., *Gaylussacia baccata* (black huckleberry), and *Photinia melanocarpa* (black chokeberry).

Environmental Description: This association occurs on rock outcrops and summits at 365-1220 m (1200-4000 feet) elevation in the Central Appalachians and adjacent regions. Settings include flat summits, outcrops, plateaus and southwest-facing upper slopes. Bare rock (acidic sandstone and conglomerates) typically makes up a large part of the cover.

Vegetation Description: *Danthonia spicata* (poverty oatgrass), *Schizachyrium scoparium* (little bluestem), and *Deschampsia flexuosa* (wavy hairgrass) are all typical. Total herbaceous cover is usually 25-50%. Other associates include *Carex pensylvanica* (Pennsylvania sedge), *Piptatherum pungens* (mountain ricegrass), *Piptatherum racemosum* (blackseed ricegrass), *Prunus pumila* (sandcherry), *Rumex acetosella* (common sheep sorrel), *Rubus* (blackberry) spp., *Sibbaldiopsis tridentata* (shrubby fivefingers), *Cladonia* (cup lichen) sp., and *Umbilicaria* (navel lichen) sp. There may be small patches of shrubs within the graminoid matrix, including *Vaccinium* (blueberry) spp., *Gaylussacia baccata* (black huckleberry), and *Photinia melanocarpa* (black chokeberry).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Rumex acetosella* (common sheep sorrel)
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass)

Characteristic Species: *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Gaylussacia baccata* (black huckleberry), *Schizachyrium scoparium* (little bluestem).

Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: Information not available.
States/Provinces: CT, NJ, NY:S3, PA:S2.
Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS
Rank: GNR (8-Jul-1999).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler.
References: Eastern Ecology Working Group n.d., Fike 1999.



Figure E42. Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening in Upper Delaware Scenic and Recreational River (Plot UPDE.185). July 2005. NAD 1983 / UTM easting 515160, northing 4586897.

COMMON NAME (PARK-SPECIFIC): RIVERSIDE PRAIRIE GRASSLAND

SYNONYMS

USNVC English Name: **Sand Cherry / Big Bluestem - Yellow Indiangrass Herbaceous Vegetation**

USNVC Scientific Name: ***Prunus pumila / Andropogon gerardii - Sorghastrum nutans* Herbaceous Vegetation**

USNVC Identifier: **CEGL006518**

LOCAL INFORMATION

Environmental Description: This community occurs on sand/gravel and cobble deposits along shorelines and on islands in the Delaware River. These sites are subject to seasonal heavy flooding, which removes woody vegetation and maintains a graminoid- and herbaceous-dominated assemblage.

Vegetation Description: This association resembles a tall, dry, prairie-like grassland, particularly in summer and early fall. A sparse assortment of seedlings and short shrubs may be present, including river birch (*Betula nigra*), American sycamore (*Platanus occidentalis*), sandcherry (*Prunus pumila*), willow species (*Salix* spp.), bear oak (*Quercus ilicifolia*), Carolina rose (*Rosa carolina*), Blue Ridge blueberry (*Vaccinium pallidum*), and common winterberry (*Ilex verticillata*). The vegetation is strongly dominated by big bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum nutans*). Characteristic associated species can be wrinkleleaf goldenrod (*Solidago rugosa*), prairie cordgrass (*Spartina pectinata*), little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), horseflyweed (*Baptisia tinctoria*), giant goldenrod (*Solidago gigantea*), early goldenrod (*Solidago juncea*), Canada goldenrod (*Solidago canadensis*), and eastern marsh fern (*Thelypteris palustris*), among many others.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Betula nigra* (river birch), *Prunus pumila* (sandcherry)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indiangrass)

Characteristic Species: *Andropogon gerardii* (big bluestem), *Betula nigra* (river birch), *Prunus pumila* (sandcherry), *Sorghastrum nutans* (Indiangrass).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S1*	1	Riverside Ice Meadow	Edinger et al. 2002
PA	S3*	1	Big Bluestem - Indian Grass River Grassland	Fike 1999

Local Range: This community occurs along shorelines and on islands in the Delaware River.

Classification Comments: This association occurs at a slightly higher elevation than Reed Canarygrass Eastern Marsh and Hairy-fruit Sedge Wetland; it can be associated with or be surrounded by Sycamore - Mixed Hardwood Riverine Shrubland.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.96, UPDE.97, UPDE.121, UPDE.123, UPDE.145, UPDE.146, UPDE.152, UPDE.153, UPDE.193, UPDE.219.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Temporarily flooded temperate or subpolar grassland (V.A.5.N.j.)
Alliance	*Andropogon gerardii - (Sorghastrum nutans)* Temporarily Flooded Herbaceous Alliance (A.1337)
Alliance (English name)	Big Bluestem - (Yellow Indiangrass) Temporarily Flooded Herbaceous Alliance
Association	*Prunus pumila / Andropogon gerardii - Sorghastrum nutans* Herbaceous Vegetation
Association (English name)	Sand Cherry / Big Bluestem - Yellow Indiangrass Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept Summary: These are tall alluvial grasslands in the temperate region of the northeastern United States. They are found on sandy point bars and linear deposits along semi-stable rivershores subject to periodic flooding. Ice build-up during the winter can scour the rivershore in spring, limiting woody growth. The substrate is cobble, gravel or coarse sediment with interstices of alluvial sand and silt. Bare cobble is exposed in some areas. Herbaceous plants dominate, and may form a dense cover; scattered shrubs may grow among them, but are generally kept short by the annual flooding. Bryophytes are absent or at most sparse. The dominant plants are tall grasses such as *Sorghastrum nutans* (Indiangrass), *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), and *Panicum virgatum* (switchgrass). Characteristic herbs include *Helianthemum canadense* (longbranch frostweed), *Helianthus divaricatus* (woodland sunflower), *Asclepias tuberosa* (butterfly milkweed), and *Lespedeza capitata* (roundhead lespedeza). *Spiraea alba* (white meadowsweet), *Rosa virginiana* (Virginia rose), *Quercus ilicifolia* (bear oak), *Betula nigra* (river birch), and *Prunus pumila* (sandcherry) are common shrubs. Other herbaceous associates include *Anemone virginiana* (tall thimbleweed), *Calamagrostis canadensis* (bluejoint), *Eupatorium maculatum* (spotted joepyeweed), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago nemoralis* (gray goldenrod), *Solidago gigantea* (giant goldenrod), *Spartina pectinata* (prairie cordgrass), *Achillea millefolium* (common yarrow), *Baptisia tinctoria* (horseflyweed), *Asclepias syriaca* (common milkweed), *Dichanthelium clandestinum* (deertongue), *Euthamia graminifolia* (flat-top goldentop), *Apocynum androsaemifolium* (spreading dogbane), *Thelypteris palustris* (eastern marsh fern), *Lycopus uniflorus* (northern bugleweed), *Phalaris arundinacea* (reed canarygrass), *Scleria triglomerata* (whip nutrush), and *Symphyotrichum novi-belgii* (New York aster). This association differs from more northerly riverside ice meadows in being dominated by prairie grasses (*Andropogon gerardii* (big bluestem), *Sorghastrum nutans)* rather than by *Calamagrostis canadensis* (bluejoint).

Environmental Description: These are tall alluvial grasslands in the temperate region of the northeastern United States. They are found on sandy point bars and linear deposits along semi-stable rivershores subject to periodic flooding. Ice build-up during the winter can scour the rivershore in spring, limiting woody growth. The substrate is cobble, gravel or coarse sediment with interstices of alluvial sand and silt. Bare cobble is exposed in some areas.

Vegetation Description: Herbaceous plants dominate and may form a dense cover; scattered shrubs may grow among them but are generally kept short by annual flooding. Bryophytes are absent or at most sparse. The dominant plants are tall grasses such as *Sorghastrum nutans*

(Indiangrass), *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), and *Panicum virgatum* (switchgrass). Characteristic herbs include *Helianthemum canadense* (longbranch frostweed), *Helianthus divaricatus* (woodland sunflower), *Apocynum cannabinum* (Indianhemp), *Asclepias tuberosa* (butterfly milkweed), *Lespedeza hirta* (hairy lespedeza), and *Lespedeza capitata* (roundhead lespedeza). *Spiraea alba* (white meadowsweet), *Rosa virginiana* (Virginia rose), *Quercus ilicifolia* (bear oak), *Betula nigra* (river birch), and *Prunus pumila* (sandcherry) are common shrubs. Other herbaceous associates include *Anemone virginiana* (tall thimbleweed), *Calamagrostis canadensis* (bluejoint), *Eupatorium maculatum* (spotted joepyeweed), *Solidago rugosa*, *Solidago gigantea* (giant goldenrod), *Solidago nemoralis* (gray goldenrod), *Spartina pectinata* (prairie cordgrass), *Baptisia tinctoria* (horseflyweed), *Asclepias syriaca* (common milkweed), *Dichanthelium clandestinum* (deertongue), *Euthamia graminifolia* (flat-top goldentop), *Thelypteris palustris* (eastern marsh fern), *Achillea millefolium* (common yarrow), *Lycopus uniflorus*, *Phalaris arundinacea* (reed canarygrass), *Scleria triglomerata* (whip nutrush), and *Symphyotrichum novi-belgii* (New York aster).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Apocynum cannabinum* (Indianhemp), *Lespedeza hirta* (hairy lespedeza)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Panicum virgatum* (switchgrass), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (Indiangrass)

Characteristic Species: *Andropogon gerardii* (big bluestem), *Panicum virgatum* (switchgrass), *Prunus pumila* var. *susquehanae* (Sesquehana sandcherry), *Sorghastrum nutans* (Indiangrass).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: Information not available.
States/Provinces: CT, MA, NH, NJ, NY, PA, VT.
Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS
Rank: GNR (6-Jul-1999).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts:
- Willow - Indian grass riverine shrubland (Perles et al. 2004) B

SOURCES
Description Authors: S. C. Gawler, mod. E. Largay.
References: Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Metzler and Barrett 2001, Nichols et al. 2001, Perles et al. 2004, Thompson and Sorenson 2000.



Figure E43. Riverside Prairie Grassland in Upper Delaware Scenic and Recreational River (Plot UPDE.121). September 2005. NAD 1983 / UTM easting 517432, northing 4585549.



Figure E44. Riverside Prairie Grassland in Upper Delaware Scenic and Recreational River (Plot UPDE.96). September 2005. NAD 1983 / UTM easting 521751, northing 4584490.

COMMON NAME (PARK-SPECIFIC): HAIRY-FRUIT SEDGE WETLAND

SYNONYMS
USNVC English Name: **Hairy-fruit Sedge Herbaceous Vegetation**
USNVC Scientific Name: ***Carex trichocarpa* Herbaceous Vegetation**
USNVC Identifier: **CEGL006447**

LOCAL INFORMATION

Environmental Description: This association is found occasionally in patches on gently sloping, moist shoreline sand/gravel deposits, and on islands in the mainstem of the Upper Delaware River, as well as on the floodplains of major tributaries where tree canopy is lacking. This community is routinely flooded during most high-water events and commonly occurs on low flats associated with the active floodplain, either directly adjacent to the channel or in association with backwater depressions and sloughs.

Vegetation Description: This community is strongly dominated by hairyfruit sedge (*Carex trichocarpa*) with a diverse range of herbaceous associates, including reed canarygrass (*Phalaris arundinacea*), Emory's sedge (*Carex emoryi*), giant goldenrod (*Solidago gigantea*), prairie cordgrass (*Spartina pectinata*), flat-top goldentop (*Euthamia graminifolia*), jewelweed (*Impatiens capensis*), knotweeds (*Polygonum* spp.), deertongue (*Dichanthelium clandestinum*), Canada germander (*Teucrium canadense*), common milkweed (*Asclepias syriaca*), eastern hayscented fern (*Dennstaedtia punctilobula*), Nepalese smartweed (*Persicaria nepalensis*), and common ladyfern (*Athyrium filix-femina*). Fringed black bindweed (*Polygonum cilinode*), a herbaceous vine, can be abundant at some sites. Occasionally, a few trees or shrubs are present. Shrubby St. Johnswort (*Hypericum prolificum*) is a common short shrub. Other woody species include bitternut hickory (*Carya cordiformis*), black oak (*Quercus velutina*), and gray birch (*Betula populifolia*); northern dewberry (*Rubus flagellaris*) and Japanese barberry (*Berberis thunbergii*) are occasionally present.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex trichocarpa* (hairyfruit sedge)

Characteristic Species: *Carex trichocarpa* (hairyfruit sedge), *Hypericum prolificum* (shrubby St. Johnswort), *Solidago gigantea* (giant goldenrod), *Teucrium canadense* (Canada germander).

Other Noteworthy Species:

Species	GRank	Type	Note
Dennstaedtia punctilobula(eastern hayscented fern)		plant	
Euthamia graminifolia (flat-top goldentop)		plant	
Phalaris arundinacea (reed canarygrass)		plant	
Spartina pectinata (prairie cordgrass)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Shallow Emergent Marsh	Edinger et al. 2002
PA	S3		[not crosswalked]	

Local Range: This association occurs on shorelines and islands throughout of the Upper Delaware River.

Classification Comments: At three sites in the park (UPDE.AA.484, UPDE.AA.516, UPDE.AA.524), a sedge tentatively identified as *Carex emoryi* (Emory's sedge) was dominant, with greater cover than *Carex trichocarpa* (hairyfruit sedge). However, the environmental setting and associated species at these sites were very similar to that described above for this

association. Because the dominant sedge could not be conclusively identified and there is no current association in the USNVC describing riparian herbaceous vegetation strongly dominated by Emory's sedge, these sites were classified as Hairy-fruit Sedge Wetland until further information is gathered on these areas.
Other Comments: Information not available.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.24, UPDE.25, UPDE.28, UPDE.92.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Temporarily flooded temperate or subpolar grassland (V.A.5.N.j.)
Alliance	*Carex torta* Temporarily Flooded Herbaceous Alliance (A.1340)
Alliance (English name)	Twisted Sedge Temporarily Flooded Herbaceous Alliance
Association	*Carex trichocarpa* Herbaceous Vegetation
Association (English name)	Hairy-fruit Sedge Herbaceous Vegetation
Ecological System(s):	Central Appalachian River Floodplain (CES202.608). Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: This association occurs in small patches on floodplain edges, deposition bars, and islands where tree canopy is lacking, on medium- to large-sized rivers in the mid-Atlantic region and on third- or fourth-order streams above 800 m elevation in the Central Appalachians. This community is routinely flooded during most high-water events and commonly occurs on low flats associated with the active floodplain, either directly adjacent to the channel or in association with backwater depressions and sloughs. Ice-scour during high winter flows contributes to the open physiognomy of this community. *Carex trichocarpa* (hairyfruit sedge) is the dominant species in this association. Shrubs may be present but at less than 25% cover, including *Rosa multiflora* (multiflora rose), *Cornus amomum* (silky dogwood), and *Rubus allegheniensis* (Allegheny blackberry). This type is susceptible to invasion by *Phalaris arundinacea* (reed canarygrass). Other common herbaceous species include *Solidago gigantea* (giant goldenrod), *Boehmeria cylindrica* (small-spike false nettle), *Dichanthelium clandestinum* (deertongue), *Urtica dioica* (stinging nettle), *Polygonum* (knotweed) spp., *Scirpus cyperinus* (woolgrass), *Euthamia graminifolia* var. *graminifolia* (flat-top goldentop), *Verbena hastata* var. *hastata* (swamp verbena), *Doellingeria umbellata* var. *umbellata* (parasol whitetop), *Asclepias syriaca* (common milkweed), *Arisaema triphyllum* (Jack in the pulpit), *Onoclea sensibilis* (sensitive fern), and *Lilium superbum* (turk's-cap lily). Vines may be present at low cover, including *Polygonum convolvulus* (black bindweed) and *Clematis virginiana* (devil's darning needles).
Environmental Description: This association is found occasionally in small patches on floodplain edges, deposition bars, and islands where tree canopy is lacking. It occurs along medium- to large-sized rivers in the mid-Atlantic region and on third- or fourth-order streams above 800 m elevation in the Central Appalachians. This community is routinely flooded during most high-water events and commonly occurs on low flats associated with the active floodplain,

either directly adjacent to the channel or in association with backwater depressions and sloughs. Ice-scour during high winter flows contributes to the open physiognomy of this community. In New Jersey and Pennsylvania, typical soils include coarse loamy to sandy, somewhat poorly to very poorly drained glacio-fluvial deposits. In West Virginia, the community occurs on moderately poorly to well-drained sandy loam or silt loam with pH averaging 4.8 (n=4), underlain by fluvial deposits including stratified sediments, cobbles, and organic inclusions. Hydric soil indicators include alluvial depleted matrix and iron/manganese masses (Byers et al. 2007).

Vegetation Description: This herbaceous floodplain prairie occurs in the mid-Atlantic region and Central Appalachians. The community is dominated by dense rhizomatous stands of *Carex trichocarpa* (hairyfruit sedge), which can tolerate annual sediment deposition and occasional high-energy ice-scour. Shrubs may be present but at less than 25% cover, including *Rosa multiflora* (multiflora rose), *Cornus amomum* (silky dogwood), and *Rubus allegheniensis* (Allegheny blackberry). This type is susceptible to invasion by *Phalaris arundinacea* (reed canarygrass). Other common herbaceous species include *Solidago gigantea* (giant goldenrod), *Boehmeria cylindrica* (small-spike false nettle), *Dichanthelium clandestinum* (deertongue), *Urtica dioica* (stinging nettle), *Polygonum* (knotweed) spp., *Scirpus cyperinus* (woolgrass), *Euthamia graminifolia* var. *graminifolia* (flat-top goldentop), *Verbena hastata* var. *hastata* (swamp verbena), *Doellingeria umbellata* var. *umbellata* (parasol whitetop), *Asclepias syriaca* (common milkweed), *Arisaema triphyllum* (Jack in the pulpit), *Onoclea sensibilis* (sensitive fern), *Lilium superbum* (turk's-cap lily), *Carex projecta* (necklace sedge), *Thalictrum pubescens* (king-of-the-meadow), *Veratrum viride* (green false hellebore), *Elymus riparius* (riverbank wildrye), and *Solidago rugosa* (wrinkleleaf goldenrod). Vines may be present at low cover, including *Polygonum convolvulus* (black bindweed) and *Clematis virginiana* (devil's darning needles). Cover by nonvascular plants is insignificant. Mean species richness of vascular plants is 27 taxa per 400 square meters for 4 plots in West Virginia (Byers et al. 2007).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex trichocarpa* (hairyfruit sedge)

Characteristic Species: *Boehmeria cylindrica* (small-spike false nettle), *Carex trichocarpa* (hairyfruit sedge), *Cornus amomum* (silky dogwood), *Dichanthelium clandestinum* (deertongue), *Solidago gigantea* (giant goldenrod).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community occurs in northern New Jersey, northeastern Pennsylvania, southeastern New York, and the Allegheny Mountains region of West Virginia.

States/Provinces: NJ, NY, PA:S3, WV:S1.

Federal Lands: NPS (Delaware Water Gap, Saratoga, Upper Delaware).

CONSERVATION STATUS

Rank: G3 (15-May-2007).

Reasons: This community occurs on the upper Delaware River but not on the Susquehanna River (G. Podniesinski pers. comm.). It is critically imperiled (two occurrences, slightly threatened by *Phalaris arundinacea* (reed canarygrass) invasion) in West Virginia. Its status north and east of Pennsylvania is unknown.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: This community is described from the Delaware Water Gap, where it is distinct although often narrow and linear, and from the Central Appalachians of West Virginia. In West Virginia, it is represented by 4 plots (2 occurrences), which cluster consistently and ordinate closely, near the high-elevation riverscour and tall-herb floodplain types. Occurrence elsewhere in the northeastern U.S. needs to be documented.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler, mod. E. A. Byers.
References: Byers et al. 2007, Eastern Ecology Working Group n.d., NRCS 2004, Podniesinski pers. comm.



Figure E45. Hairy-fruit Sedge Wetland in Upper Delaware Scenic and Recreational River (Plot UPDE.25). August 2005. NAD 1983 / UTM easting 491626, northing 4624478.



Figure E46. Hairy-fruit Sedge Wetland in Upper Delaware Scenic and Recreational River (Plot UPDE.28). July 2005. NAD 1983 / UTM easting 486088, northing 4633481.

COMMON NAME (PARK-SPECIFIC): REED CANARYGRASS EASTERN MARSH

SYNONYMS
USNVC English Name: **Reed Canarygrass Eastern Herbaceous Vegetation**
USNVC Scientific Name: ***Phalaris arundinacea* Eastern Herbaceous Vegetation**
USNVC Identifier: **CEGL006044**

LOCAL INFORMATION

Environmental Description: This association occurs along the Upper Delaware River and its tributaries on both shoreline sand/gravel deposits and on islands, forming large, level floodplain marshes that may have small, winding drainages running through them. They are exposed to frequent floods, high stream velocity and ice-scour. The underlying bedrock is Devonian-age sandstone, siltstone, and shale in the Catskill Formation; surficial deposits consist of coarse alluvial sand, gravel, and cobbles.

Vegetation Description: This wetland association is strongly dominated by reed canarygrass (*Phalaris arundinacea*). Common associates, present at variable abundances, include big bluestem (*Andropogon gerardii*), flat-top goldentop (*Euthamia graminifolia*), sensitive fern (*Onoclea sensibilis*), common milkweed (*Asclepias syriaca*), smallspike false nettle (*Boehmeria cylindrica*), prairie cordgrass (*Spartina pectinata*), spreading dogbane (*Apocynum androsaemifolium*), giant goldenrod (*Solidago gigantea*), spotted joepyeweed (*Eupatorium maculatum*), and eastern marsh fern (*Thelypteris palustris*).

Most Abundant Species:

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

Characteristic Species: *Phalaris arundinacea* (reed canarygrass).

Other Noteworthy Species:

Species	GRank	Type	Note
Andropogon gerardii (big bluestem)		plant	
Euthamia graminifolia (flat-top goldentop)		plant	
Lythrum salicaria (purple loosestrife)		plant	exotic noxious weed

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Shallow Emergent Marsh	Edinger et al. 2002
PA	S5*	1	Bluejoint - Reed Canary Grass Marsh	Fike 1999

Local Range: This association can be widespread in Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.21, UPDE.65, UPDE.90, UPDE.91, UPDE.132.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
Alliance	*Phalaris arundinacea* Seasonally Flooded Herbaceous Alliance (A.1381)
Alliance (English name)	Reed Canarygrass Seasonally Flooded Herbaceous Alliance
Association	*Phalaris arundinacea* Eastern Herbaceous Vegetation
Association (English name)	Reed Canarygrass Eastern Herbaceous Vegetation
Ecological System(s):	Central Interior Highlands and Appalachian Sinkhole and Depression Pond (CES202.018). North-Central Interior Floodplain (CES202.694). Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582).

GLOBAL DESCRIPTION

Concept Summary: This association is found throughout the northeastern United States and Canada, but its distribution as a natural type is complicated elsewhere. *Phalaris arundinacea* 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* 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: 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: 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 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:

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

Characteristic Species: *Phalaris arundinacea* (reed canarygrass).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION

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.
States/Provinces: CT, DE, IA, IN, MA, MD, ME, MN, NH, NJ, NY, OH, ON, PA, RI, TN, VA, VT, WV.
Federal Lands: NPS (Allegheny Portage Railroad, C&O Canal?, Catoctin Mountain?, Delaware Water Gap, Effigy Mounds, Eisenhower, Gettysburg, Indiana Dunes, Saint Croix, Saratoga, Saugus Iron Works, Upper Delaware); USFWS (Assabet River?, Erie, Great Meadows?, Great Swamp, Iroquois, Montezuma, Oxbow, Parker River).

CONSERVATION STATUS

Rank: GNA (invasive) (1-Dec-1997).
Reasons: *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 INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
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).

Similar Associations:

- *Calamagrostis canadensis - Phalaris arundinacea* Herbaceous Vegetation (CEGL005174).
- *Phalaris arundinacea* Western Herbaceous Vegetation (CEGL001474).

Related Concepts:

- Bottomland old fields (Vanderhorst 2001a) =
- Palustrine Persistent Emergent Wetland (PEM1) (Cowardin et al. 1979) ?
- Reed canary grass riverine grassland (Perles et al. 2004) ?
- SNE low-energy riverbank community (Rawinski 1984) ?
- Shallow Emergent Marsh (Thompson 1996) ?
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

SOURCES

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

References: Apfelbaum and Sams 1987, Barnes 1999, Cowardin et al. 1979, Edinger et al. 2002, Fike 1999, Metzler and Barrett 2001, Midwestern Ecology Working Group n.d., NRCS 2004, Perles et al. 2004, Perles et al. 2007, 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.



Figure E47. Reed Canarygrass Eastern Marsh in Upper Delaware Scenic and Recreational River (Plot UPDE.21). July 2005. NAD 1983 / UTM easting 491354, northing 4624762.

COMMON NAME (PARK-SPECIFIC): EASTERN REED MARSH

SYNONYMS

USNVC English Name: **Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation**

USNVC Scientific Name: ***Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation**

USNVC Identifier: **CEGL004141**

LOCAL INFORMATION

Environmental Description: This wetland type occurs in depressions and basins that contain ponded water nearly all year. In general, water flow out of the sites is restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. These wetlands typically occur on very poorly drained soils such as mucky silt loam or shallow mucky peat, and they are often associated with human disturbance.

Vegetation Description: This association contains standing water for most or all of the year and is often associated with impounded drainages, ponded areas near streams, or saturated areas surrounding drainages. Vegetation is strongly dominated by common reed (*Phragmites australis*), which can form nearly monotypic stands.

Most Abundant Species:

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

Characteristic Species: *Phragmites australis* (common reed).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Reedgrass Marsh	Edinger et al. 2002
PA	SNA		[not crosswalked]	.

Local Range: This association is widespread in Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: None.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l.)
Alliance	*Phragmites australis* Semipermanently Flooded Herbaceous Alliance (A.1431)
Alliance (English name)	Common Reed Semipermanently Flooded Herbaceous Alliance
Association	*Phragmites australis* Eastern North America Temperate Semi-natural Herbaceous Vegetation
Association (English name)	Common Reed Eastern North America Temperate Semi-natural Herbaceous Vegetation

Ecological System(s): Southeastern Coastal Plain Interdunal Wetland (CES203.258).
Northern Atlantic Coastal Plain Tidal Salt Marsh (CES203.519).
Laurentian-Acadian Wet Meadow-Shrub Swamp (CES201.582).
Laurentian-Acadian Freshwater Marsh (CES201.594).
North-Central Interior Freshwater Marsh (CES202.899).
Semi-natural / Altered Vegetation and Conifer Plantations (CES203.074).

GLOBAL DESCRIPTION

Concept 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: Stands occur in semipermanently flooded marshes, ditches, impoundments, etc. that have often been disturbed by human activity.

Vegetation Description: 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:

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

Characteristic Species: *Phragmites australis* (common reed).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

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.

States/Provinces: AL, AR, CT, DE, FL, GA, IA, IN, LA, MA, MD, ME, MI, MN, MS, NC, NH, NJ, NY, OH, ON, PA, RI, SC, TX, VA, VT, WI, WV.

Federal Lands: NPS (Assateague Island, Boston Harbor Islands, Cape Cod, Indiana Dunes, Minute Man, Saint Croix, Saratoga, Sleeping Bear Dunes, Upper Delaware, Voyageurs); USFWS (Alligator River, Aransas, Bon Secour, Brazoria, Great Dismal Swamp, Great Meadows, Great Swamp, Matagorda Island, Montezuma, Nomans Land Island?, Oxbow, Parker River, Prime Hook).

CONSERVATION STATUS

Rank: GNA (invasive) (23-Nov-1997).

Reasons: 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 INFORMATION

Status: Standard.

Confidence: 1 - Strong.

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 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).

Similar Associations:

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

Related Concepts:

- *Phragmites australis* community (Metzler and Barrett 1992) ?
- *Phragmites australis* tidal marsh association (Clancy 1993b) ?
- Inland Emergent Marsh (Chapman et al. 1989) B
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

SOURCES

Description Authors: D. Faber-Langendoen.

References: Bailey 1997, Bailey 1998, Bell et al. 2002, Chapman et al. 1989, Clancy 1993b, Harris et al. 1996, INAI unpubl. data, Metzler and Barrett 1992, Metzler and Barrett 2001, NRCS 2004, Nelson 1986, Rawinski 1984, Schafale and Weakley 1990, Schotz pers. comm., Southeastern Ecology Working Group n.d., Swain and Kearsley 2001.

No photo available.

COMMON NAME (PARK-SPECIFIC): EASTERN CATTAIL MARSH

SYNONYMS

USNVC English Name: **(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Eastern Herbaceous Vegetation**

USNVC Scientific Name: ***Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Eastern Herbaceous Vegetation**

USNVC Identifier: **CEGL006153**

LOCAL INFORMATION

Environmental Description: This variable wetland type occurs in depressions and basins that contain ponded water nearly all year. In general, waterflow out of the sites is restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. These wetlands typically occur on very poorly drained soils such as mucky silt loam or shallow mucky peat.

Vegetation Description: This association contains standing water for most or all of the year and is often associated with impounded drainages, ponded areas near streams, or saturated areas surrounding drainages. Vegetation is dominated by cattails (*Typha* spp.), which can have 30-75% cover.

Most Abundant Species: Information not available.

Characteristic Species: Information not available.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Shallow Emergent Marsh	Edinger et al. 2002
PA	S5	1	Cattail Marsh	Fike 1999

Local Range: This association can occur throughout Upper Delaware Scenic and Recreational River.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: None.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial graminoid vegetation (V.A.)
Physiognomic Group	Temperate or subpolar grassland (V.A.5.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
Formation	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l.)
Alliance	*Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance (A.1436)
Alliance (English name)	(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance
Association	*Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Eastern Herbaceous Vegetation
Association (English name)	(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Eastern Herbaceous Vegetation
Ecological System(s):	Laurentian-Acadian Freshwater Marsh (CES201.594).

GLOBAL DESCRIPTION

Concept Summary: These tall emergent marshes are common throughout the northeastern United States and adjacent Canadian provinces. They occur in permanently flooded basins, often as part of a larger wetland mosaic and associated with lakes, ponds, or slow-moving streams. The substrate is muck over mineral soil. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. Tall graminoids dominate the vegetation; scattered shrubs are often present (usually totaling less than 25% cover) and are frequently shorter than the graminoids. Trees are absent. Bryophyte cover varies and is rarely extensive; bryophytes are mostly confined to the hummocks. *Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail), or their hybrid *Typha X glauca* (blue cattail) dominate, either alone or in combination with other tall emergent marsh species. Associated species vary widely; sedges, such as *Carex aquatilis* (water sedge), *Carex lurida* (shallow sedge), *Carex rostrata* (beaked sedge), *Carex pellita* (woolly sedge), *Carex stricta* (upright sedge), *Scirpus cyperinus* (woolgrass), and bulrushes, such as *Schoenoplectus americanus* (chairmaker's bulrush) and *Schoenoplectus acutus* (hardstem bulrush), occur along with patchy grasses, such as *Calamagrostis canadensis* (bluejoint). Broad-leaved herbs include *Thelypteris palustris* (eastern marsh fern), *Asclepias incarnata* (swamp milkweed), *Onoclea sensibilis* (sensitive fern), *Symplocarpus foetidus* (skunk-cabbage), *Calla palustris* (water arum), *Impatiens capensis* (jewelweed), *Sagittaria latifolia* (broadleaf arrowhead), *Scutellaria lateriflora* (blue skullcap), *Sparganium eurycarpum* (broadfruit bur-reed), and *Verbena hastata* (swamp verbena). Floating aquatics, such as *Lemna minor* (common duckweed), may be common in deeper zones. Shrub species vary across the geographic range of this type; in the northern part of its range, *Myrica gale* (sweetgale), *Ilex verticillata* (common winterberry), and *Spiraea alba* (white meadowsweet) are common. The invasive exotic plants *Lythrum salicaria* (purple loosestrife) and *Phragmites australis* (common reed) may be abundant in parts of some occurrences. This association is distinguished from other northeastern freshwater marshes by the strong dominance of *Typha* (cattail) spp.

Environmental Description: These tall emergent marshes are common throughout the northeastern United States and adjacent Canadian provinces. They occur in permanently flooded basins, often as part of a larger wetland mosaic and associated with lakes, ponds, or slow-moving streams. The substrate is muck over mineral soil. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat. This association is often found in impounded waters.

Vegetation Description: Tall graminoids dominate the vegetation; scattered shrubs are often present (usually totaling less than 25% cover) and are frequently shorter than the graminoids. Trees are absent. Bryophyte cover varies and is rarely extensive; bryophytes are mostly confined to the hummocks. *Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail), or their hybrid *Typha X glauca* (blue cattail) dominate, either alone or in combination with other tall emergent marsh species. Associated species vary widely; sedges, such as *Carex aquatilis* (water sedge), *Carex lurida* (shallow sedge), *Carex rostrata* (beaked sedge), *Carex pellita* (woolly sedge), *Carex stricta* (upright sedge), *Scirpus cyperinus* (woolgrass), and bulrushes, such as *Schoenoplectus americanus* (chairmaker's bulrush) and *Schoenoplectus acutus* (hardstem bulrush), occur along with patchy grasses, such as *Calamagrostis canadensis* (bluejoint). Broad-leaved herbs include *Thelypteris palustris* (eastern marsh fern), *Asclepias incarnata* (swamp

milkweed), *Onoclea sensibilis* (sensitive fern), *Symplocarpus foetidus* (skunk-cabbage), *Calla palustris* (water arum), *Impatiens capensis* (jewelweed), *Sagittaria latifolia* (broadleaf arrowhead), *Scutellaria lateriflora* (blue skullcap), *Sparganium eurycarpum* (broadfruit bur-reed), and *Verbena hastata* (swamp verbena). Floating aquatics, such as *Lemna minor* (common duckweed), may be common in deeper zones. Shrub species vary across the geographic range of this type; in the northern part of its range, *Myrica gale* (sweetgale), *Ilex verticillata* (common winterberry), and *Spiraea alba* (white meadowsweet) are common. The invasive plants *Lythrum salicaria* (purple loosestrife) and *Phragmites australis* (common reed) may be abundant in parts of some occurrences.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail), *Typha* x *glauca* (blue cattail)

Characteristic Species: *Onoclea sensibilis* (sensitive fern), *Schoenoplectus acutus* (hardstem bulrush), *Schoenoplectus americanus* (chairmaker's bulrush), *Typha angustifolia* (narrowleaf cattail), *Typha latifolia* (broadleaf cattail).

Other Noteworthy Species:

Species	GRank	Type	Note
Lythrum salicaria (purple loosestrife)		plant	invasive exotic
Phragmites australis (common reed)		plant	invasive

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This association occurs throughout the northeastern U.S. from Maine to North Carolina.
States/Provinces: CT, DC?, DE, MA, MD, ME:S5, NC, NH:S4?, NJ:S5, NY, PA:S5, RI, VA, VT, WV.
Federal Lands: NPS (Acadia, Blue Ridge Parkway?, Boston Harbor Islands, C&O Canal?, Cape Cod, Delaware Water Gap, Johnstown Flood, Minute Man, National Capital-East?, Saint-Gaudens, Saratoga, Upper Delaware); USFS (Nantahala?, Pisgah?); USFWS (Aroostook, Assabet River, Carlton Pond?, Erie, Great Meadows, Great Swamp, Iroquois, Montezuma, Moosehorn, Nomans Land Island, Nulhegan Basin, Oxbow, Pondicherry?, Prime Hook).

CONSERVATION STATUS

Rank: G5 (1-Dec-1997).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 - Moderate.
Comments: *Typha angustifolia* (narrowleaf cattail) can grow in deeper water compared to *Typha latifolia* (broadleaf cattail), although both species reach maximum growth at a water depth of 50 cm (Grace and Wetzel 1981). *Typha* (cattail) often occurs in pure stands and can colonize areas recently exposed by either natural or human causes.

Similar Associations:

- *Typha latifolia* Southern Herbaceous Vegetation (CEGL004150).
- *Typha* spp. - *Schoenoplectus acutus* - Mixed Herbs Midwest Herbaceous Vegetation (CEGL002229).
- *Typha* spp. - *Schoenoplectus tabernaemontani* - Mixed Herbs Southern Great Lakes Shore Herbaceous Vegetation (CEGL005112).
- *Typha* spp. Midwest Herbaceous Vegetation (CEGL002233).

Related Concepts:

- Cattail Marsh (Thompson 1996) ?
- Cattail marsh (CAP pers. comm. 1998) ?
- Palustrine Narrow-leaved Persistent Emergent Wetland, Permanently Flooded (PEM5H) (Cowardin et al. 1979) ?
- Robust Emergent Marsh (Breden 1989) ?
- Southern New England nutrient-poor streamside/lakeside marsh (Rawinski 1984) ?
- Southern New England nutrient-rich streamside/lakeside marsh (Rawinski 1984) ?

SOURCES

Description Authors: S. C. Gawler.

References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Clancy 1996, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Gawler 2002, Grace and Wetzel 1981, Harrison 2004, Metzler and Barrett 2001, NRCS 2004, Northern Appalachian Ecology Working Group 2000, Rawinski 1984, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.

No photo available.

COMMON NAME (PARK-SPECIFIC): WATER-WILLOW ROCKY BAR AND SHORE

SYNONYMS
USNVC English Name: **American Water-willow Herbaceous Vegetation**
USNVC Scientific Name: ***Justicia americana* Herbaceous Vegetation**
USNVC Identifier: **CEGL004286**

LOCAL INFORMATION

Environmental Description: This association is found at the heads of islands, along the edges of bars, banks, terraces, and spits, and in shallow sections of the river channel in the Upper Delaware River. The substrate is saturated and there are at least a few inches of standing water throughout the growing season in most years. The lower portions of the plants' stems are underwater for most of the year, with the tops of the plants emerging above the flowing water. These beds are entirely submerged by most flood events. During extreme low water periods, the soil below the beds can be exposed, showing a varied mixture of sand, gravel, and cobbles, often with deposits of silt and muck.

Vegetation Description: American water-willow (*Justicia americana*) is the dominant species in this association and is often the only species present in a colonial bed. Because American water-willow spreads by rhizomes, the species can form dense (>70% cover), extensive, monocultural colonies. Some herbaceous species may be associates, including softstem bulrush (*Schoenoplectus tabernaemontani*), rice cutgrass (*Leersia oryzoides*), water knotweed (*Polygonum amphibium*), spikerushes (*Eleocharis* spp.), waterweed (*Elodea* sp.), common threesquare (*Schoenoplectus pungens*), and field horsetail (*Equisetum arvense*). Scaldweed (*Cuscuta gronovii*) is an infrequently associated herbaceous vine. The invasive exotic purple loosestrife (*Lythrum salicaria*) may be common in this vegetation type. Scattered shrub seedlings of black willow (*Salix nigra*), river birch (*Betula nigra*), silver maple (*Acer saccharinum*), or American sycamore (*Platanus occidentalis*) may also be present.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Vine/Liana	*Cuscuta gronovii* (scaldweed)
Herb (field)	Forb	*Justicia americana* (American water-willow)
Herb (field)	Graminoid	*Schoenoplectus tabernaemontani* (softstem bulrush)

Characteristic Species: *Justicia americana* (American water-willow).

Other Noteworthy Species:

Species	GRank	Type	Note
Schoenoplectus tabernaemontani(softstem bulrush)		plant	

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S2*	1	Cobble Shore Wet Meadow	Edinger et al. 2002
PA	S5	1	Water-Willow (*Justicia americana*) - Smartweed Riverbed Community	Fike 1999

Local Range: This association is found at the heads of islands, along the edges of bars, banks, terraces, and spits, and in shallow sections of the river channel in the Upper Delaware River.
Classification Comments: Information not available.
Other Comments: Information not available.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.148.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d.)
Alliance	*Justicia americana* Temporarily Flooded Herbaceous Alliance (A.1657)
Alliance (English name)	American Water-willow Temporarily Flooded Herbaceous Alliance
Association	*Justicia americana* Herbaceous Vegetation
Association (English name)	American Water-willow Herbaceous Vegetation
Ecological System(s):	Central Appalachian River Floodplain (CES202.608). Central Appalachian Stream and Riparian (CES202.609). South-Central Interior Small Stream and Riparian (CES202.706). Southern Piedmont Small Floodplain and Riparian Forest (CES202.323). Cumberland Riverscour (CES202.036). South-Central Interior Large Floodplain (CES202.705). Ozark-Ouachita Riparian (CES202.703).

GLOBAL DESCRIPTION

Concept Summary: This association is found primarily in the Piedmont, Central Appalachians, Cumberland Plateau, Interior Low Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. Stands occur on the shoals or bars of rocky streams and riverbeds, where they are subject to frequent high-energy floods. It provides habitat in some portions of its range for globally rare dragonflies and herbs. *Justicia americana* (American water-willow) is the characteristic dominant. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species that may be present include *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Podostemum ceratophyllum* (hornleaf riverweed), *Scirpus* (bulrush) sp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), *Cyperus* (flatsedge) spp., *Eleocharis* (spikerush) spp., *Diodia teres* (poorjoe), *Gratiola brevifolia* (sticky hedgehyssop), *Bidens* (beggarticks) spp., *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), and *Xyris difformis* var. *difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife). A sparse canopy layer, which can include *Carpinus caroliniana* ssp. *caroliniana* (American hornbeam), *Salix interior* (sandbar willow), *Acer saccharinum* (silver maple), *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), *Fagus grandifolia* (American beech), and *Fraxinus pennsylvanica* (green ash), among other species, may be present. Scattered shrub seedlings of *Salix nigra* (black willow), *Betula nigra* (river birch), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present.

Environmental Description: This association occurs on the shoals or bars of rocky streams and riverbeds, on bedrock, boulders, cobble, gravel, and sands. They are subject to frequent high energy floods, and are entirely submerged by most flood events. During extreme low water periods, the soil below the beds can be exposed, showing a varied mixture of sand, gravel and cobbles, often with deposits of silt and muck. Stands commonly occur on the edge of the river and at the heads and tails of islands and may sometimes occur on deposition bars in the middle of the river. Substrate pH was circumneutral (6.0 - 6.5) in two samples. Slopes range from level to moderate but are typically gentle. Elevations of West Virginia stands range from 73 to at least 654 m; the type occurs at lower elevations in the Piedmont and Coastal Plain.

Vegetation Description: *Justicia americana* (American water-willow) is the dominant(and sometimes the only) species, forming lawnlike stands in shallow reaches of rivers. Cover by *Justicia americana* (American water-willow) ranges from 40 to 85%. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species may be present but rarely achieve more than 1% cover; they include *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Lemna minor* (common duckweed), *Orontium aquaticum* (goldenclub), *Podostemum ceratophyllum* (hornleaf riverweed), *Scirpus* (bulrush) sp., *Schoenoplectus pungens* (common threesquare), *Schoenoplectus tabernaemontani* (softstem bulrush), *Cyperus* (flatsedge) spp., *Elodea* (waterweed) sp., *Eleocharis* (spikerush) spp., *Equisetum arvense* (field horsetail), *Bidens* (beggarticks) spp., *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Diodia teres* (poorjoe), *Gratiola brevifolia* (sticky hedgehyssop), and *Xyris difformis* var. *difformis* (bog yelloweyed grass). Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden yellow loosestrife). In some areas, *Justicia* (water-willow) usually grows in nearly pure patches, so that few other species are associated with it. *Bidens* (beggarticks) spp., *Cuscuta gronovii* (scaldweed), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum* (knotweed) spp., *Rumex* (dock) spp., and *Salix interior* (sandbar willow) can occur (Anderson 1982). Some stands have low cover by scattered flood-suppressed trees or an overhanging canopy. Trees in plots include *Acer saccharinum* (silver maple), *Betula nigra* (river birch), *Fraxinus pennsylvanica* (green ash), and *Platanus occidentalis* (American sycamore). A sparse canopy layer may be present, which can include *Carpinus caroliniana* (American hornbeam), *Fagus grandifolia* (American beech), and *Fraxinus pennsylvanica* (green ash), among others. Scattered shrub seedlings of *Salix nigra* (black willow), *Betula nigra* (river birch), *Acer saccharinum* (silver maple), or *Platanus occidentalis* (American sycamore) may also be present. In the Cumberland Plateau of Alabama, *Justicia americana* (American water-willow) is present in dense patches with some interspersion of other species, including *Pilea pumila* (Canadian clearweed), *Boehmeria cylindrica* (small-spike false nettle), *Eclipta prostrata* (false daisy), *Juncus coriaceus* (leathery rush), *Mikania scandens* (climbing hempvine), *Ludwigia palustris* (marsh seedbox), *Leersia* (cutgrass) sp., and *Bidens* (beggarticks) sp. Schmalzer and DeSelm (1982) discuss *Orontium aquaticum* (goldenclub) growing along streambanks or in shallow riffles "along or with" *Justicia americana* (American water-willow) in the Obed River in the Cumberland Plateau of Tennessee. In 29 plots sampled in the Potomac River watershed (Piedmont, Blue Ridge and Ridge and Valley provinces), *Justicia* (water-willow) was overwhelmingly dominant (50-75% mean cover), and no associated species occurred in more than 48% of the plots. Vascular plant species richness in sampled plots is low (typically 6-14 taxa). The exotic invasive *Lythrum salicaria* (purple loosestrife) was found in one West Virginia plot but has not been observed in abundance in this community, possibly due to intolerance of high-energy flooding.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Justicia americana* (American water-willow)

Characteristic Species: *Justicia americana* (American water-willow), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (whitegrass), *Polygonum amphibium* (water knotweed), *Polygonum caespitosum* var. *longisetum* (oriental ladysthumb), *Saururus cernuus* (lizard's-tail), *Schoenoplectus pungens* (common threesquare).

Other Noteworthy Species:

Species	GRank	Type	Note
Lysimachia vulgaris (garden yellow loosestrife)		plant	exotic
Lythrum salicaria (purple loosestrife)		plant	invasive exotic
Ptilimnium nodosum (piedmont mock bishopweed)	G2	plant	Federally listed endangered; globally imperiled
Sagittaria secundifolia (Little River arrowhead)	G1	plant	Federally listed threated; globally critically imperiled

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, Pennsylvania, and Delaware.

States/Provinces: AL, AR, GA, KY, MD, NC, NJ, NY, OH:S4, OK, PA:S5, SC?, TN, VA, WV.

Federal Lands: NPS (Big South Fork, C&O Canal, Delaware Water Gap, George Washington Parkway, Harpers Ferry, Little River Canyon, Mammoth Cave, Manassas, Natchez Trace, New River Gorge, Obed, Stones River, Upper Delaware); USFS (Bankhead, Cherokee, Daniel Boone, Oconee?, Ouachita, Ouachita (Mountains), Ozark, Pisgah, Sumter (Mountains)?, Sumter (Piedmont)?, Sumter?, Uwharrie, Wayne).

CONSERVATION STATUS

Rank: G4G5 (12-Sep-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This type, in Ohio, often forms pure patches, but consistent identification may require a simple cutoff rule, such as at least 50% cover of *Justicia* (water-willow) (Anderson 1982). However, Anderson (1996) no longer recognizes this type.

Similar Associations:

- *Hymenocallis coronaria - Justicia americana* Herbaceous Vegetation (CEGL004285).
- *Justicia americana - Peltandra virginica* Herbaceous Vegetation [Provisional] (CEGL006579).
- *Peltandra virginica - Saururus cernuus - Boehmeria cylindrica / Climacium americanum* Herbaceous Vegetation (CEGL007696).

Related Concepts:

- *Justicia americana* riparian herbaceous vegetation (Vanderhorst 2001b) =
- Aquatic Types (Schmalzer and DeSelm 1982) B
- IIE3a. Riverside Shoal and Stream Bar Complex (Allard 1990) B
- Lizard's tail emergent bed (Perles et al. 2004) ?
- Rocky Bar and Shore (Water Willow Subtype) (Schafale 1998b) ?
- Water willow emergent bed (Perles et al. 2004) ?

SOURCES

Description Authors: A. S. Weakley, mod. D. Faber-Langendoen and S. C. Gawler.

References: Allard 1990, Anderson 1982, Anderson 1996, Fike 1999, Fleming et al. 2001, Harrison 2004, Hoagland 1997, Hoagland 2000, Major et al. 1999, McCoy 1958, Nelson 1986, ONHD unpubl. data, Palmer-Ball et al. 1988, Peet et al. unpubl. data 2002, Penfound 1953,

Perles et al. 2004, Schafale 1998b, Schafale 2002, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004, Vanderhorst 2001b, Vanderhorst et al. 2007.



Figure E48. Water-willow Rocky Bar and Shore in Upper Delaware Scenic and Recreational River (Plot UPDE.148). July 2005. NAD 1983 / UTM easting 515862, northing 4588010.

COMMON NAME (PARK-SPECIFIC): JAPANESE KNOTWEED GRAVELBAR

SYNONYMS

USNVC English Name: **Japanese Knotweed Temporarily Flooded Herbaceous Vegetation**

USNVC Scientific Name: ***Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation**

USNVC Identifier: **CEGL008472**

LOCAL INFORMATION

Environmental Description: This vegetation type occurs on islands and along the shoreline of the Upper Delaware River. The substrate is typically well-drained, moist, sandy alluvium. These sites are subject to frequent floods and scour.

Vegetation Description: This association is dominated by Japanese knotweed (*Polygonum cuspidatum*), establishing essentially monotypic stands that are over 2 m high.

Most Abundant Species:

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

Characteristic Species: *Polygonum cuspidatum* (Japanese knotweed).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Shallow Emergent Marsh	Edinger et al. 2002
PA	SNA		[not crosswalked]	

Local Range: This association can occur throughout Upper Delaware Scenic and Recreational River on the shores and islands of the Upper Delaware River, but it is most common in the upper reaches of the river.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).

Plots: UPDE.26.

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d.)
Alliance	*Polygonum cuspidatum* Temporarily Flooded Herbaceous Alliance (A.2005)
Alliance (English name)	Japanese Knotweed Temporarily Flooded Herbaceous Alliance
Association	*Polygonum cuspidatum* Temporarily Flooded Herbaceous Vegetation
Association (English name)	Japanese Knotweed Temporarily Flooded Herbaceous Vegetation
Ecological System(s):	Information not available.

GLOBAL DESCRIPTION

Concept 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: 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).

Vegetation Description: 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:

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

Characteristic Species: *Polygonum cuspidatum* (Japanese knotweed).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

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.

States/Provinces: AL, GA, KY, NC, NJ, NY, PA, SC, TN, VA.

Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Gateway, Upper Delaware); USFS (Cherokee?, Daniel Boone).

CONSERVATION STATUS

Rank: GNA (invasive) (31-May-2001).

Reasons: This vegetation is composed of and dominated by a species which is not native to North America.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 3 - Weak.
Comments: This species has also been treated as *Reynoutria japonica*.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: M. Pyne, mod. S. C. Gawler.
References: Brown pers. comm., M. Evans pers. comm., NRCS 2001b, Schafale pers. comm., Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004, WPC and TNC 2002.



Figure E49. Japanese Knotweed Gravelbar in Upper Delaware Scenic and Recreational River (Plot UPDE.26). July 2005. NAD 1983 / UTM easting 491386, northing 4624654.

COMMON NAME (PARK-SPECIFIC): MIXED FORB MARSH

SYNONYMS

USNVC English Name: **Nodding Beggarticks - Swamp Verbena - Smartweed species Herbaceous Vegetation**

USNVC Scientific Name: ***Bidens cernua* - *Verbena hastata* - *Polygonum* spp. Herbaceous Vegetation**

USNVC Identifier: **CEGL006446**

LOCAL INFORMATION

Environmental Description: This variable wetland type occurs in depressions, drainages, and basins that contain ponded water throughout the year. In general, waterflow out of the sites is restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is often restricted to the edges of the basins, with open water remaining in the center. These wetlands typically occur on very poorly drained soils such as mucky silt loam or shallow mucky peat.

Vegetation Description: This herbaceous-dominated association contains standing water for most or all of the year and is often associated with impounded drainages, ponded areas near streams, or saturated areas surrounding drainages. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites. Common species include needle spikerush (*Eleocharis acicularis*), swamp verbena (*Verbena hastata*), nodding beggartick (*Bidens cernua*), rice cutgrass (*Leersia oryzoides*), marshpepper knotweed (*Polygonum hydropiper*), arrowleaf tearthumb (*Polygonum sagittatum*), field horsetail (*Equisetum arvense*), New England aster (*Symphyotrichum novae-angliae*), owlfruit sedge (*Carex stipata*), and/or marsh seedbox (*Ludwigia palustris*).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Bidens cernua* (nodding beggartick), *Polygonum hydropiper* (marshpepper knotweed), *Verbena hastata* (swamp verbena)
Herb (field)	Graminoid	*Eleocharis acicularis* (needle spikerush), *Leersia oryzoides* (rice cutgrass)

Characteristic Species: *Bidens cernua* (nodding beggartick), *Eleocharis acicularis* (needle spikerush), *Leersia oryzoides* (rice cutgrass), *Polygonum hydropiper* (marshpepper knotweed), *Verbena hastata* (swamp verbena).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S5*	1	Shallow Emergent Marsh	Edinger et al. 2002
PA	S4*	3	Mixed Forb Marsh	Fike 1999

Local Range: This wetland type can probably occur widely at Upper Delaware Scenic and Recreational River but has only been seen in the northern portion of the park.

Classification Comments: Mixed Forb Marsh has highly variable species composition; however, it is distinguished from other palustrine types by the year-round ponded water and the associated hydrophilic species that are tolerant of standing water. These wetlands are not dominated by *Typha* (cattail) spp. [see Cattail Marsh]. This type lacks shrubs and other woody species. The description provided here departs from Mixed Forb Marsh described in Fike (1999) by including graminoid species and specifying ponded hydrology.

Other Comments: None.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: None.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Semipermanently flooded temperate perennial forb vegetation (V.B.2.N.e.)
Alliance	*Pontederia cordata - Peltandra virginica* Semipermanently Flooded Herbaceous Alliance (A.1669)
Alliance (English name)	Pickerelweed - Green Arrow-arum Semipermanently Flooded Herbaceous Alliance
Association	*Bidens cernua - Verbena hastata - Polygonum* spp. Herbaceous Vegetation
Association (English name)	Nodding Beggarticks - Swamp Verbena - Smartweed species Herbaceous Vegetation
Ecological System(s):	Laurentian-Acadian Freshwater Marsh (CES201.594).

GLOBAL DESCRIPTION

Concept Summary: This variable wetland type occurs in depressions, drainages, and basins that contain ponded water throughout the year. In general, waterflow out of the sites is restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites. Common species may include *Eleocharis acicularis* (needle spikerush), *Verbena hastata* (swamp verbena), *Bidens cernua* (nodding beggartick), *Eupatorium maculatum* (spotted joepyeweed), *Leersia oryzoides* (rice cutgrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Equisetum arvense* (field horsetail), *Symphyotrichum novae-angliae* (New England aster), *Schoenoplectus americanus* (chairmaker's bulrush), *Carex stipata* (owlfruit sedge), *Carex vulpinoidea* (fox sedge), *Eupatorium perfoliatum* (common boneset), *Poa trivialis* (rough bluegrass), *Ludwigia palustris* (marsh seedbox), and/ or *Toxicodendron radicans* (eastern poison-ivy).
Environmental Description: This variable wetland type occurs in depressions, drainages, and basins that contain ponded water throughout the year. Waterflow out of the sites is typically restricted, either due to naturally occurring depressions or from beaver activity, roads, or berms. The vegetation is often restricted to the edges of the basins, with open water remaining in the center. These wetlands typically occur on very poorly drained soils such as mucky silt loam, shallow mucky peat, and, less occasionally, on ponded gravelly sand.
Vegetation Description: This herbaceous-dominated association contains standing water for most or all of the year and is often associated with impounded drainages, ponded areas near streams, or saturated areas surrounding drainages. The vegetation is dominated by species that are tolerant of standing water, and species composition is extremely variable among sites. Common species include *Eleocharis acicularis* (needle spikerush), *Verbena hastata* (swamp verbena), *Bidens cernua* (nodding beggartick), *Eupatorium maculatum* (spotted joepyeweed), *Leersia oryzoides* (rice cutgrass), *Polygonum hydropiper* (marshpepper knotweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Equisetum arvense* (field horsetail), *Symphyotrichum novae-angliae* (New England aster), *Schoenoplectus americanus* (chairmaker's bulrush), *Carex stipata* (owlfruit sedge), *Carex vulpinoidea* (fox sedge), *Eupatorium perfoliatum* (common boneset),

Poa trivialis (rough bluegrass), *Ludwigia palustris* (marsh seedbox), and/ or *Toxicodendron radicans* (eastern poison-ivy).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Bidens cernua* (nodding beggartick), *Polygonum hydropiper* (marshpepper knotweed), *Verbena hastata* (swamp verbena)

Characteristic Species: *Bidens cernua* (nodding beggartick), *Eupatorium maculatum* (spotted joepyeweed), *Polygonum hydropiper* (marshpepper knotweed), *Toxicodendron radicans* (eastern poison-ivy), *Verbena hastata* (swamp verbena).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Palustrine.

DISTRIBUTION
Range: This community is described from Pennsylvania and New Jersey and probably ranges northward.
States/Provinces: CT?, MA?, NJ, NY, PA, RI?, VT?
Federal Lands: NPS (Delaware Water Gap, Gateway, Saratoga, Upper Delaware); USFWS (Iroquois).

CONSERVATION STATUS
Rank: GNR (7-Feb-2006).
Reasons: Better data on this community are needed in order to assign a conservation rank to it.

CLASSIFICATION INFORMATION
Status: Nonstandard.
Confidence: 3 - Weak.
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler, mod. E. Largay.
References: Eastern Ecology Working Group n.d., FNA Editorial Committee 2006, Fike 1999, NRCS 2001b, NRCS 2004.

No photo available.

COMMON NAME (PARK-SPECIFIC): SPARSELY VEGETATED CLIFF

SYNONYMS
USNVC English Name: **Eastern Red-cedar - Rock Harlequin Cliff Sparse Vegetation**
USNVC Scientific Name: ***Juniperus virginiana - Corydalis sempervirens* Cliff Sparse Vegetation**
USNVC Identifier: **CEGL006422**

LOCAL INFORMATION

Environmental Description: This association occurs on acidic sandstone bedrock outcrops and acidic to circumneutral siltstone cliffs. The outcrops are typically vertical to near-vertical. Vegetation habitat is restricted to narrow ledges and crevices in the rock face. These cliffs often occur immediately below the Eastern Redcedar - Hickory Rocky Woodland that persists at the top of the cliffs.

Vegetation Description: This vegetation type is characterized by sparse vegetation growing on narrow ledges or from bedrock crevices. The vegetation can vary greatly in composition but is generally limited to drought-tolerant species. Trees are typically absent or, when present, are usually stunted and less than 10 m in height. Occasional trees include eastern redcedar (*Juniperus virginiana*), white ash (*Fraxinus americana*), red hickory (*Carya ovalis*), pignut hickory (*Carya glabra*), and chestnut oak (*Quercus prinus*). The tall-shrub/sapling layer (2-5 m in height) may include occasional bear oak (*Quercus ilicifolia*), black cherry (*Prunus serotina*), and other tree saplings. The short-shrub layer (<2 m in height), when present, is variable and may include tree saplings, sumac (*Rhus* spp.), Allegheny blackberry (*Rubus allegheniensis*), Carolina rose (*Rosa carolina*), and blueberry (*Vaccinium* spp.). The herb layer can be very diverse, but the total cover is usually very low, ranging from <1% to as high as 40% total cover. Typical species are wavy hairgrass (*Deschampsia flexuosa*), little bluestem (*Schizachyrium scoparium*), smooth crabgrass (*Digitaria ischaemum*), poverty oatgrass (*Danthonia spicata*), and eastern hayscented fern (*Dennstaedtia punctilobula*). Occasional herbaceous species include rock polypody (*Polypodium virginianum*), rock harlequin (*Corydalis sempervirens*), red columbine (*Aquilegia canadensis*), early saxifrage (*Saxifraga virginiensis*), and moss phlox (*Phlox subulata*). Vines may be present, typically summer grape (*Vitis aestivalis*) and Virginia creeper (*Parthenocissus quinquefolia*). Lichens are usually present and often abundant on bare rock.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch), *Carya glabra* (pignut hickory)
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula lenta* (sweet birch)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper), *Vitis aestivalis* (summer grape)
Herb (field)	Graminoid	*Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Digitaria ischaemum* (smooth crabgrass), *Schizachyrium scoparium* (little bluestem)
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula* (eastern hayscented fern)

Characteristic Species: *Betula lenta* (sweet birch), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Digitaria ischaemum* (smooth crabgrass), *Schizachyrium scoparium* (little bluestem).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4?*	1	Cliff Community	Edinger et al. 2002
PA	S3		[not crosswalked]	

Local Range: Although smaller examples of this association occur throughout the park, the largest and most visible examples occur adjacent to Route 97 at Hawks Nest.

Classification Comments: Key features of this type are sparse vegetation and vertical to near-vertical sandstone and siltstone outcrops and cliffs. Actual species composition is variable given the limited habitat to support vegetation and the unpredictable nature of plant colonization and establishment.

Other Comments: Information not available.

Local Description Authors: G. S. Podniesinski (PNHP).

Plots: UPDE.AA.27 (Podniesinski 1999, Podniesinski and Kunsman 1999, Perles et al. 2007).

Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Consolidated rock sparse vegetation (VII.A.)
Physiognomic Group	Sparsely vegetated cliffs (VII.A.1.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated cliffs (VII.A.1.N.)
Formation	Cliffs with sparse vascular vegetation (VII.A.1.N.a.)
Alliance	Open Cliff Sparsely Vegetated Alliance (A.1836)
Alliance (English name)	Open Cliff Sparsely Vegetated Alliance
Association	*Juniperus virginiana - Corydalis sempervirens* Cliff Sparse Vegetation
Association (English name)	Eastern Red-cedar - Rock Harlequin Cliff Sparse Vegetation
Ecological System(s):	North-Central Appalachian Acidic Cliff and Talus (CES202.601).

GLOBAL DESCRIPTION

Concept Summary: This sparsely vegetated cliff association occurs in the oak - pine - hemlock forest region of the northeastern U.S. The setting is dry vertical exposures of resistant acidic bedrock such as granite, quartzite, sandstone, shale or schist, with little or no soil development. These cliffs are mostly dry but may contain small areas of seepy conditions, with associated floristic variation. The patchy vegetation is restricted to cracks and crevices and can vary from well-vegetated to barren across the cliff face. In most cases, overall cover averages less than 25%. The association presents itself as a mixture of open rock, scrubby trees and shrubs, herbaceous plants, and bryoids. Typical tree species include *Juniperus virginiana* (eastern red-cedar), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), and *Betula papyrifera* (paper birch); none usually grow very large. Individuals of additional tree species from the surrounding forest may also be present; these include *Tsuga canadensis* (eastern hemlock), *Quercus* (oak) spp., and *Carya* (hickory) spp. *Rubus odoratus* (purpleflowering raspberry), *Rubus allegheniensis* (Allegheny blackberry), and *Rhus copallinum* (flameleaf sumac) are representative shrubs. Woody vines include *Vitis aestivalis* (summer grape) and *Parthenocissus quinquefolia* (Virginia creeper). Herbaceous composition varies; typical species include *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Campanula rotundifolia* (bluebell bellflower), *Aquilegia canadensis* (red columbine), *Corydalis sempervirens* (rock harlequin), *Saxifraga virginiensis* (early saxifrage), and *Woodsia ilvensis*

(rusty woodsia). *Adlumia fungosa* (allegheny vine) may be found in these habitats; *Opuntia humifusa* (devil's-tongue) occurs in some of the most southerly occurrences of this association.
Environmental Description: This community is found on cliff faces developed on resistant acidic bedrock such as granite, quartzite, sandstone, shale or schist, with little or no soil development. The outcrops are typically vertical to near-vertical. Exposure varies, and moisture regime likewise varies from dry on the exposed faces to moist on more protected or seepy areas. These cliffs may contain small areas of seepage vegetation among the generally dry substrate. [For extensive seepage cliffs, see the cliff seep association *Drosera rotundifolia - Viola* spp. Cliff Sparse Vegetation (CEGL006429).]
Vegetation Description: The patchy vegetation is restricted to cracks and crevices and can vary from well-vegetated to barren across the cliff face. In most cases, overall cover averages less than 25%. The association presents itself as a mixture of open rock, scrubby trees and shrubs, herbaceous plants, and bryoids. Typical tree species include *Juniperus virginiana* (eastern red-cedar), *Fraxinus americana* (white ash), *Acer rubrum* (red maple), and *Betula papyrifera* (paper birch); none usually grow very large. Individuals of additional tree species from the surrounding forest may also be present; these include *Tsuga canadensis* (eastern hemlock), *Quercus* (oak) spp., and *Carya* (hickory) spp. *Rubus odoratus* (purpleflowering raspberry), *Rubus allegheniensis* (Allegheny blackberry), and *Rhus copallinum* (flameleaf sumac) are representative shrubs. Woody vines include *Vitis aestivalis* (summer grape) and *Parthenocissus quinquefolia* (Virginia creeper). Herbaceous composition varies; typical species include *Deschampsia flexuosa* (wavy hairgrass), *Danthonia spicata* (poverty oatgrass), *Campanula rotundifolia* (bluebell bellflower), *Aquilegia canadensis* (red columbine), *Corydalis sempervirens* (rock harlequin), *Saxifraga virginiensis* (early saxifrage), and *Woodsia ilvensis* (rusty woodsia). *Opuntia humifusa* (devil's-tongue) occurs in some of the most southerly occurrences of this association.
Most Abundant Species:

Stratum	Lifeform	Species
Tall shrub/sapling	Needle-leaved shrub	*Juniperus virginiana* (eastern red-cedar)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Betula lenta* (sweet birch)
Short shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum* (red maple), *Rubus allegheniensis* (Allegheny blackberry)
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia* (Virginia creeper)

Characteristic Species: *Aquilegia canadensis* (red columbine), *Campanula rotundifolia* (bluebell bellflower), *Corydalis sempervirens* (rock harlequin), *Danthonia spicata* (poverty oatgrass), *Deschampsia flexuosa* (wavy hairgrass), *Juniperus virginiana* (eastern red-cedar), *Rhus copallinum* (flameleaf sumac), *Rubus odoratus* (purpleflowering raspberry), *Woodsia ilvensis* (rusty woodsia).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This type is documented from Massachusetts, New Hampshire, Vermont, New Jersey, and Pennsylvania; southward and westward extent has not been determined.
States/Provinces: CT, MA, NH, NJ, NY, PA:S3, VT:S4.
Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS

Rank: G4 (22-Jun-2006).

Reasons: This community is considered relatively common in at least two of the states where it occurs (state conservation rank of S4).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations:

- Appalachian - Alleghenian Sandstone Dry Cliff Sparse Vegetation (CEGL006435)--species composition is different due to ecoregional differences.
- Piedmont Acidic Cliff Sparse Vegetation (CEGL003979)--occurs primarily in the Southeast, within topographically low settings such as river bluffs that are not subject to flood scouring.
- *Polypodium (virginianum, appalachianum)* Cliff Sparse Vegetation (CEGL006528)--is similar in physiognomy and in that both occur on acidic cliffs. They are different in that this type represents a warmer climate, more typical of Lower New England than Northern Appalachians.
- Sandstone Dry Cliff Sparse Vegetation (CEGL002045)--occurs in the Midwest and the species composition is different.

Related Concepts: Information not available.

SOURCES

Description Authors: S. C. Gawler and G. S. Podniesinski.

References: Anderson 1996, Collins and Anderson 1994, Eastern Ecology Working Group n.d., Edinger et al. 2002, Metzler and Barrett 2004, Perles et al. 2007, Podniesinski 1999, Podniesinski 2005, Podniesinski and Kunsman 1999, Sneddon and Menard 2002, Sperduto 1992, Sperduto 2000a, Swain and Kearsley 2000, Thompson and Sorenson 2000.



Figure E50. Sparsely Vegetated Cliff in Upper Delaware Scenic and Recreational River (Plot UPDE.AA.27). August 2006. NAD 1983 / UTM easting 516348, northing 4587961.

COMMON NAME (PARK-SPECIFIC): NORTHERN RIVERSIDE ROCK OUTCROP

SYNONYMS

USNVC English Name: **Big Bluestem - Bluebell Bellflower - Sticky Goldenrod Sparse Vegetation**

USNVC Scientific Name: ***Andropogon gerardii - Campanula rotundifolia - Solidago simplex* Sparse Vegetation**

USNVC Identifier: **CEGL006284**

LOCAL INFORMATION

Environmental Description: This vegetation type occurs along the shoreline of the Upper Delaware River where winter ice-scouring, shale bedrock outcrops, and natural seepage co-occur. The substrate consists of open, flood-scoured flat to nearly flat bedrock exposures that extend for variable lengths from the woodland edge to the river edge. Species are distributed patchily due to microsite conditions that range from dry to moist (seepage areas) and the sparse vegetation, when present, establishes in crevices and in thin soil over bedrock.

Vegetation Description: Herbaceous species typically dominate this association, but shrubs can be present in areas with somewhat good soil development. Gray alder (*Alnus incana*), silky dogwood (*Cornus amomum*), white meadowsweet (*Spiraea alba*), and river birch (*Betula nigra*) are most common; sandcherry (*Prunus pumila*), American sycamore (*Platanus occidentalis*), Carolina rose (*Rosa carolina*), and others can also be present. Big bluestem (*Andropogon gerardii*) is the most abundant native herb; purple loosestrife (*Lythrum salicaria*) is a common invasive exotic species. Many herbs can be present sparsely in the thin soil of crevices, including white panicle aster (*Symphyotrichum lanceolatum*), eastern marsh fern (*Thelypteris palustris*), flat-top goldentop (*Euthamia graminifolia*), flaxleaf whitetop aster (*Ionactis linariifolius*), weak rush (*Juncus debilis*), American water-willow (*Justicia americana*), brownish beaksedge (*Rhynchospora capitellata*), switchgrass (*Panicum virgatum*), strawcolored flatsedge (*Cyperus strigosus*), toothed flatsedge (*Cyperus dentatus*), early goldenrod (*Solidago juncea*), golden hedgehyssop (*Gratiola aurea*), slender fimbry (*Fimbristylis autumnalis*), purpleleaf willowherb (*Epilobium coloratum*), and Allegheny monkeyflower (*Mimulus ringens*).

Most Abundant Species:

Stratum	Lifeform	Species
Short shrub/sapling	Broad-leaved deciduous shrub	*Spiraea alba* (white meadowsweet)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem)

Characteristic Species: *Andropogon gerardii* (big bluestem).

Other Noteworthy Species:

Species	GRank	Type	Note
Euthamia graminifolia (flat-top goldentop)		plant	
Lythrum salicaria (purple loosestrife)		plant	exotic noxious weed

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	Sname	Reference
NY	S3S4*	1	Shoreline Outcrop	Edinger et al. 2002
PA	SNR		[not crosswalked]	

Local Range: These outcrops can occur on the shores of the Upper Delaware River throughout Upper Delaware Scenic and Recreational River, but they are more common in the southern part of the park.

Classification Comments: Information not available.

Other Comments: Information not available.

Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.117, UPDE.122, UPDE.154, UPDE.155.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Consolidated rock sparse vegetation (VII.A.)
Physiognomic Group	Sparsely vegetated pavement (VII.A.2.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated pavement (VII.A.2.N.)
Formation	Pavement with sparse vascular vegetation (VII.A.2.N.a.)
Alliance	Open Pavement Sparsely Vegetated Alliance (A.1843)
Alliance (English name)	Open Pavement Sparsely Vegetated Alliance
Association	*Andropogon gerardii - Campanula rotundifolia - Solidago simplex* Sparse Vegetation
Association (English name)	Big Bluestem - Bluebell Bellflower - Sticky Goldenrod Sparse Vegetation
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609). Boreal Ice-Scour Rivershore (CES103.589).

GLOBAL DESCRIPTION

Concept Summary: This riverside rock outcrop community of the northeastern U.S. occurs on open flood-scoured bedrock exposures of major rivers, typically along river narrows. Emergent seepage is absent. Typically a gradient from dry acidic conditions higher on the bank to moist, fairly enriched conditions lower down may exist at any one site. This community is prone to flooding in the upper regions and deposition in the topographically lower areas. It is also prone to severe drought periods that may stress or kill some vegetation. Within the community, the species are distributed patchily, probably due to microsite conditions. The variability in species composition has not been measured, but it shows substantial variation from site to site and from year to year. Vegetation is typically sparse and occurs in the cracks and crevices of the bedrock. Typical vegetation is a mixture of riparian species, xeric-loving crevice plants, and calciphiles. Characteristic species include *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Campanula rotundifolia* (bluebell bellflower), *Solidago simplex* (Mt. Albert goldenrod), *Toxicodendron radicans* (eastern poison-ivy), *Ionactis linariifolius* (flaxleaf whitetop aster), *Sisyrinchium montanum* (strict blue-eyed grass), *Packera paupercula* (balsam groundsel), and *Prunus pumila* (sandcherry). Other associates include *Anemone virginiana* var. *alba* (tall thimbleweed), *Symphyotrichum lateriflorum* (calico aster), *Carex crawei* (Crawe's sedge), *Carex crawfordii* (Crawford's sedge), *Potentilla arguta* (tall cinquefoil), *Campanula rotundifolia* (bluebell bellflower), *Arabis lyrata* (lyrate rockcress), *Aquilegia canadensis* (red columbine), *Cornus amomum* (silky dogwood), *Euthamia graminifolia* (flat-top goldentop), *Juncus debilis* (weak rush), and *Eupatorium perfoliatum* (common boneset), among others. *Astragalus robbinsii* var. *jesupii* (Jesup's milkvetch) occurs in limited areas along the upper Connecticut River. These sites are susceptible to invasion by *Lythrum salicaria* (purple loosestrife) and *Melilotus officinalis* (yellow sweetclover). This association is more temperate than the related *Campanula rotundifolia - Packera paupercula - (Aquilegia canadensis)* Sparse Vegetation (CEGL006532), which occurs on near-boreal rivers and lacks prairie elements such as *Andropogon gerardii* (big bluestem).
Environmental Description: This sparse vegetation occurs on open flood-scoured bedrock exposures of major rivers, typically along river narrows. Emergent seepage is absent. Typically a

gradient from dry acidic conditions higher on the bank to moist, fairly enriched conditions lower down may exist at any one site. This community is prone to flooding in the upper regions and deposition in the topographically lower areas. It is also prone to severe drought periods that may stress or kill some vegetation.

Vegetation Description: This community is essentially a rock outcrop with a bit of soil development in the lower reaches. Within the community, the species are distributed patchily, probably due to microsite conditions. The variability in species composition has not been measured but shows substantial variation both spatially and temporally. Vegetation is typically sparse and occurs in the cracks and crevices of the bedrock. Typical vegetation is a mixture of riparian species, xeric-loving crevice plants, and calciphiles. Characteristic species include *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), *Campanula rotundifolia* (bluebell bellflower), *Solidago simplex* (Mt. Albert goldenrod), *Toxicodendron radicans* (eastern poison-ivy), *Ionactis linariifolius* (flaxleaf whitetop aster), *Sisyrinchium montanum* (strict blue-eyed grass), *Packera paupercula* (balsam groundsel), and *Prunus pumila* (sandcherry). Other associates include *Anemone virginiana* var. *alba* (tall thimbleweed), *Symphyotrichum lateriflorum* (calico aster), *Carex crawei* (Crawe's sedge), *Carex crawfordii* (Crawford's sedge), *Potentilla arguta* (tall cinquefoil), *Campanula rotundifolia*, *Arabis lyrata* (lyrate rockcress), *Aquilegia canadensis* (red columbine), *Cornus amomum* (silky dogwood), *Euthamia graminifolia* (flat-top goldentop), *Juncus debilis* (weak rush), and *Eupatorium* (thoroughwort) *perfoliatum*, among others. *Astragalus robbinsii* var. *jesupii* (Jesup's milkvetch) occurs in limited areas along the upper Connecticut River. These sites are susceptible to invasion by *Lythrum salicaria* (purple loosestrife) and *Melilotus officinalis* (yellow sweetclover).

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Solidago simplex* (Mt. Albert goldenrod)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem)

Characteristic Species: *Allium schoenoprasum* var. *sibiricum* (wild chives), *Andropogon gerardii* (big bluestem), *Astragalus robbinsii* var. *jesupii* (Jesup's milkvetch), *Campanula rotundifolia* (bluebell bellflower), *Ionactis linariifolius* (flaxleaf whitetop aster), *Packera paupercula* (balsam groundsel), *Prunus pumila* (sandcherry), *Schizachyrium scoparium* (little bluestem), *Solidago simplex* (Mt. Albert goldenrod), *Toxicodendron radicans* (eastern poison-ivy).

Other Noteworthy Species:

Species	GRank	Type	Note
Astragalus robbinsii var. *jesupii* (Jesup's milkvetch)	G5T1	plant	Federally listed endangered

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community is reported from Vermont, New Hampshire, Maine, Connecticut, New Jersey, Pennsylvania, and New York. It may also occur in Massachusetts.

States/Provinces: CT, MA, ME, NH, NJ, NY, PA, VT.

Federal Lands: NPS (Delaware Water Gap, Upper Delaware).

CONSERVATION STATUS

Rank: G2 (17-Nov-1997).

Reasons: There are probably fewer than 20 occurrences of this community rangewide. Individual occurrences tend to be small, so there are probably fewer than 500 acres rangewide. Currently five occurrences are documented in New Hampshire, with a total acreage of less than

20 acres. Similar vegetation is reported from Vermont, Maine, and New York, but these still need confirmation. This community is restricted to calcareous or basic bedrock outcrops along ice-scoured upper reaches of major rivers such as the Connecticut River in New Hampshire and Vermont, the Kennebec River in Maine, the Hudson River in New York, and the Delaware River in New Jersey.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This community may occur in conjunction with seep communities. However, emergent seepage is absent as are the corresponding seepage and wetland plants found in riverside seeps. Sedges are notably lacking. This community differs from rock outcrop/rocky summit communities by the paucity of lichen and woody species intolerant of flooding and the presence of flood-tolerant species on lower, somewhat enriched reaches of the community, where regular erosion and deposition of silty sediments occur.

Similar Associations:

- *(Hypericum prolificum, Leucothoe racemosa) / Schizachyrium scoparium - Solidago simplex* var. *racemosa - Ionactis linariifolius* Sparse Vegetation (CEGL006491).
- *Campanula rotundifolia - Packera paupercula - (Aquilegia canadensis)* Sparse Vegetation (CEGL006532).
- *Deschampsia caespitosa - Carex viridula* Herbaceous Vegetation (CEGL006969).

Related Concepts:

- Riverine Lower Perennial Emergent Wetland, Seasonally Flooded (R2EMC) (Cowardin et al. 1979) ?
- Rivershore Grassland (Thompson 1996) ?
- Riverside Outcrop Community (Thompson 1996) ?
- SNE Riverside Outcrop Community (Rawinski 1984) ?

SOURCES

Description Authors: M. Anderson, mod. S. L. Neid, S. C. Gawler, E. Largay.

References: Breden 1989, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Gawler 2002, Grossman et al. 1994, Metzler and Barrett 2001, Rawinski 1984, Shank and Shreiner 1999, Sperduto 1992, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.



Figure E51. Northern Riverside Rock Outcrop in Upper Delaware Scenic and Recreational River (Plot UPDE.117). September 2006. NAD 1983 / UTM easting 521818, northing 4586649.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN TEMPERATE COBBLE SCOUR RIVERSHORE

SYNONYMS
USNVC English Name: **Fringed Loosestrife - Indian-hemp Sparse Vegetation**
USNVC Scientific Name: ***Lysimachia ciliata* - *Apocynum cannabinum* Sparse Vegetation**
USNVC Identifier: **CEGL006554**

LOCAL INFORMATION

Environmental Description: This association occurs on the linear banks and cobble shores of islands (upstream point), bars, and shores that are underwater for a significant portion of the year. The substrate is exposed during periods of low water, which, except for infrequent flood events, typically occurs from mid-summer to early fall. Frequent scour causes the variation in species composition that is characteristic of this community.

Vegetation Description: This community is strongly dominated by herbaceous species, but some tall and short shrubs may be present in low abundance. Such species can include American sycamore (*Platanus occidentalis*), black locust (*Robinia pseudoacacia*), willow species (*Salix* spp.), and staghorn sumac (*Rhus typhina*). At Upper Delaware Scenic and Recreational River, smartweeds, including Pennsylvania smartweed (*Polygonum pensylvanicum*), arrowleaf tearthumb (*Polygonum sagittatum*), and dotted smartweed (*Polygonum punctatum*), are often dominant, with spreading dogbane (*Apocynum androsaemifolium*) commonly subdominant. Many diverse associates can be present in varying amounts, including reed canarygrass (*Phalaris arundinacea*), rough bluegrass (*Poa trivialis*), big bluestem (*Andropogon gerardii*), rice cutgrass (*Leersia oryzoides*), eastern marsh fern (*Thelypteris palustris*), strawcolored flatsedge (*Cyperus strigosus*), hairyfruit sedge (*Carex trichocarpa*), Nepalese smartweed (*Persicaria nepalensis*), Carolina horsenettle (*Solanum carolinense*), blunt spikerush (*Eleocharis obtusa*), swamp verbena (*Verbena hastata*), common milkweed (*Asclepias syriaca*), and marsh seedbox (*Ludwigia palustris*), among many others. Purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Polygonum cuspidatum*) are common invasive components that can become quite dominant.

Most Abundant Species:

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	*Platanus occidentalis* (American sycamore)
Herb (field)	Forb	*Apocynum androsaemifolium* (spreading dogbane), *Polygonum pensylvanicum* (Pennsylvania smartweed)

Characteristic Species: *Apocynum androsaemifolium* (spreading dogbane), *Platanus occidentalis* (American sycamore), *Polygonum pensylvanicum* (Pennsylvania smartweed).

Other Noteworthy Species:

Species	GRank	Type	Note
Lythrum salicaria (purple loosestrife)		plant	common invasive

Subnational Distribution with Crosswalk Data:

State	SRank	Conf	SName	Reference
NY	S4*	1	Cobble Shore	Edinger et al. 2002
PA	SNR		[not crosswalked]	

Local Range: This association is most common in northern, upstream reaches of the Upper Delaware River but occurs along the length of the river in the park.

Classification Comments: Occurs on islands (upstream point), bars, and shores on linear banks at slightly higher elevation than Water-willow Rocky Bar and Shore.

Other Comments: Information not available.
Local Description Authors: A. L. Feldmann (NYNHP).
Plots: UPDE.93, UPDE.95, UPDE.99, UPDE.100, UPDE.116, UPDE.144, UPDE.147, UPDE.149, UPDE.150, UPDE.151, UPDE.156, UPDE.157, UPDE.159.
Upper Delaware Scenic and Recreational River Inventory Notes: Information not available.

GLOBAL INFORMATION

USNVC CLASSIFICATION

Physiognomic Class	Sparse Vegetation (VII)
Physiognomic Subclass	Boulder, gravel, cobble, or talus sparse vegetation (VII.B.)
Physiognomic Group	Sparsely vegetated rock flats (VII.B.2.)
Physiognomic Subgroup	Natural/Semi-natural sparsely vegetated rock flats (VII.B.2.N.)
Formation	Cobble/gravel beaches and shores (VII.B.2.N.b.)
Alliance	Cobble/Gravel Shore Sparsely Vegetated Alliance (A.1850)
Alliance (English name)	Cobble/Gravel Shore Sparsely Vegetated Alliance
Association	*Lysimachia ciliata* - *Apocynum cannabinum* Sparse Vegetation
Association (English name)	Fringed Loosestrife - Indian-hemp Sparse Vegetation
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609).

GLOBAL DESCRIPTION

Concept Summary: Island heads, bars, spits, low terraces, and riverbanks are all home to this broadly defined community. The underlying substrate also varies greatly, although it is often cobbles and sand, with thin deposits of silt, muck or organic matter. Species composition also varies greatly from site to site. The unifying factor that bridges the differences in environmental factors and species composition is the frequent scour that these sites experience. This community establishes in areas of the active channel that are underwater for the majority of the year and are exposed only at low water or in drought years. Therefore, these areas are subjected to high water velocities, floods and ice-scour more frequently than other herbaceous communities or shrublands (with the exception of emergent beds). The constant scour removes established vegetation and maintains or creates exposed sediments, cobbles or bedrock. New seeds and plant propagules are constantly being dispersed to these areas by water, air and animals. This causes a continual flux in species composition that is characteristic of this community. Typical species are a mix of annuals and perennials, including *Lysimachia ciliata* (fringed loosestrife), *Lysimachia vulgaris* (garden yellow loosestrife), *Lysimachia nummularia* (creeping jenny), *Senecio* (ragwort) spp., *Eupatorium* (thoroughwort) spp., other Asteraceae spp., *Convolvulus* (bindweed) spp., *Phyla lanceolata* (lanceleaf fogfruit), , *Justicia americana* (American water-willow), *Cyperus esculentus* (chufa flatsedge), *Boehmeria cylindrica* (small-spike false nettle), *Polygonum* (knotweed) spp., *Apocynum cannabinum* (Indianhemp), *Betula nigra* (river birch), and *Platanus occidentalis* (American sycamore). This community is defined mainly by its setting and disturbance regime.
Environmental Description: Island heads, bars, spits, low terraces, and riverbanks are all home to this broadly defined community. The underlying substrate also varies greatly, although it is often cobbles and sand, with thin deposits of silt, muck or organic matter. Species composition also varies greatly from site to site. The unifying factor that bridges the differences in environmental factors and species composition is the frequent scour that these sites experience. This community establishes in areas of the active channel that are underwater for the majority of the year and are exposed only at low water or in drought years. Therefore, these areas are subjected to high water velocities, floods and ice-scour more frequently than other herbaceous

communities or shrublands (with the exception of emergent beds). The constant scour removes established vegetation and maintains or creates exposed sediments, cobbles or bedrock. New seeds and plant propagules are constantly being dispersed to these areas by water, air and animals. This causes a continual flux in species composition that is characteristic of this community.

Vegetation Description: Typical species are a mix of annuals and perennials including *Lysimachia ciliata* (fringed loosestrife), *Lysimachia vulgaris* (garden yellow loosestrife), *Lysimachia nummularia* (creeping jenny), *Senecio* (ragwort) sp., Asteraceae spp., *Eupatorium* (thoroughwort) spp., *Convolvulus* (bindweed) spp., *Phyla lanceolata* (lanceleaf fogfruit), *Justicia americana* (American water-willow), *Cyperus esculentus* (chufa flatsedge), *Boehmeria cylindrica* (small-spike false nettle), *Polygonum* (knotweed) spp., *Apocynum cannabinum* (Indianhemp), *Betula nigra* (river birch), *Platanus occidentalis* (American sycamore). This community is defined mainly by its setting and disturbance regime.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Lysimachia ciliata* (fringed loosestrife)

Characteristic Species: *Apocynum cannabinum* (Indianhemp), *Lysimachia ciliata* (fringed loosestrife), *Polygonum amphibium* (water knotweed).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: The full distribution of this type is not well-known. It is currently documented only from Pennsylvania and New Jersey but believed to range further. Lack of samples and inherent variability are challenges.

States/Provinces: NJ, NY, PA.

Federal Lands: NPS (Delaware Water Gap, Johnstown Flood, Upper Delaware).

CONSERVATION STATUS

Rank: GNR (8-Jul-1999).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 3 - Weak.

Comments: Information not available.

Similar Associations: Information not available.

Related Concepts: Information not available.

SOURCES

Description Authors: E. Largay, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Fike 1999, TNC and WPC 2004.



Figure E52. Northeastern Temperate Cobble Scour Rivershore in Upper Delaware Scenic and Recreational River (Plot UPDE.95). September 2005. NAD 1983 / UTM easting 521812, northing 45846019.



Figure E53. Northeastern Temperate Cobble Scour Rivershore in Upper Delaware Scenic and Recreational River (Plot UPDE.99). September 2005. NAD 1983 / UTM easting 494556, northing 4616976.

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UPDE.28. Hairy-fruit Sedge Wetland (Figure E46)
UPDE.30. Steeplebush / Reed Canarygrass Successional Wet Meadow (Figure E37)
UPDE.32. Central Appalachian Blueberry Shrubland (Figure E40)
UPDE.33. Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (Figure E9)
UPDE.34. Northeastern Successional Shrubland (Figure E35)
UPDE.35. Mixed Pine Conifer Plantation (Figure E1)
UPDE.36. Central Appalachian Northern Hardwood Forest (Figure E6)
UPDE.43. Red Maple - Sweet Birch Hardwood Forest (Figure E12)
UPDE.46. Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (Figure E10)
UPDE.48. Maple - Sweet Birch Hardwood Forest (Figure E13)
UPDE.61. Semi-rich Northern Hardwood Forest (Figure E7)
UPDE.62. Semi-rich Northern Hardwood Forest (Figure E8)
UPDE.76. Red Oak - Heath Woodland / Rocky Summit (Figure E33)
UPDE.95. Northeastern Temperate Cobble Scour Rivershore (Figure E52)
UPDE.96. Riverside Prairie Grassland (Figure E44)
UPDE.99. Northeastern Temperate Cobble Scour Rivershore (Figure E53)
UPDE.108. Hickory - Eastern Redcedar Rocky Woodland (Figure E32)
UPDE.113. Central Appalachian Northern Hardwood Forest (Figure E5)
UPDE.117. Northern Riverside Rock Outcrop (Figure E51)
UPDE.121. Riverside Prairie Grassland (Figure E43)
UPDE.129. Northeastern Modified Successional Forest (Figure E14)
UPDE.134. Sycamore - Mixed Hardwood Floodplain Forest (Figure E25)
UPDE.135. Inland Pitch Pine - Oak Forest (Figure E17)

UPDE.137. Mixed Pine Conifer Plantation (Figure E2)
UPDE.148. Water-willow Rocky Bar and Shore (Figure E48)
UPDE.158. Birch - Willow Riverbank Shrubland (Figure E34)
UPDE.165. Lower New England Slope Chestnut Oak Forest (Figure E18)
UPDE.176. Hemlock - Northern Hardwood Forest (Figure E28)
UPDE.182. Pitch Pine Rocky Summit (Figure E31)
UPDE.185. Little Bluestem - Poverty Grass Low- to Mid- Elevation Outcrop Opening (Figure E42)
UPDE.216. Little Bluestem Old Field (Figure E41)
UPDE.222. Bitternut Hickory Lowland Forest (Figure E23)
UPDE.226. Southern New England Red Maple Seepage Swamp (Figure E26)

Appendix G. Definitions of conservation ranks and classification confidence.

Global Rank Codes and Definitions

Global ranks (i.e. range-wide conservation status ranks) are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network.

GX - Presumed Extinct - Believed to be extinct throughout its range. Not located despite intensive searches of historic sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

GH - Possibly Extinct - Known from only historical occurrences. Still some hope of rediscovery.

G1 - Critically Imperiled - Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or stream miles (<10).

G2 - Imperiled - Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or stream miles (10 to 50).

G3 - Vulnerable - Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

G4 - Apparently Secure - Uncommon but not rare, and usually widespread. Possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.

G5 - Secure - Common, typically widespread and abundant. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

GNA - Rank not applicable - Common cultural, ruderal, planted, modified, managed, invasive, and/or non-natural type. Has little or no conservation value.

GNR - Not Ranked - A rank has not yet been determined for this element, therefore its rarity is currently unspecified. As the USNVC is further revised with additional information, the SNR will be changed to a numeric rank based on available data.

G#G# - Rank Range - The actual rank of the element is within the range specified by the numbers, however the exact status of the rariety of the element is uncertain. For example, G2G3 indicates that the rank may be either G2 or G3.

State Rank Codes and Definitions

State ranks are assigned by the Pennsylvania Natural Heritage Program and the New York Natural Heritage Program and apply to an element only as it exists in each state, regardless of its range-wide status.

SX - Extirpated - Element is believed to be extirpated from the state.

SH - Historical - Element occurred historically in the state (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an Element would become SH without such a 20-year delay if the only known occurrences in a state were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, SH-ranked Elements would typically receive an S1 rank. The SH rank should be reserved for Elements for which some effort has been made to relocate occurrences, rather than simply ranking all Elements not known from verified extant occurrences with this rank.

S1 - Critically Imperiled - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer occurrences or very few remaining individuals or acres.

S2 - Imperiled - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 occurrences or few remaining individuals or acres.

S3 - Vulnerable - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences.

S4 - Apparently Secure - Uncommon but not rare, and usually widespread in the state. Usually more than 100 occurrences.

S5 - Secure - Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.

SNA - Rank not applicable - Common cultural, ruderal, planted, modified, managed, invasive, and/or non-natural type. Has little or no conservation value.

SNR - Not Ranked - A rank has not yet been determined for this element, therefore its rarity is currently unspecified. As the state vegetation classifications are further revised by additional information, the SNR will be changed to a numeric rank based on available data.

S#S# - Rank Range - The actual rank of the element is within the range specified by the numbers, however the exact status of the rariety of the element is uncertain. For example, S1S3 indicates that the rank may be either S1, S2, or S3.

Other Rank Qualifiers

? - Inexact or Uncertain - Denotes inexact or uncertain numeric rank. The ? qualifies the character immediately preceding it in the rank.

Association Classification Confidence

Confidence refers to the certainty that the classification is correct, that the association is accurately described, and that the association is distinct from other similar associations. Confidence for the global USNVC association descriptions was attributed by NatureServe. Confidence for the state association crosswalks was attributed by the Pennsylvania Natural Heritage Program and the New York Natural Heritage Program.

1 - Strong - Classification is based on quantitative analysis of verifiable, high-quality field data (species lists and associated environmental information) from plots that are published in full or are archived in a publicly accessible database. A sufficient number of high-quality plots covering the expected geographic distribution and habitat variability of the vegetation type, as well as plots from related types across the region, have been used in the analysis.

2 - Moderate - Classification is based either on quantitative analysis of a limited data set of high-quality, published/accessible plots and/or plots from only part of the geographic range, or on a more qualitative assessment of published/accessible field data of sufficient quantity and quality.

3 - Weak - Classification is based on limited, or unpublished/inaccessible plot data or insufficient analysis, anecdotal information, or community descriptions that are not accompanied by plot data. These types have often been identified by local experts. Although there is a high level of confidence that these types represent recognized vegetation entities, it is not known whether they would meet national standards for floristic types in concept or in classification approach if sufficient data were available.

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Appendix I. Dichotomous field key to the vegetation associations of Upper Delaware Scenic and Recreational River.

1. Area is predominantly sparsely-vegetated rock outcrops or cobble with scattered vegetation covering less than 25% of total area. These are generally either shoreline or ridgetop communities. ..... SPARSE VEGETATION GROUP

1. Area is not predominantly bare rock outcrops, boulders, talus or scree. Vegetation covers 25% or more of the area.

    2. Association is dominated by herbaceous or graminoid species. Woody species cover less than 25% of the area. ..... HERBACEOUS GROUP

    2. Woody species (shrubs or trees) cover at least 25% of the area.

        3. Shrubs (woody species 5 meters tall or less) cover at least 25% of the area. Trees (woody species greater than 5 meters tall) cover less than 25% of the area. ..... SHRUB GROUP

        3. Trees (woody species greater than 5 meters tall) cover at least 25% of the area.

            4. Trees (woody species greater than 5 meters tall) cover 25–60% of the area. ..... WOODLAND GROUP

            4. Trees (woody species greater than 5 meters tall) cover greater than 60% of the area. ..... FOREST GROUP

SPARSE VEGETATION GROUP

1. Sparse vegetation occurs on cobble, gravel, or rock outcrops adjacent to the Delaware River.

    2. Substrate consists of open, flood-scoured flat to nearly flat bedrock exposures with species distributed patchily due to microsite conditions that range from dry to moist (seepage areas). The sparse vegetation, when present, establishes in crevices and in thin soil over bedrock. Dominants include big bluestem (*Andropogon gerardii*) and little bluestem (*Schizachyrium scoparium*); associated species can include white meadowsweet (*Spiraea alba* var. *latifolia*), flat-top goldentop (*Euthamia graminifolia*), and river birch (*Betula nigra*). Purple loosestrife (*Lythrum salicaria*) is a common invasive species. ..... **Northern Riverside Rock Outcrop (CEGL006284)**

    2. Substrate is cobble or sand/gravel.

        3. Vegetation, which can form dense (>50% cover) emergent beds, occurs adjacent to bars and shoreline and is dominated by American water-willow (*Justicia americana*). The substrate is saturated with at least a few inches of water throughout the season in most years and the elevation of this association is slightly lower than that of Northeastern Temperate Cobble Scour Rivershore. ..... **Water-willow Rocky Bar and Shore (CEGL004286)**

        3. Vegetation occurs on cobble shores that are underwater for a significant portion of the year and exposed during periods of low water (typically mid-summer to early fall except during flood events). Frequent scour causes the variation in species composition that is characteristic of this community. Dominated by Polygonum species, including Pennsylvania smartweed (*Polygonum pensylvanicum*), dotted smartweed (*Polygonum punctatum* var. *punctatum*), and arrowleaf tearthumb (*Polygonum sagittatum*). Occurs on islands (upstream point), bars, and shores on linear banks at slightly higher elevation than Water-willow Rocky Bar and Shore. .... **Northeastern Temperate Cobble Scour Rivershore (CEGL006536)**

1. Sparse vegetation does not occur on cobble, gravel, or sand bars adjacent to the Delaware River; rather, substrate is sandstone, either as boulders, sloping bedrock outcrops or steep cliffs.

    4. Sparse variable vegetation established in crevices of steep, sandstone cliff; substrate not ridgetop rock outcrops. ..... **Sparsely Vegetated Cliff (CEGL006422)**

    4. Association occurs on ridgetop rocky summits, steep rock outcrops, and thin soils.

5. Trees and shrubs cover less than 10% of the area. Prominent vegetation includes herbaceous and graminoid species growing in crevices and in thin soil over bedrock. Characteristic species include wavy hairgrass (*Deschampsia flexuosa*), Pennsylvania sedge (*Carex pensylvanica*), poverty oatgrass (*Danthonia spicata*), and little bluestem (*Schizachyrium scoparium*). ..... **Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening (CEGL006544)**

5. Trees and shrubs cover 10–25% of the area.

    6. Vegetation is dominated by stunted pitch pine (*Pinus rigida*), chestnut oak (*Quercus prinus*), lowbush blueberry (*Vaccinium angustifolium*), black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium pallidum*), wavy hairgrass (*Deschampsia flexuosa*), and greygreen reindeer lichen (*Cladonia rangiferina*) with little bluestem (*Schizachyrium scoparium*) and common serviceberry (*Amelanchier arborea*) present in lower abundance. Occurs at high elevation on flat, lichen-covered bedrock. This is a fire-maintained association. ..... **Pitch Pine Rocky Summit (CEGL006116)**

    6. Vegetation is dominated by stunted, shallow-rooted eastern redcedar (*Juniperus virginiana*) and occurs among rock outcrops on upper slopes and tops of cliffs/bluffs with an S/SW aspect. Characteristic associated species in this sparse, rocky woodland include pignut hickory (*Carya glabra*), northern red oak (*Quercus rubra*), hophornbeam (*Ostrya virginiana*), downy arrowwood (*Viburnum rafinesquianum*), and poverty oatgrass (*Danthonia spicata*). ..... **Hickory - Eastern Redcedar Rocky Woodland (CEGL006002)**

HERBACEOUS GROUP

1. Riparian vegetation that occurs in the floodplain of the Delaware River on islands, shorelines, gravel/cobble bars, or riverbeds. Vegetation structure and composition are influenced by river flooding and scour.

    2. Association is dominated (relative cover > 75%) by either American water-willow (*Justicia americana*) or Japanese knotweed (*Polygonum cuspidatum).*

        3. Vegetation, which can form dense (>50% cover) emergent beds, occurs adjacent to bars and shoreline and is dominated by American water-willow (*Justicia americana*). The substrate is saturated with at least a few inches of water throughout the season in most years. ..... **Water-willow Rocky Bar and Shore (CEGL004286)**

        3. Association is dominated by Japanese knotweed (*Polygonum cuspidatum*), establishing nearly monotypic stands that are over 2 m high on islands and shorelines. ..... **Japanese Knotweed Gravelbar (CEGL008472)**

    2. Association is not dominated (relative cover <75%) by American water-willow (*Justicia americana*) or Japanese knotweed (*Polygonum cuspidatum*).

        4. Substrate consists of open, flood-scoured flat to nearly flat bedrock exposures with species distributed patchily due to microsite conditions that range from dry to moist (seepage areas). The sparse vegetation, when present, establishes in crevices and in thin soil over bedrock. Dominants include big bluestem (*Andropogon gerardii*) and little bluestem (*Schizachyrium scoparium*); associated species can include white meadowsweet (*Spiraea alba* var. *latifolia*), flat-top goldentop (*Euthamia graminifolia*), and river birch (*Betula nigra*). Purple loosestrife (*Lythrum salicaria*) is a common invasive species. ..... **Northern Riverside Rock Outcrop (CEGL006284)**

        4. Vegetation not associated with bedrock outcrops or large fractured cobbles along the shoreline of the Delaware River.

            5. Association is dominated by reed canarygrass (*Phalaris arundinacea*) or hairyfruit sedge (*Carex trichocarpa*).

6. Association is dominated by reed canarygrass (*Phalaris arundinacea*). Common associates include flat-top goldentop (*Euthamia graminifolia*) and giant goldenrod (*Solidago gigantea*). Purple loosestrife (*Lythrum salicaria*) is a common invasive associate. Association occurs on both shoreline sand/gravel deposits and on islands, forming large, level, floodplain marshes that may have small, winding drainages running through them. .. **Reed Canarygrass Eastern Marsh (CEGL006044**)

6. Association is dominated by hairyfruit sedge (*Carex trichocarpa*) with a diverse range of herbaceous associates, including giant goldenrod (*Solidago gigantea*), reed canarygrass (*Phalaris arundinacea*), and prairie cordgrass (*Spartina pectinata*). Association occurs on gently-sloping, moist shoreline sand/gravel deposits along the mainstem of the Delaware River. ..... **Hairyfruit Sedge Wetland (CEGL006447)**

5. Association is not dominated by reed canarygrass (*Phalaris arundinacea*) or hairyfruit sedge (*Carex trichocarpa*).

7. Association resembles tall, dry prairie-like grassland (in summer and early fall) and occurs on shoreline sand/gravel and cobble deposits and islands above the scour zone. Vegetation is dominated by big bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum nutans*). Characteristic associated species can include little bluestem (*Schizachyrium scoparium*), prairie cordgrass (*Spartina pectinata*), switchgrass (*Panicum virgatum*), and wrinkleleaf goldenrod (*Solidago rugosa*). ..... **Riverside Prairie Grassland (CEGL006518)**

7. Vegetation occurs on cobble shores that are underwater for a significant portion of the year and exposed during periods of low water (typically mid-summer to early fall except during flood events). Frequent scour causes the variation in species composition that is characteristic of this community. Dominated by Polygonum species, including Pennsylvania smartweed (*Polygonum pensylvanicum*), dotted smartweed (*Polygonum punctatum* var. *punctatum*), and arrowleaf tearthumb (*Polygonum sagittatum*). Occurs on islands (upstream point), bars, and shores on linear banks. ..... **Northeastern Temperate Cobble Scour Rivershore (CEGL006536)**

1. Palustrine or terrestrial vegetation that is not directly associated with the Delaware River. Palustrine vegetation associated with creeks and tributaries to the Delaware River is included here.

    8. Palustrine vegetation with standing water, saturated soil, or groundwater seepage for at least a portion of the growing season.

        9. Association typically occurs adjacent to creeks and tributaries. Vegetation dominated by reed canarygrass (*Phalaris arundinacea*) with relative cover of 50% or greater. ..... **Reed Canarygrass Eastern Marsh (CEGL006044)**

        9. Association is not typically associated with creeks and tributaries. Reed canarygrass (*Phalaris arundinacea*) is absent or constitutes less than 50% relative cover.

            10. Association contains standing water for most or all of the year and is often associated with impounded drainages, ponded areas near streams, or saturated areas surrounding drainages.

                11. Association is dominated by cattails (*Typha* spp.) or common reed (*Phragmites australis*).

                    12. Vegetation is dominated by cattails (*Typha* spp.), which can have 30-75% cover. ..... **Eastern Cattail Marsh (CEGL006153)**

                    12. Vegetation is dominated by common reed (*Phragmites australis*), which can form nearly monotypic stands. ..... **Eastern Reed Marsh (CEGL004141)**

                11. Association is not dominated by cattails (*Typha* spp.) or common reed (*Phragmites australis*). Vegetation is dominated by species that are tolerant of standing water and species composition is variable between sites. Common species include needle spikerush (*Eleocharis acicularis*), swamp verbena (*Verbena hastata*), nodding beggartick (*Bidens cernua*), rice cutgrass (*Leersia oryzoides*), marshpepper smartweed (*Polygonum hydropiper*), arrowleaf tearthumb (*Polygonum sagittatum*), field horsetail (*Equisetum arvense*), New England aster (*Symphyotrichum novae-angliae*), owlfruit sedge (*Carex stipata*), and/or marsh seedbox (*Ludwigia palustris*). ..... **Mixed Forb Marsh (CEGL006446)**

            10. Association does not contain standing water for most or all of the year and is not associated with impounded drainages. Vegetation is dominated by wet meadow species and is associated with abandoned pastures or old agricultural fields in low-lying or seepy areas. Dominant species are extremely variable and can include Canada goldenrod (*Solidago canadensis*), wrinkleleaf goldenrod (*Solidago rugosa*), flat-top goldentop (*Euthamia graminifolia*),

parasol whitetop (*Doellingeria umbellata* var. *umbellata*), Allegheny blackberry (*Rubus allegheniensis*) and white meadowsweet (*Spiraea alba* var. *latifolia*). ..... **Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)**

8. Terrestrial vegetation with no standing water or saturated soil.

13. Vegetation cover is somewhat patchy and occurs on ridgetop rocky summits and steep rock outcrops. Prominent vegetation includes herbaceous and graminoid species growing in crevices and in thin soil over bedrock. Characteristic species include wavy hairgrass (*Deschampsia flexuosa*), Pennsylvania sedge (*Carex pensylvanica*), poverty oatgrass (*Danthonia spicata*), and little bluestem (*Schizachyrium scoparium*). ..... **Little Bluestem - Poverty Grass Low- to Mid-Elevation Outcrop Opening (CEGL006544)**

13. Vegetation is typically dense and continuous, not dominated by wavy hairgrass (*Deschampsia flexuosa*), and is not associated with bedrock outcrops.

14. Little bluestem (*Schizachyrium scoparium*) covers greater than 50% of the area. ..... **Little Bluestem Old Field (CEGL006333)**

14. Little bluestem (*Schizachyrium scoparium*) covers less than 50% of the area. Vegetation is dominated by nonnative, early successional grasses and herbs on abandoned pasture and post-agricultural fields. Dominant species can include orchardgrass (*Dactylis glomerata*), timothy (Phleum pratense), wrinkleleaf goldenrod (*Solidago rugosa*), and sweet vernalgrass (*Anthoxanthm odoratum*) with numerous associates. ..... **Northeastern Old Field (CEGL006107)**

SHRUB GROUP

1. Riparian or palustrine vegetation that is either directly associated with the Delaware River or that has standing water, saturated soil or groundwater seepage for at least a portion of the growing season.

    2. Riparian vegetation that occurs in the floodplain of the Delaware River or its main tributaries on islands, shorelines, gravel/cobble bars, or riverbeds. Vegetation structure and composition is influenced by river flooding and scour.

        3. Vegetation is characterized by a moderately dense to dense short shrub layer less than 2 m in height that cover greater than 25% of the area. Characteristic species include Salix species [black willow (*Salix nigra*), Missouri River willow (*Salix eriocephala*), silky willow (*Salix sericea*)] and American sycamore (*Platanus occidentalis*). ..... **Willow River-bar Shrubland (CEGL006065)**

        3. Vegetation is characterized by a moderately dense to dense tall shrub layer of shrubs 2–5 m in height that cover greater than 25% of the area. The dominant species is typically American sycamore (*Platanus occidentalis*), with associates including river birch (Betula nigra), black willow (*Salix nigra*), silver maple (*Acer saccharinum*), and big bluestem (*Andropogon gerardii*). ..... **Birch - Willow Riverbank Shrubland (CEGL003896)**

    2. Palustrine vegetation with standing water, saturated soil or groundwater seepage for at least a portion of the growing season. Area contains standing water in at least the early portion of the growing season or is associated with floodplains of creeks and drainages.

        4. Dominant shrubs are leatherleaf (*Chamaedaphne calyculata*), highbush blueberry (*Vaccinium corymbosum*) and/or sheep laurel (*Kalmia angustifolia*), over a continuous blanket of sphagnum moss (*Sphagnum* spp.).

            5. Shrubland is characterized by dwarf shrubs under 40 cm high and is dominated by leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), black chokeberry (*Photinia melanocarpa*) and sheep laurel (*Kalmia angustifolia*). ..... **Southern New England Bog (CEGL006008)**

            5. Shrubland is characterized by dense highbush blueberry (*Vaccinium corymbosum*), greater than 1 m in height. ..... **Highbush Blueberry Bog Thicket (CEGL006190)**

        4. Dominant shrubs are alders (*Alnus* spp.), dogwoods (*Cornus* spp.), meadowsweet (Spiraea spp.), viburnum (*Viburnum* spp.), raspberries (*Rubus* spp.), and/or willows (*Salix* spp.).

6. Association is dominated by speckled alder (*Alnus incana* spp. *rugosa*) with varied associated shrub species, including redosier dogwood (*Cornus sericea*), meadowsweet (*Spiraea* spp.), and viburnum (*Viburnum* spp.). ..... **Speckled Alder Swamp (CEGL002381)**

6. Association is not dominated by speckled alder (*Alnus incana* spp. *rugosa*). Vegetation is dominated by wet meadow species and is associated with abandoned pastures or old agricultural fields in low-lying or seepy areas. Dominant species are extremely variable and can include white meadowsweet (*Spiraea alba* var. *latifolia*), Allegheny blackberry (*Rubus allegheniensis*), willows (*Salix* spp.), Canada goldenrod (*Solidago canadensis*), wrinkleleaf goldenrod (*Solidago rugosa*), flat-top goldentop (*Euthamia graminifolia*), and parasol whitetop (*Doellingeria umbellata* var. *umbellata*). ..... **Steeplebush / Reed Canarygrass Successional Wet Meadow (CEGL006571)**

1. Terrestrial vegetation that is not directly associated with the Delaware River and that does not have standing water, saturated soils, or groundwater seepage.

7. Shrubland typically occurs on former agricultural land or after intensive timber harvest. Characteristic shrubs can include raspberries [(Allegheny blackberry) *Rubus allegheniensis*, wine raspberry (*Rubus phoenicolasius*), black raspberry (*Rubus occidentalis*)], gray dogwood (*Cornus racemosa*), multiflora rose (*Rosa multiflora*), eastern redcedar (*Juniperus virginiana*), eastern white pine (*Pinus strobus*), and smooth sumac (*Rhus glabra*). Herbaceous vegetation is extremely variable but is generally composed of early successional grasses and herbs; eastern hayscented fern (*Dennstaedtia punctilobula*) can be quite abundant. ..... **Northeastern Successional Shrubland (CEGL006451)**

7. Shrubland is restricted to rocky and thin soil at high elevations. In general, the influential factors in vegetation structure and composition are harsh edaphic conditions and fire regimes. Characteristic shrubs include bear oak (*Quercus ilicifolia*), lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*), deerberry (*Vaccinium stamineum*), black huckleberry (*Gaylussacia baccata*), sheep laurel (*Kalmia angustifolia*), mountain laurel (*Kalmia latifolia*) and eastern redcedar (*Juniperus virginiana*).

8. Association is characterized by bear oak (*Quercus ilicifolia*) or ericaceous shrubs (*Vaccinium* spp.). Eastern redcedar (*Juniperus virginiana*), if present, occurs at low abundance.

9. Association is dominated by bear oak (*Quercus ilicifolia*), with heath species such as black huckleberry (*Gaylussacia baccata*) and blueberries (*Vaccinium* spp.) as characteristic associates. Common graminoids include wavy hairgrass (*Deschampsia flexuosa*), Pennsylvania sedge (*Carex pensylvanica*), and little bluestem (*Schizachyrium scoparium*). ..... **Ridgetop Scrub Oak Barrens (CEGL006121)**

9. Association is dominated by ericaceous shrubs, primarily blueberries [lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*)] and black huckleberry (*Gaylussacia baccata*). White meadowsweet (*Spiraea alba* var. *latifolia*) and maleberry (*Lyonia ligustrina*) are common associated shrubs. The clubmosses fan clubmoss (*Lycopodium digitatum*) and rare clubmoss (*Lycopodium obscurum*) are also potentially characteristic. Association is created and maintained by fire. ..... **Central Appalachian Blueberry Shrubland (CEGL003958)**

8. Association is characterized by eastern redcedar (*Juniperus virginiana*). Bear oak (*Quercus ilicifolia*) and ericaceous shrubs, if present, occur at low abundance. This sparse, rocky woodland occurs among rock outcrops on upper slopes. Characteristic associated species include pignut hickory (*Carya glabra*), northern red oak (*Quercus rubra*), hophornbeam (*Ostrya virginiana*), and poverty oatgrass (*Danthonia spicata*). ..... **Hickory - Eastern Redcedar Rocky Woodland (CEGL006002)**

WOODLAND GROUP

1. Riparian vegetation that occurs in the floodplain of the Delaware River or its major tributaries on islands, shorelines, or terraces.

    2. Woodland is dominated by either river birch (*Betula nigra*) or bitternut hickory (*Carya cordiformis*). American sycamore (*Platanus occidentalis*) and/or silver maple (*Acer saccharinum*) may be present, but neither species is dominant.

        3. Woodland is dominated by river birch (*Betula nigra*) with associated species that include American sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and redosier dogwood (*Cornus sericea*). Trees are typically young (<15 m height) and often have multiple trunks. There can be a dense layer of reed canarygrass (*Phalaris arundinacea*) beneath. ..... **River Birch Low Floodplain Forest (CEGL006184)**

        3. Woodland is dominated by bitternut hickory (*Carya cordiformis*), often in a linear strip of floodplain between the river and fields or houses. Trees are typically greater than 15 m in height. .....**Bitternut Hickory Lowland Forest (CEGL006445)**

    2. Woodland is dominated by either American sycamore (*Platanus occidentalis*) or silver maple (*Acer saccharinum*). River birch (*Betula nigra*) and/or bitternut hickory (*Carya cordiformis*) may be present, but neither species is dominant.

        4. Woodland is dominated by American sycamore (*Platanus occidentalis*), which co-occurs with sugar maple (*Acer saccharum*), American hornbeam (*Carpinus caroliniana*), and green ash (*Fraxinus pennsylvanica*). Black locust (*Robinia pseudoacacia*) can be a common early successional species in these forests. Vines, including Virginia creeper (*Parthenocissus quinquefolia*) and eastern poison ivy (*Toxicodendron radicans*), are common. ..... **Sycamore - Mixed Hardwood Floodplain Forest (CEGL006036)**

        4. Woodland is dominated by silver maple (*Acer saccharinum*) often with a dense layer of reed canarygrass (*Phalaris arundinacea*) beneath. ..... **Silver Maple Floodplain Forest (CEGL002586)**

1. Palustrine or terrestrial vegetation not directly associated with the Delaware River.

    5. Palustrine vegetation typically dominated by an open canopy (25-95% relative cover) of red maple (*Acer rubrum*) with a variety of associates, including eastern white pine (*Pinus strobus*), swamp white oak (*Quercus bicolor*), and sweet birch (*Betula lenta*). Characteristic herbaceous species can include cinnamon fern (*Osmunda cinnamomea*), upright

sedge (*Carex stricta*), and eastern marsh fern (*Thelypteris palustris* var. *pubescens)*. This association can be temporarily to permenantly flooded. ..... **Southern New England Red Maple Seepage Swamp (CEGL006406)**

5. Terrestrial vegetation.

    6. Vegetation is restricted to rocky and thin soils including rocky summits, rock outcrops, and cliffs. In general, the influential factors in vegetation structure and composition are harsh edaphic conditions and fire regimes.

        7. Woodland occurs on gently to steeply sloping large sandstone bedrock outcrops, cliffs, or rocky summits.

            8. Vegetation is dominated by eastern redcedar (*Juniperus virginiana*) and/or pignut hickory (*Carya glabra*), and occurs among rock outcrops on upper slopes or the crests of cliffs. Characteristic associated species in this sparse, rocky woodland include northern red oak (*Quercus rubra*), hophornbeam (*Ostrya virginiana*), and poverty oatgrass (*Danthonia spicata*). .... **Hickory - Eastern Redcedar Rocky Woodland (CEGL006002)**

            8. Vegetation is dominated by oaks (*Quercus* spp.) or pitch pine (*Pinus rigida*). Eastern redcedar (*Juniperus virginiana*), if present, occurs at low abundance. Ericaceous shrubs such as blueberry (*Vaccinium* spp.) huckleberry (*Gaylussacia* spp.), and laurel (*Kalmia* spp.) are common.

                9. Woodland tree canopy contains less than 25% cover of evergreen species. Canopy dominants include chestnut oak (*Quercus prinus*), scarlet oak (*Quercus coccinea*), northern red oak (*Quercus rubra*), and sweet birch (Betula lenta) with lesser amounts of pine [(eastern white pine (*Pinus strobus*), pitch pine (*Pinus rigida*)]. Typical shrub species, often occurring at high abundance, include black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium angustifolium*), and Blue Ridge blueberry (*Vaccinium pallidum*) with deerberry (*Vaccinium stamineum*), mountain laurel (*Kalmia latifolia*), and sweet fern (*Comptonia peregrina*) often present in lower abundance. Pennsylvania sedge (*Carex pennsylvanica*) is a characteristic herb. Association occurs on the highest elevation knob tops. ..... **Red Oak - Heath Woodland / Rocky Summit (CEGL006134)**

                9. Woodland tree canopy contains at least 25% cover of pitch pine (*Pinus rigida*), which is typically the canopy dominant. Other common species include chestnut oak (*Quercus prinus*), lowbush blueberry (*Vaccinium angustifolium*), black

huckleberry (*Gaylussacia baccata*), Blue Ridge blueberry (*Vaccinium pallidum*), wavy hairgrass (*Deschampsia flexuosa*), and greygreen reindeer lichen (*Cladonia rangiferina*). Little bluestem (*Schizachyrium scoparium*) and common serviceberry (*Amelanchier arborea*) are present in lower abundance. ..... **Pitch Pine Rocky Summit (CEGL006116)**

7. Woodland does not occur on gently to steeply sloping large bedrock outcrops, cliffs, or rocky summits.

    10. Canopy is dominated by eastern white pine (*Pinus strobus*) with dry oak species [white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*)], and sweet birch (*Betula lenta*) present as associated species. The potentially dense shrub layer (20-90% cover) can be dominated by deerberry (*Vaccinium stamineum*), lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*), and black huckleberry (*Gaylussacia baccata*). Pink azalea (*Rhododendron periclymenoides*) is commonly present in low abundance. Occurs elevationally at high level, low level, or step-in-slope position on sandy loam above tributaries to the Delaware River. ..... **White Pine - Oak Forest (CEGL006293)**

    10. Canopy is dominated by pitch pine (*Pinus rigida*) with dry oak species [white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*)], and pignut hickory (*Carya glabra*). The potentially dense shrub layer (20-60% cover) can be dominated by deerberry (*Vaccinium stamineum*), lowbush blueberry (*Vaccinium angustifolium*), and Blue Ridge blueberry (*Vaccinium pallidum*). Occurs on ridges and knobs; probably develops after fire. ..... **Inland Pitch Pine - Oak Forest (CEGL006290)**

6. Vegetation is not restricted to rocky sites with thin soils. In general, current vegetation structure and composition are most influenced by past land management and land use history.

    11. Woodland dominated by conifers such as pine (*Pinus* spp.) or spruce (*Picea* spp.).

        12. Association consists of successional, open woodland on abandoned pasture and post-agricultural fields dominated by eastern white pine (*Pinus strobus*). Adventitious, early successional hardwoods such as white ash (*Fraxinus americana*), black locust (*Robinia pseudoacacia*), bigtooth aspen (*Populus grandidentata*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*) can be co-dominant; northern red oak (*Quercus rubra*) and American beech

(*Fagus grandifolia*) may also be compositionally important. Groundstory vegetation is generally dominated by nonnative, early successional grasses and herbs. Dominant species can include orchardgrass (*Dactylis glomerata*), timothy (*Phleum pratense*), wrinkleleaf goldenrod (*Solidago rugosa*), and sweet vernalgrass (*Anthoxanthm odoratum*) with numerous associated invasive herb, shrub, and vine species. ..... **Northeastern Oak - Red Maple Successional Forest (CEGL006506)**

12. Association dominated by scattered established, even-aged, regularly-spaced eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*), Norway spruce (*Picea abies*), or blue spruce (*Picea pungens*). ..... **Mixed Pine Conifer Plantation (CEGL006313)**

11. Woodland dominated by hardwoods [eastern redcedar (*Juniperus virginiana*) or eastern white pine (*Pinus strobus*)] may be co-dominant in some stands).

13. Association consists of an open to closed stand of even-aged, regularly-spaced European larch (*Larix decidua*). The herbaceous layer is usually sparse with low diversity. ..... **Larch Plantation (CEGL006408)**

13. Association does not consist of a planted stand of European larch (*Larix decidua*).

14. Woodland is characterized by a successional mixture of native hardwood trees such as northern red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), and red maple (*Acer rubrum*) with eastern white pine (*Pinus strobus*) and aspen (*Populus* spp.). Sweet birch (*Betula lenta*) and red maple (*Acer rubrum*) are not dominant (see CEGL008503 in Forest Group). Invasive species are sparse or absent. ..... **Northeastern Oak - Red Maple Successional Forest (CEGL006506)**

14. Woodland is characterized by early successional, weedy species such as black cherry (*Prunus serotina*), red maple (*Acer rubrum*), black locust (*Robinia pseudoacacia*), tree of heaven (*Ailanthus altissima*), and white ash (*Fraxinus americana*). Invasive shrub species, such as Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*) are characteristic and can be abundant. Occurs on low, flat areas (sometimes replacing floodplain forest), succeeding on abandoned agricultural fields and/or surrounding development. ..... **Northeastern Modified Successional Forest (CEGL006599)**

FOREST GROUP

1. Riparian or palustrine forests that contain saturated soil for at least part of the growing season or that occur in the floodplain of the Delaware River or its major tributaries.

    2. Forest is dominated by maples [silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), or red maple (*Acer rubrum*)] that constitute at least 25% relative cover of the canopy. Numerous species may be present as associates, but each of the following species do not constitute more than 25% relative cover of the canopy: American sycamore (*Platanus occidentalis*), bitternut hickory (*Carya cordiformis*), river birch (*Betula nigra*), or eastern hemlock (*Tsuga canadensis*). If maples constitute 25–50% relative cover, and one of the above species constitutes greater than 25% relative cover, see couplet 5 below.

        3. Forest is dominated by silver maple (*Acer saccharinum*) or sugar maple (*Acer saccharum*). Forest typically occurs on the floodplain of the Delaware River or its major tributaries.

            4. Silver maple (*Acer saccharinum*) constitutes at least 25% relative cover of the canopy; frequently relative cover exceeds 50%. Sugar maple (*Acer saccharum*) can be absent or co-dominant. ..... **Silver Maple Floodplain Forest (CEGL002586)**

            4. Silver maple (*Acer saccharinum*) and American sycamore (*Platanus occidentalis*) are absent or are occasional canopy associates (<25% relative cover). Sugar maple (*Acer saccharum*) constitutes at least 25% relative cover of the canopy and is prominent in the subcanopy; frequently relative cover exceeds 50%. [If American sycamore (*Platanus occidentalis*) canopy cover exceeds 25% relative cover, see CEGL006036 below]. ..... **Sugar Maple Floodplain Forest (CEGK006459)**

        3. Forest is dominated by an open to closed canopy (25–95% relative cover) of red maple (*Acer rubrum*) with a variety of associates, including eastern white pine (*Pinus strobus*), swamp white oak (*Quercus bicolor*), and sweet birch (*Betula lenta*). Characteristic herbaceous species can include cinnamon fern (*Osmunda cinnamomea*), upright sedge (*Carex stricta*), and eastern marsh fern (*Thelypteris palustris* var. *pubescens*). This association can be temporarily to permanently flooded and typically occurs around smaller drainages, in depressions, and near groundwater seepage. ..... **Southern New England Red Maple Seepage Swamp (CEGL006406)**

2. Forest is not dominated by maples (silver maple [*Acer saccharinum*], sugar maple [*Acer saccharum*], or red maple [*Acer rubrum*]). Canopy is dominated by one or more of the following species that can constitute more than 25% relative cover of the canopy: American sycamore (*Platanus occidentalis*), bitternut hickory (*Carya cordiformis*), river birch (Betula nigra), red spruce (*Picea rubens*), or eastern hemlock (*Tsuga canadensis*). Maples may constitute 25–50% relative cover if one of the above species constitutes grater than 25% relative cover.

    5. Forest is dominated or co-dominated by conifer species, especially eastern hemlock (*Tsuga canadensis*) or red spruce (*Picea rubens*) with relative cover of 25% or greater in the canopy.

        6. Forest is dominated by eastern hemlock (*Tsuga canadensis*) with at least 25% relative canopy cover. Common canopy associates include red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), and/or blackgum (*Nyssa sylvatica*). This swamp type occurs in small basins, often associated with headwater seepage. ..... **Hemlock - Hardwood Swamp (CEGL006226)**

        6. Forest is dominated by red spruce (*Picea rubens*) with at least 25% relative canopy cover. Common canopy associates include eastern white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), and blackgum (*Nyssa sylvatica*). This wetland type occurs in isolated upland depressions typically on ridgetops in Pennsylvania. This association occurs on shallow organic soils or mineral soils with substantial accumulation of organic matter. ..... **Swamp Forest - Bog Complex (Spruce Type) (CEGL006277)**

    5. Forest is dominated by American sycamore (*Platanus occidentalis*), bitternut hickory (*Carya cordiformis*) or river birch (*Betula nigra*) with relative cover of 25% or greater in the canopy.

        7. Forest is dominated by bitternut hickory (*Carya cordiformis*), which constitutes at least 25% relative cover in the canopy. Sugar maple (*Acer saccharum*) and ostrich fern (*Matteuccia struthiopteris*) can be characteristic associated species; garlic mustard (*Alliaria petiolata*) and Japanese barberry (*Berberis thunbergii*) are common invasives. This forest occurs on the floodplain of the Delaware River or its major tributaries. ..... **Bitternut Hickory Lowland Forest (CEGL006445)**

        7. Forest is dominated by American sycamore (*Platanus occidentalis*), which co-occurs with sugar maple (*Acer saccharum*), American hornbeam (*Carpinus caroliniana*), and green ash (*Fraxinus pennsylvanica*) on the Delaware River or its major tributaries. Black locust (*Robinia pseudoacacia*) can be a common early successional

species in these forests and vines, including Virginia creeper (*Parthenocissus quinquefolia*) and eastern poison ivy (*Toxicodendron radicans*), are common. ..... **Sycamore - Mixed Hardwood Floodplain Forest (CEGL006036)**

7. Forest is dominated by river birch (*Betula nigra*) with associated species that include American sycamore (*Platanus occidentalis*), silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and redosier dogwood (*Cornus sericea*). Trees are typically young (<15 m height) and often have multiple trunks. ..... **River Birch Low Floodplain Forest (CEGL006184)**

1. Terrestrial forests that do not regularly experience saturated soils during the growing season and do not occur in the floodplain of the Delaware River and its major tributaries.

8. Association consists of an even-aged, regularly-spaced stand of European larch (*Larix decidua*). The herbaceous layer is usually sparse with low diversity. ..... **Larch Plantation (CEGL006408)**

8. Association does not consist of even-aged European larch (*Larix decidua*).

9. Within the canopy and subcanopy combined, conifers have relative cover of 75% or greater. Association dominated by an even-aged, regularly-spaced stand of eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*), Scotch pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), or blue spruce (*Picea pungens*). The herbaceous layer is usually sparse with low diversity. ..... **Mixed Pine Conifer Plantation (CEGL006313)**

9. Within the canopy and subcanopy combined, conifers have relative cover less than 75%.

10. Within the canopy and subcanopy combined, conifers have relative cover of 25–75%. ..... **MIXED TERRESTRIAL FOREST SUBGROUP**

10. Within the canopy and subcanopy combined, conifers have relative cover less than 25%. ..... **DECIDUOUS TERRESTRIAL FOREST SUBGROUP**

MIXED TERRESTRIAL FOREST SUBGROUP

[Note: Due to hemlock decline, observed foliar cover in hemlocks may lower than the percentages listed in the key.]

1. Successional forest generally located on abandoned pasture and post-agricultural fields dominated by eastern white pine (*Pinus strobus*). Adventitious, early successional hardwoods such as white ash (*Fraxinus americana*), black locust (*Robinia pseudoacacia*), bigtooth aspen (Populus grandidentata), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*) can be co-dominant; northern red oak (*Quercus rubra*) and American beech (*Fagus grandifolia*) may also be compositionally important. Groundstory vegetation is generally dominated by nonnative, early successional grasses and herbs. Dominant species can include orchardgrass (*Dactylis glomerata*), timothy (*Phleum pratense*), wrinkleleaf goldenrod (*Solidago rugosa*), and sweet vernalgrass (*Anthoxanthm odoratum*) with numerous associated invasive herb, shrub, and vine species. ..... **Northeastern Oak - Red Maple Successional Forest (CEGL006506)**

1. Forest not as described above.

    2. Relative cover of pines (*Pinus* spp.) or spruces (*Picea* spp.) in the canopy and subcanopy combined is greater than the relative cover of eastern hemlock (*Tsuga canadensis*) in the canopy and subcanopy combined. Eastern redcedar (*Juniperus virginiana*) may be common in the subcanopy.

        3. Forest dominated by even-aged, regularly-spaced canopy trees. Association consists of an even-aged, regularly-spaced stand of eastern white pine (*Pinus strobus*), red pine (*Pinus resinosa*), Scotch pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), or blue spruce (Picea pungens) mixed with adventitious hardwood species, including white ash (*Fraxinus americana*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), American beech (*Fagus grandifolia*), American hornbeam (*Carpinus caroliniana*), and sweet birch (*Betula lenta*). Eastern redcedar (*Juniperus virginiana*) may be common in the subcanopy. The herbaceous layer is usually sparse with low diversity. ..... **Mixed Pine Conifer Plantation (CEGL006313)**

        3. Forest not of even-aged, regularly-spaced canopy trees. Eastern white pine (*Pinus strobus*) or pitch pine (*Pinus rigida*) composed at least 25% relative cover in the canopy and subcanopy combined, with hardwood associates typical of dry oak forests.

            4. Canopy is dominated by eastern white pine (*Pinus strobus*) with dry oak species [white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*)], and sweet birch (*Betula lenta*) present as associated species. The potentially

dense shrub layer (20-90% cover) can be dominated by deerberry (*Vaccinium stamineum*), lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*), and black huckleberry (*Gaylussacia baccata*). Pink azalea (*Rhododendron periclymenoides*) is commonly present in low abundance. Occurs elevationally at a high level, low level, or step-in-slope position on sandy loam above tributaries to the Delaware River. ..... **White Pine - Oak Forest (CEGL006293)**

4. Canopy is dominated by pitch pine (*Pinus rigida*) with dry oak species [white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*)], and pignut hickory (*Carya glabra*). The potentially dense shrub layer (20-60% cover) can be dominated by deerberry (*Vaccinium stamineum*), lowbush blueberry (*Vaccinium angustifolium*), and Blue Ridge blueberry (*Vaccinium pallidum*). Occurs on ridges and knobs; probably develops after fire. ..... **Inland Pitch Pine - Oak Forest (CEGL006290)**

2. Relative cover of eastern hemlock (*Tsuga canadensis*) in the canopy and subcanopy combined is greater than the relative cover of pines (*Pinus* spp.) or spruces (*Picea* spp.) in the canopy and subcanopy combined.

5. Canopy is composed of eastern hemlock (*Tsuga canadensis*) with a strong component of dry oak species [especially white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), and scarlet oak (*Quercus coccinea*)], along with American beech (*Fagus grandifolia*) and sweet birch (*Betula lenta*). Eastern white pine (*Pinus strobus*) and red maple (*Acer rubrum*) can also be compositionally important. Sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*) are absent or rare. Ericaceous shrubs such as great laurel (Rhododendron maximum), mountain laurel (*Kalmia latifolia*), Blue Ridge blueberry (*Vaccinium pallidum*), lowbush blueberry (*Vaccinium angustifolium*), and black huckleberry (*Gaylussacia baccata*) can be locally abundant; other common shrubs include American witchhazel (*Hamamelis virginiana*) and mapleleaf viburnum (*Viburnum acerifolium*). The herb layer is characteristically sparse (0-10% cover). The association occurs on dry, nutrient-poor, well-drained (often shallow) soils over acidic bedrock. Slope and aspect are variable. ..... **Hemlock - Beech - Oak Forest (CEGL006088)**

5. Canopy is composed of eastern hemlock (*Tsuga canadensis*) with a strong component of mesic northern hardwood species. Sugar maple (*Acer saccharum*) and yellow birch (*Betula alleghaniensis*) are diagnostic species. Other common associates can include tuliptree (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), striped maple (*Acer pensylvanicum*), American basswood (*Tilia americana*), American beech (*Fagus grandifolia*) and sweet birch (*Betula lenta*).

Oaks (*Quercus* spp.), and eastern white pine (*Pinus strobus*) are absent or rare. This community occurs on rocky, moist, north-facing slopes at lower elevation as well as in well-drained but seepy depressions and protected coves. ..... **Hemlock - Northern Hardwood Forest (CEGL006109)**

DECIDUOUS TERRESTRIAL FOREST SUBGROUP

1. Forests occur on dry sites, mid- to upper slopes, and ridgetops. In general, forests are dominated by dry oaks [chestnut oak (*Quercus prinus*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*, black oak (*Quercus velutina*), northern red oak (*Quercus rubra*)] and/or hickories [pignut hickory (*Carya glabra*), mockernut hickory (*Carya alba*), red hickory (*C. ovalis*)]. Common associates include red maple (*Acer rubrum*), sweet birch (*Betula lenta*), eastern white pine (Pinus strobus), and pitch pine (*Pinus rigida*). Characteristic shrubs are ericaceous species [black huckleberry (*Gaylussacia baccata*) blueberries (*Vaccinium* spp.), laurel (*Kalmia* spp.)].

    2. Association strongly dominated by chestnut oak (*Quercus prinus).* Forests contains dense tall and/or short shrub layer (40-95% absolute cover) dominated by ericaceous species, especially black huckleberry (*Gaylussacia baccata*) and blueberries [(lowbush blueberry (*Vaccinium angustifolium*) Blue Ridge blueberry (*Vaccinium pallidum*)]. Canopy is composed of established chestnut oak (*Quercus prinus*), northern red oak (Quercus rubra) and/or white oak (*Quercus alba*). Other common canopy associates include pitch pine (*Pinus rigida*) and eastern white pine (*Pinus strobus*); pines can approach 50% cover in the canopy. Scarlet oak (Quercus coccinea), pignut hickory (*Carya glabra*), sweet birch (Betula lenta), and red maple (*Acer rubrum*) can also occur. Herbaceous layer is typically poorly developed and depauperate. Association develops on very dry knobs and ridges. ..... **Lower New England Slope Chestnut Oak Forest (CEGL006282)**

    2. Association not strongly dominated by chestnut oak (*Quercus prinus*).

        3. An enriched oak-hickory forest with abundant (roughly 10-20% of canopy cover) hickories; conifers are scarce to absent. Co-dominant canopy species include shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), bitternut hickory (*Carya cordiformis*), northernred oak (*Quercus rubra*), white oak (*Quercus alba*), scarlet oak (*Quercus coccinea*), chestnut oak (*Quercus prinus*), and sweet birch (*Betula lenta*). Enrichment indicators often include sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), American basswood (*Tilia americana*), and hophornbeam (*Ostrya virginiana*). Forest can contain patches of ericaceous species, especially black huckleberry (*Gaylussacia baccata*) and blueberries [(lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*). Wild sarsaparilla (*Aralia nudicaulis*) Pennsylvania sedge (*Carex pensylvanica*), and marginal woodfern (*Dryopteris marginalis*) are common herbs. Occurs on dry, usually convex, upper slopes, most frequently with a southwest/south/southeast aspect but aspect can be variable. ..... **Dry, Rich Oak - Hickory Forest (CEGL006236)**

3. An oak-hickory to mixed oak forest lacking enrichment indicators; conifers may be present in low abundance. Hickories [(pignut hickory (*Carya glabra*), shagbark hickory (*Carya ovata*)] can be present but only in low abundance. Co-dominant canopy species include white oak (*Quercus alba*), northern red oak (*Quercus rubra*), scarlet oak (*Quercus coccinea)*, chestnut oak (*Quercus prinus*), and sweet birch (*Betula lenta*). Forest can contain a moderately dense tall and/or short shrub layer dominated by ericaceous species, especially black huckleberry (*Gaylussacia baccata*) and blueberries [(lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*). Beaked hazelnut (*Corylus cornuta*) can also be important in the tall shrub layer. Common groundstory species are wavy hairgrass (*Deschampsia flexuosa*), Swan's sedge (*Carex swanii*), partridgeberry (*Mitchella repens*), striped prince's pine (*Chimaphila maculata*), Pennsylvania sedge (*Carex pensylvanica*), marginal woodfern (*Dryopteris marginalis*), wild sarsaparilla (Aralia nudicaulis), and starflower (*Trientalis borealis*). Occurs on slightly moist, upper and middle slopes; aspect is variable. ..... **Northeastern Dry Oak-Hickory Forest (CEGL006336)**

1. In general, forests occur on dry-mesic to mesic sites, mid- to lower slopes, and low elevations. Forests are dominated by maples (*Acer* spp.), birches (*Betula* spp.), tuliptree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), bitternut hickory (*Carya cordiformis*), and/or American basswood (*Tilia americana*). Also included here are young hardwood forests in which diameter at breast height of canopy trees does not exceed 25 cm for most trees, and forests dominated by early successional or weedy trees with abundant invasive species. Characteristic shrubs are northern spicebush (*Lindera benzoin*), American witchhazel (*Hamamelis virginiana*), American hornbeam (*Carpinus caroliniana*), common winterberry (*Ilex verticillata*) and raspberries (*Rubus* spp.).

    4. Forest is dominated by early successional, weedy species such as black cherry (*Prunus serotina*), red maple (*Acer rubrum*), black locust (*Robinia pseudoacacia*), tree of heaven (*Ailanthus altissima*), and white ash (*Fraxinus americana*). Invasive shrub species, such as Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*) are characteristic and can be abundant. Occurs on low, flat areas (sometimes replacing floodplain forest), succeeding on abandoned agricultural fields and/or surrounding development. ..... **Northeastern Modified Successional Forest (CEGL006599)**

    4. Forest is not dominated by early successional, weedy tree species and invasive herbs, shrubs and vines.

        5. Association is characterized by the co-dominance in the canopy of northern red oak (*Quercus rubra*), white oak (*Quercus alba*), tuliptree (*Liriodendron tulipifera*) and sugar maple (*Acer saccharum*). Other canopy associates can include birch [(sweet

birch (*Betula lenta)*, yellow birch (*Betula alleghaniensis*)], white ash (*Fraxinus amercana*), hickories [(pignut hickory (*Carya glabra*), bitternut hickory (*Carya cordiformis*), shagbark hickory (*Carya ovata*)], and American basswood (*Tilia americana*). Northern spicebush (*Lindera benzoin*) is a commonly associated shrub. Occurs on moist to very moist, often seepy, gently-sloping toeslopes. ... **High Allegheny Rich Red Oak - Sugar Maple Forest (CEGL006125)**

5. Forest not as above. Tuliptree (*Liriodendron tulipifera*) is not an important associate in the canopy.

    6. Sweet birch (*Betula lenta*) and/or red maple (*Acer rubrum*) constitute at least 50% relative cover in the canopy and subcanopy. Current species composition and forest structure is generally influenced significantly by previous silvicultural or agricultural activities. ..... **Red Maple - Sweet Birch Hardwood Forest (CEGL008503)**

    6. Sweet birch (*Betula lenta*) and/or red maple (*Acer rubrum*) constitute less than 50% relative cover in the canopy. In general, forest has not been influenced significantly by previous silvicultural or agricultural activities.

        7. Forests with enrichment indicators in the canopy, shrub, and/or herb layers. Such indicators include sugar maple (*Acer saccharum*, often abundant), American basswood (*Tilia americana*), white ash (*Fraxinus americana*), hophornbeam (*Ostrya virginiana*), hickories (*Carya* spp.), alternateleaf dogwood (*Cornus alternifolia*), blue cohosh (*Caulophyllum thalictroides*), American ginseng (*Panax quinquefolius*), Goldie's fern (*Dryopteris goldiana*), northern maidenhair (*Adiantum pedatum*), roundeaf yellow violet (*Viola rotundifolia*), hepatica (*Hepatica nobilis*), and Robert geranium (*Geranium robertianum*).

            8. Enriched deciduous forests strongly dominated by sugar maple (*Acer saccharum*, often abundant), American basswood (*Tilia americana*), white ash (*Fraxinus americana*), and hophornbeam (*Ostrya virginiana*) with frequent and sometimes abundant strong enrichment indicator herbs such as blue cohosh (*Caulophyllum thalictroides*), northern maidenhair (*Adiantum pedatum*), Canadian wildginger (*Asarum canadense*), American ginseng (*Panax quinquefoius*), and often with abundant spring ephemerals. Occurs on cool north- to northeast-facing, often convex, midslopes. ..... **Sugar Maple - Ash - Basswood Northern Rich Mesic Forest (CEGL005008)**

8. Enriched deciduous forests with varied dominance and semi-rich indicators. Canopy species typically show codominance of mesic indicators [(sugar maple (*Acer saccharum*) and, less commonly, white ash (*Fraxinus Americana*) and American basswood (*Tilia americana*)] with northern hardwoods [(American beech (Fagus grandifolia), sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*)] and/or oaks [(northern red oak (*Quercus rubra*), white oak (*Quercus alba*), chestnut oak (*Quercus prinus*)]. Semi-rich indicators are common such as roundleaf yellow violet (*Viola rotundifolia*), heartleaf foamflower (*Tiarella cordifolia*), white baneberry (*Actaea pachypoda*), wide-leaved sedges such as spreading sedge (*Carex laxiculmis*) and broadleaf sedge (*Carex platyphylla*), and zigzag goldenrod (*Solidago flexicaulis*), but strong-enrichment indicator species as noted above are missing. Occurs on concave mid-to lower slopes; usually not south-facing. ..... **Semi-rich Northern Hardwood Forest (CEGL006211)**

7. Forests not as above; northern hardwoods dominant and enrichment indicators lacking.

   9. Forest dominated by American beech (*Fagus grandifolia*) with mixed oaks including chestnut oak (*Quercus montana*), white oak (*Q. alba*), or black oak (*Q. velutina*). American beech root sprouts are important in the shrub layer and ericaceous species, including black huckleberry (*Gaylussacia baccata*) and blueberries (*Vaccinium angustifolium, V. pallidum*) may also be present. ..... **Beech-maple mesic forest (CEGL006920)**

   9. Forest co-dominated by sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), white ash (*Fraxinus americana*) with associates that can include black cherry (*Prunus serotina*), red maple (Acer rubrum), eastern hemlock (*Tsuga canadensis*), northern red oak (*Quercus rubra*). American beech root sprouts can be important in the shrub layer and eastern hayscented fern (*Dennstaedtia punctilobula*) is a common herb. Occurs midslope, often with west- or east-facing aspect. ..... **Central Appalachian Northern Hardwood Forest (CEGL006045)**

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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